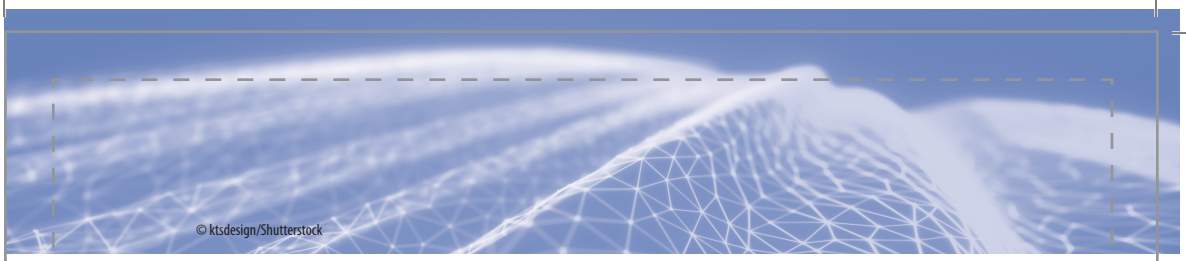


CHAPTER 2

# Self-Efficacy Theory

## STUDENT LEARNING OUTCOMES

After reading this chapter the student will be able to:

- Explain the concept of Self-Efficacy Theory.
- Define the constructs of Self-Efficacy Theory.
- Explain how vicarious experience influences self-efficacy.
- Describe the influence of mastery experience on self-efficacy.
- Discuss how verbal persuasion impacts self-efficacy.
- Compare how the somatic and emotional states affect self-efficacy.
- Use Self-Efficacy Theory to explain one health behavior.

## SELF-EFFICACY THEORY ESSENCE SENTENCE

People will only try to do what they think they can do, and won't try what they think they can't do.

### Constructs

**Mastery experience:** Prior success at having accomplished something that is similar to the new behavior

**Vicarious experience:** Learning by watching someone similar to ourselves be successful

**Verbal persuasion:** Encouragement by others

**Somatic and emotional states:** The physical and emotional states caused by thinking about undertaking the new behavior

## In the Beginning

For eons of time, we have been trying to understand and explain why people do what they do. Early on, the theories used to explain behavior were based on psychology and shared three characteristics—behavior is regulated physically at a subconscience level; behaviors diverging from the prevailing norm are a symptom of a disease or disorder; and behavior changes as a result of gaining self-insight through

analysis with a therapist (Bandura, 2004). These theories formed the foundation of the "lie on the couch" approach of talk therapy thought to be the magic bullet of behavior change. Unfortunately, research on the outcome of talk therapy showed that although people did gain insight into their behavior, their behavior usually didn't change (Bandura, 2004).

In the 1960s, an alternative behaviorist approach to the explanation of human behavior was introduced. This new approach viewed behavior as the result of an interplay between personal, behavioral, and environmental factors rather an unconscious process with psychodynamic roots, and it did not consider deviant behavior a disease symptom (Bandura, 2004).

A shift in treatment also occurred at this time in terms of content, location, and (behavior) change agent. Treatment content became action oriented and focused on changing the actual deviant behavior rather than trying to find the psychological origins of the behavior. Mastery experiences were used to give people the skills and belief in themselves to adopt healthier behavior. Treatment occurred in the settings where the behavior occurred—in homes, schools, workplaces, and communities—rather than in a therapist's office. And this new approach did not limit treatment change agents to only mental health professionals. For example, teachers were trained to assist in reducing problem behaviors in the school setting; peers or role models who had overcome the problem behavior themselves were also used as change agents (Bandura, 2004).

Although both approaches were very different, research done on phobias showed that both were equally as effective. Since both approaches worked, it was apparent there was some underlying mechanism connecting them. It was Albert Bandura in the late 1970s who proposed Self-Efficacy Theory as the unifying mechanism (Bandura, 1977, 2004).

## Theory Concept

If you were given the opportunity to fund your college education by swimming 10 laps in a pool, you surely would give it a try, assuming you can swim. Now imagine you were given the same opportunity to raise tuition money, but had to swim the English Channel instead. Would you still go for it? If your swimming ability is like the average person's, there's no way you'd even attempt it. Why the difference? In the first case, you believe you can swim the 10 laps. In the second, you don't believe you can swim the English Channel, and so you won't even try. Think back to your childhood and the book, *The Little Engine That Could*: "I think I can. I think I can." This is the concept of self-efficacy.

Self-efficacy is the belief in one's own ability to successfully accomplish something, achieve a goal. It is a theory by itself, as well as being a construct of Social Cognitive Theory. Self-Efficacy Theory tells us that people generally will only attempt things they believe they can accomplish and won't attempt things they believe they will fail. It makes sense—why would you try doing something you don't think you can do? However, people with a strong sense of efficacy believe they can accomplish even difficult tasks. They see these as challenges to be mastered, rather than threats to be avoided (Bandura, 1994).

Efficacious people set challenging goals and maintain a strong commitment to them. In the face of impending failure, they increase and sustain their efforts to be successful. They approach difficult or threatening situations with confidence that

they have control over them. Having this type of outlook reduces stress and lowers the risk of depression (Bandura, 1994).

Conversely, people who doubt their ability to accomplish difficult tasks see them as threats. They avoid them based on their own personal weaknesses or the obstacles preventing them from being successful. They give up quickly in the face of difficulties or failure, and it doesn't take much for them to lose faith in their capabilities. An outlook like this increases stress and the risk of depression (Bandura, 1994).

# Theory Constructs

Self-Efficacy Theory introduces the idea that the perception of efficacy is influenced by four factors: mastery experience, vicarious experience, verbal persuasion, and somatic and emotional state (Bandura, 1994, 1997; Pajares, 2002).

## Mastery Experience

We all have mastery experiences. These occur when we attempt to do something and are successful; that is, we have mastered something. Mastery experiences are the most effective way to boost self-efficacy, because people are more likely to believe they can do something new if it is similar to something they have already done well (Bandura, 1994).

Perhaps you never thought about this, but babysitting is a significant mastery experience (**FIGURE 2.1**). Babysitting is among the strongest predictors of a new mom's belief in her ability to take care of her own children. Women who have experience taking care of infants prior to becoming mothers themselves are more confident in their maternal abilities, and even more so in completing infant care tasks they did frequently (Froman & Owen, 1989, 1990; Gross, Rocissano, & Roncoli, 1989). So, babysitting as a teenager pays off in many ways.

**FIGURE 2.1** Babysitting provides mastery experiences.

Conversely, parents of children with autism usually do not have mastery experiences to support their parenting self-efficacy, even if they had other children prior to the birth of the child with autism. The experiences gained from parenting children without autism are not applicable to parenting a child with autism. Therefore, to provide experiences for mastery of skills necessary for raising a child with special needs, a parent-coaching model is used to give parents opportunities to develop the skills they need to successfully interact with their children (Raj & Kumar, 2010).

Mastery is the basis for preoperative teaching of men undergoing surgery for prostate cancer. Since this type of surgery can result in urinary incontinence, it is important for men to do pelvic exercises postoperatively to restore urine control. If they are taught these exercises before surgery and practice them, their self-efficacy increases and they are more likely to quickly regain urine control after surgery (Maliski, Clerkin, & Litwin, 2004).

Providing opportunities for people to gain mastery is the aim of workshops, training or apprentice programs, internships, and clinical experiences. These are ways people can practice and become proficient at new skills, thereby increasing their self-efficacy. For example, hours in clinical practice areas provide opportunities for student nurses to master nursing skills, and internships afford public health students the chance to master the competencies needed for their professional practice. Increasing self-efficacy through mastery experiences is one way of assisting older adults at risk of falling to gain confidence in safely participating in everyday activities. In a fall prevention program for older adults, providing opportunities for negotiating outdoor activities such as using public transportation, climbing stairs, and crossing streets proved to be among the most effective strategies for increasing participants' fall prevention self-efficacy (Cheal & Clemson, 2001). For personal trainers, mastery experiences are effective ways to support client exercise self-efficacy. Starting with a simple exercise program that can be successfully completed creates a mastery experience that can lead to success with more challenging programs (Jackson, 2010).

It would seem that mastering something new is relatively simple: all you have to do is practice. However, this isn't always the case. If the new tasks are always easy and similar to ones already mastered, and difficult, unfamiliar ones are avoided, then a strong sense of efficacy does *not* develop. To develop a strong sense of efficacy, difficult tasks also need to be attempted, and obstacles worked through (Bandura, 1994). In reality, it is great if you tried to make brownies, were successful, and now make them all the time. But, you can't live on brownies alone. At some point, you need to try making a meal.

## Vicarious Experience

Another factor influencing perception of self-efficacy is vicarious experience or the observation of the successes and failures of others (models) who are similar to one's self. Watching someone like yourself successfully accomplish something you would like to attempt increases self-efficacy. Conversely, observing someone like yourself fail detracts or threatens self-efficacy. The extent to which vicarious experiences affect self-efficacy is related to how much like yourself you think the model is (Bandura, 1994). The more one associates with the person being watched, the greater the influence on the belief that one's self can also accomplish the behavior being observed.

This construct can be used to explain how group weight loss programs work. If an obese person sees someone just like himself or herself lose weight and keep it

off by following a sensible diet and exercise, then the belief in his or her own ability to also do this is strengthened. Watching friends who have taken a nutrition course choose healthy foods at a fast-food establishment may increase your belief in your ability to also choose healthy foods: "If they can do it, so can I."

Not only do workshops and training sessions increase mastery, they can also provide vicarious experiences as well. Watching others in a training session, a class, or during role playing can provide observational experiences that enhance self-efficacy, especially if the person performing or learning the behavior is similar to the observer. This is what happens when vicarious learning is used to teach medical students how to communicate with patients. As it turns out, medical students learn as much and sometimes more by watching other students practice talking with patients as they do from practicing it themselves (Stegmann, Pilz, Siebeck, & Fischer, 2012).

In the "Sun Protection Is Fun" program (Tripp, Herrmann, Parcel, Chamberlain, & Gritz, 2000) developed to teach children about skin cancer prevention, vicarious learning was used not only with the children, but with the parents and teachers as well. Within the context of the curriculum, children watched their teachers and other students demonstrate how to protect their skin by using sunscreen and wearing protective clothing. Instead of using actors as the role models in the parent and teacher videos developed for this intervention, families and teachers from the intervention schools were used so as to strengthen vicarious learning.

Vicarious learning is at the core of coach/trainer–student/client instruction. The coach or trainer demonstrates the skill, and the student/client then copies. This is also how you learned to tie your shoes, brush your teeth, and eat with a fork. You watched, observed your parents or older siblings, and then copied what they did. Think about all the things you learned by watching others and how successfully accomplishing the skill increased your self-efficacy (**FIGURE 2.2**).

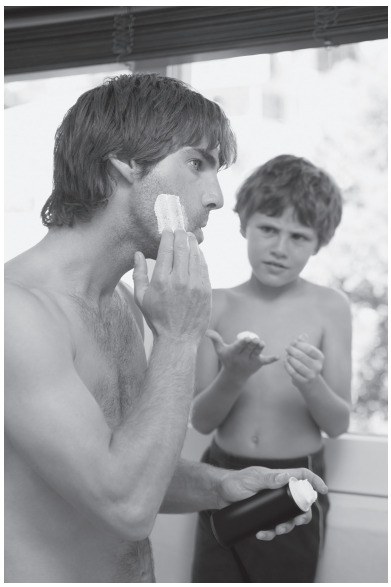

**FIGURE 2.2** Learning by watching others.

## Verbal Persuasion

The third factor influencing self-efficacy is verbal or social persuasion. When people are verbally persuaded that they can achieve or master a task, it goes a long way in boosting their self-efficacy and making it more likely they will do the task. Coaches frequently use this tactic with their teams. They psyche them up verbally, before a game or a meet (**FIGURE 2.3**). They tell the players they are going to win, that the other team is no match for them, that they are stronger, faster, better prepared, and so on.

If a team performs poorly, the coach's reaction is paramount in the effect the loss has on the players' self-efficacy. For example, the coach saying "We lost the game today because you are all lousy players" doesn't do much for self-efficacy, whereas saying "We lost because we need more practice" does (Brown, Malouff, & Schutte, 2005).

Conversely, when people are told they do not have the skill or ability to do something, they tend to give up quickly (Bandura, 1994). Imagine the same coach telling his team they can't possibly win against the opposition. What would the likely outcome be?

## Somatic and Emotional States

The physical and emotional states that occur when someone contemplates doing something provide clues as to the likelihood of success or failure. Stress, anxiety, worry, and fear all negatively affect self-efficacy and can lead to a self-fulfilling prophecy of failure or inability to perform the feared tasks (Pajares, 2002). Stressful situations create emotional arousal, which in turn affects a person's perceived self-efficacy in coping with the situation (Bandura & Adams, 1977).

People new to exercising at a gym, especially if they perceive that others are watching them, may become anxious in anticipation of an exercise session. This

**FIGURE 2.3** Coaches use verbal persuasion to psyche up players.

is a negative somatic state that may be detrimental to their self-efficacy, and in turn, threaten their continued exercising. The fitness professional in this situation can minimize the negative effects by teaching relaxation techniques and positive self-talk in an effort to reduce anxiety and support self-efficacy (Jackson, 2010).

A classic example of how the emotional state affects self-efficacy and, ultimately, health behavior is fear of the dentist (**FIGURE 2.4**). For millions of people in this country, the mere thought of going to the dentist is associated with intense pain and anxiety. As a result, they cannot bring themselves to make appointments or keep appointments for even routine, preventive dental care. This avoidance behavior results in decayed or missing teeth, a poorer quality of life, the need for more extensive treatment, and the very pain they wanted to avoid (Heidari, Andiappan, Banerjee, & Newton, 2017; Rowe & Moore, 1998).

Being afraid of the dentist is also related to poor daily dental health habits, as a study of over 8000 university students found. Students who reported being very fearful of the dentist brushed their teeth once a day or less and used tobacco, as compared to those less fearful or not fearful at all who brushed their teeth twice a day or more and used tobacco less frequently or not all. As it turned out, the more fearful students were at greater risk of dental problems, which was consistent with their need for frequent dental treatment or treatment at every dental checkup (Pohjola, Rekola, Kuntu, & Virtanen, 2016).

As is evident from this example, emotional arousal affects self-efficacy, and self-efficacy affects the decisions people make. If the emotional state improves—that is, emotional arousal or stress is reduced—a change in self-efficacy can be expected (Bandura & Adams, 1977).

While we tend to think about negative examples of how the emotional state impacts self-efficacy and health behavior, sometimes the emotional state is positive. Think about the effect of the "runner's high" on health behavior. In this case, the emotional state that results is pleasurable, rather than uncomfortable. This would

**FIGURE 2.4** Fear of the dentist can lead to avoidance behavior.

positively impact self-efficacy and support continued engagement in the behavior that created it.

In summary, according to Self-Efficacy Theory, verbal persuasion, mastery experiences, vicarious experiences, and somatic and emotional states affect our self-efficacy and, therefore, our behavior (**FIGURE 2.5**).

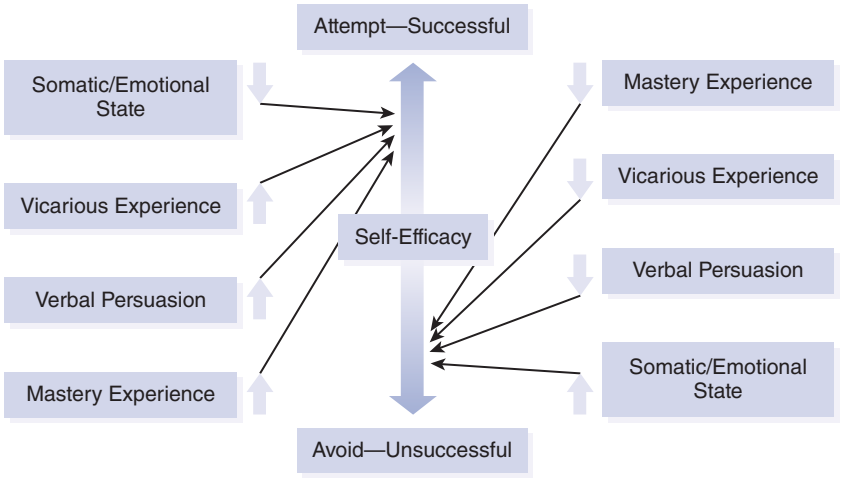


**FIGURE 2.5** Self-Efficacy Theory.

## THEORY IN ACTION—CLASS ACTIVITY

Exercise is an important aspect of health. Not only does it help with attaining and maintaining a healthy weight, but it also helps with flexibility, balance, and overall muscle strength, the latter of which helps us stay upright and prevents us from falling. While this may not be a big issue for young adults, lack of balance, flexibility, and muscle strength are significant issues for older adults with possible serious consequences. So, engaging older adults in exercise is critical to their wellbeing.

Now, think about your grandparents, another older relative or a close family friend who doesn't exercise at all. Image you are assigned the task of using the constructs of Self-Efficacy Theory to develop a walking program for older adults like them to encourage physical activity.

What might you do relative to:

Mastery experiences
Vicarious experiences
Verbal persuasion
Physical or emotional response

Now, read the following article and answer the questions at the end.

# Chapter 2 Article: The feasibility of an intervention combining self-efficacy theory and Wii Fit exergames in assisted living residents: A pilot study[1]

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## Abstract

The purpose of this study was to examine the feasibility of a self-efficacy based intervention using Wii exergames in assisted living residents. The study was a single-group pre- and post-test design. Seven older adults (aged 80–94 years) were instructed to engage in exergames twice a week for 8 weeks. Physical function (balance, mobility, and walking distance), fear of falling, self-efficacy for exercise, and outcome expectations for exercise were evaluated. All participants had enjoyable experiences and no serious adverse events were reported. Participants had significant improvement on balance. Although not significant, there were trends indicating that participants improved mobility, walking endurance, and decreased fear of falling. The use of Wii exergames was an acceptable, safe, and potentially effective approach to promote physical activity in older adults. Findings provide support for the applications of integrating self-efficacy theory into exergames as a mechanism to encourage older adults to engage in exercise.

**Keywords:** Exergames, Assisted living residents, Exercise, Physical activity, Self-efficacy theory

## Introduction

Effective exercise programs can increase flexibility, leg strength, improve balance, and further reduce the risk of falling of residents in assisted living facilities (ALFs).[1,2] However, ALFs are not mandated to offer specific exercise programs to prevent functional decline. Most activities offered in the ALFs are mainly performed in a

1 Reproduced from Chao, Y., Scherer, Y. K., Wu, Y., Lucke, K. T., & Montgomery, C. A. (2013). The feasibility of an intervention combining self-efficacy theory and WiiFit Exergames in assisted living residents: A pilot study. *Geriatric Nursing, 34*, 377–382. doi: 10.1016/j.gerinurse.2013.05.006. With permission from Elsevier.

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seated position (e.g., music, art, and game-oriented activities), rather than physical activity.[3] It is estimated that 30%–50% of ALF residents had a fall over a period of 6 to 12 months. If the possible unreported incidence of falls is included, it may make the estimate even higher by 5%–9%.[4] Older adults who fall or have developed a fear falling are at risk for avoiding activities, resulting in decreased muscle strength and postural control. This activity avoidance could further decrease physical performance and in turn increase risk of falls.[5] Therefore, developing an effective exercise program to prevent functional decline and lower risk of falls is important for residents to delay nursing home placement.

Through recent technological innovation, there has been a rapid growth in the use of the interactive health video games that are particularly designed to encourage people to engage in physical activity. Individuals can practice various activities as they do in the real world. The Nintendo Wii exergames (entertaining video games that combine game play with exercise) is one of the popular health video games and has been broadly used in senior centers and retirement communities.[6] Empirical evidence supports that using Wii exergames as an intervention in older adults can maintain or/and improve physical function, such as balance, mobility, strength, flexibility[7,8] and balance confidence.[9,10] In addition, Wii exergames can make the exercise experience more enjoyable, which motivates older adults to engage in exercise.[11,12]

Self-efficacy theory[13] has been suggested as the most effective theoretical guide to change exercise behavior in older adults.[14] People with higher exercise self-efficacy engage more in physical activity and adhere to an exercise program.[15] Self-efficacy has 2 key concepts: self-efficacy expectations and outcome expectations. Evidence shows that self-efficacy expectations and outcome expectations are both important determinants of exercise behavior in older adults.[16] The interventions based on the 4 approaches (e.g., enactive mastery experiences, vicarious experiences, verbal persuasion, and physiological and affective states) can effectively influence self-efficacy expectations and outcome expectations on exercise behavior in older adults.[17,18]

In ALF residents, only one study was found to investigate the safety and efficacy of the Wii exergames program.[19] Continued research is needed to establish the effects of Wii exergames in this specific older population. In addition, a literature review found no mention of a theoretical framework to guide exergames programs in the older adult population. Therefore, the research investigators designed an intervention incorporating the self-efficacy theoretical-based approach Staying Active, Healthy Aging (SAHA) program by utilizing Wii Fit exergames to encourage ALF residents to engage in exercise. The purpose of this study was to determine the feasibility of a SAHA program to maintain or improve physical function and decrease fear of falling in ALF residents. The specific aims of this pilot study were to (1) evaluate the acceptability, safety and efficacy of the program on physical function and fear of falling; and (2) evaluate how the self-efficacy theoretical-based intervention influenced ALF residents' confidence to continue to exercise and perceived consequence of exercise.

# Methodology

## Design

This study used a single-group pre-post design. The Staying Active, Healthy Aging (SAHA) program was an 8-week integrated health education and self-efficacy

based exercise program. The Wii Fit exergames, which include aerobic, strength, balance, and yoga exercise were used as the exercise device. The study addressed the application of Bandura's self-efficacy theory[13] to improve older adults' exercise behavior and appraise its influence on physical function, fear of falling, cognition, depression, and quality of life. The focus of this article is on physical function and fear of falling. The study was approved by the Health Science Institutional Review Board of the University at Buffalo, the State University of New York.

## Sample

Participants were recruited from one 60-bed ALF in a suburb of Buffalo NY. Inclusion criteria for the potential participants were (1) 65 years of age or older; (2) able to ambulate with or without an assistive device; (3) able to speak and read English; (4) able to understand instructions and follow commands (1:1); and (5) medically stable. Participants were excluded if they had contraindications for exercise suggested by the American College of Sports Medicine.[20]

Recruitment flyers were distributed to all residents and an announcement about the program was made at the resident council. A total of 9 residents expressed an interest in joining the study. Two of these individuals did not participate in the study. One did not participate because of failure to obtain the medical clearance approval by the primary care physician, and the other decided not to enroll in the study after being informed of the study procedure. A total of 7 participants (2 male and 5 female) enrolled and all of them completed the study. Participants had an average age of 86 $\pm$ 5 years old (range from 80 to 94). All were Caucasian and 6 of them were widowed. Four participants were able to ambulate without an assistive device and required no assistance with the activities of daily living. Three participants had a diagnosis of cognitive deficits; one had stroke; 2 had Parkinson's disease; and one had chronic obstructive pulmonary disease (COPD).

## Intervention

### Motivational intervention

Methods designed to increase self-efficacy throughout the program including enactive mastery experiences, vicarious experiences, verbal persuasion, and emotional or physical feedback were implemented[13] (**TABLE A.1**). Participants were encouraged to work in pairs since group exercise can serve as a motivator as well as increase social interaction and connections.[21] Prompt encouragements and support were given by partners and researchers supervising the exercise training. In addition, health education was given to participants at each session.

### Wii Fit exergames intervention

The design of the exercise program was modified based on the Williams et al. EXercising with Computers in Later Life (EXCELL) program[7] and input from a geriatric nurse practitioner with expertise in designing and promoting physical activity in this population. The SAHA program led by 2 nursing PhD students was conducted twice a week for 8 weeks. The exercise time per session was

**TABLE A.1** The self-efficacy-based motivational intervention.

| Self-efficacy sources | Methods | Descriptions |
|---|---|---|
| Enactive mastery experiences | – Individualized exercise prescription<br>– Goal setting<br>– Evaluation | 1. Discussed previous exercise experience and current exercise performance.<br>2. Discussed specific short- and long-term goals.<br>3. Exercise prescription was tailored to the needs of each participant.<br>4. Used diary to monitor progress. |
| Vicarious experiences | – Self-modeling<br>– Story telling<br>– Role modeling | 1. Participants' prior successful performance was used as a reminder to encourage participants themselves and encourage them to share their success with others.<br>2. Encouraged participants to observe others with comparable degrees of physical impairments successfully perform the tasks.<br>3. Wii Fit provided a "virtual trainer" to demonstrate the skills of the exercise and educate participants on the ways to improve performance in posture, strength, and balance. |
| Verbal persuasion | – Education<br>– Support and encouragement | 1. Distributed the health education booklets and underscored the benefits of exercise.<br>2. Displayed a poster in each participant's room as a reminder of exercise benefits.<br>3. Provided on-going encouragement and positive reinforcement related to goal achievement and adherence to exercise. In addition, participants provided peer support by exchanging successful experiences and encouragement for accomplishments. |

| | | |
|---|---|---|
| | | 4. Wii Fit provided the various motivational feedbacks such as encouraging commentaries, bonuses, and music. |
| Physiological and affective feedback | – Monitoring emotional and physical burden<br>– Managing any discomfort | 1. Monitored participants if they experienced fear, pain, fatigue, or other symptoms associated with exercise.<br>2. Explored participants' feelings of fear and helped them build confidence of exercise. Participants shared pointers or helpful hints like how to keep balance by using a walker while exercising.<br>3. Provided rest periods or stopped exercise if participants experienced fatigue or any discomfort. |

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designed for about 30 min per individual. Two participants worked as a team, with a goal of 60 min per session. A walker was placed around the Wii balance board. Participants were allowed to hold the walker for stability while performing any exercise. Exercise floor mats were used to reduce injury from falls. At each session, participants took turns doing gaming activities. Each participant exercised about 30 min and spent the other 30 min encouraging his/her exercise partner to perform the exercise activities. Participants began with range of motion exercise, then they performed an aerobic exercise (jogging), a strength exercise (lunge), 2 balance exercises (penguin slide and table tilt), and 2 yoga exercises (chair and deep breathing). The plan was to increase the amount of time performing strength exercise (lunge) at week 4 and week 7 since strength exercise has the strongest positive effect on improving functional performance, muscle strength, and muscle endurance.[22] The time for doing other gaming activities was decreased in order to accommodate 30 min per exercise session (**TABLES A.2** and **A.3**). However, the actual amount of time spent and progression (game levels) adjusted on each game including the lunge depended on each individual's physical tolerance and performance. Participants were allowed to terminate the session at any point. Additional topics included in the educational portion of the program are presented in Table A.3. The content for each topic was based on the information on exercise and physical activity for older adults located on the National Institutes on Aging websites.[23]

**TABLE A.2** Description of Wii Fit exergames.

| Exercise | Game | General description | Goals |
|---|---|---|---|
| Aerobic exercise | Jogging | The player walks or jogs along the paths and routes by following the software build-in runner. | Increase mobility, aerobic capacity |
| Strength exercise | Lunge | The player steps on the balance board and follows the "virtual trainer" to perform lunge exercise on each leg. | Strengthen quadriceps muscles, gluteal muscles, and hamstrings |
| Balance exercise | Penguin slide | The player steps on balance board and shifts his/her weight side to side to make a penguin catch fish. | Improve balance |
| | Table tilt | The player steps on the balance board and shifts his/her weight in all directions to direct balls into holes on the shifting platform. | Improve balance |
| Yoga exercise | Chair | The player steps on the balance board and follows the "virtual trainer" to perform the squat pose. | Strengthen hamstrings, quadriceps, gluteals, and the erector muscles of the back in order to improve balance and stability |
| | Deep breathing | Participants step on the balance board and follow the "virtual trainer" to breath in sync with the blue circle on the interface. | Improve breathing, metabolism, and circulation |

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**TABLE A.3** Program schedule.

| Week | Health education topics | Wii Fit exergames |
|---|---|---|
| Week 1–3 | 1. How exercise can help you<br>2. How to get started exercising<br>3. Stay safe<br>4. Preventing injury | Warm-up (5 min) → jogging (5 min) → lunge (4 min) → penguin slide (4 min) → chair (4 min) → table tilt (4 min) → breathing (4 min) |
| Week 4–6 | 1. Getting the right shoes<br>2. How to stay active<br>3. Four types of exercise (aerobic, strength, balance, and flexibility exercise) | Warm-up (5 min) → jogging (5 min) → lunge (4 min) → penguin slide (4 min) → chair (2 min) → table tilt (4 min) → lunge (4 min) → breathing (2 min) |
| Week 7–8 | 1. How to keep going<br>2. Content review | Warm-up (5 min) → jogging (5 min) → lunge (4 min) → penguin slide (2 min) → chair (2 min) → lunge (4 min) → table tilt (2 min) → lunge (4 min) → breathing (2 min) |

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# Measures

Outcome measures focused on evaluating the acceptability, safety, and the efficacy of the SAHA program. Interview format surveys and functional testing were administered at pre-intervention (week 0) and post-intervention (week 9).

## Acceptability outcome

### Exergames experience questionnaire

An investigator-designed exergames experience questionnaire[7,11] was used to evaluate the acceptability of using Wii exergmaes in ALF residents. The questionnaire consists of 2 parts. The first part was administered prior to the intervention. Participants were asked about their previous experience with exergames and whether they would consider the Wii exergames as an exercise tool. The second part of the questionnaire was administered after completing the 8-week program. Participants were asked about exercise experience using Wii exergames.

## Safety outcome

The safety outcome assessed any intervention-related adverse events during the exercise period, such as falls, injury, or clinical symptoms (e.g., chest pain, dizziness, shortness of breath).[20] Heart rate, blood pressure, and respirations were monitored at each session.

## Efficacy outcome

### Physical function

**Berg balance scale (BBS-14).** The BBS-14 is a 14-item scale that was developed to measure both static and dynamic aspects of balance. Each item is rated from 0 to 4, where 0 indicates an inability to complete the task and 4 indicates the highest competence in completing the task. The total score of the BBS is 56.[24] One systematic review shows that the BBS has excellent internal consistency (Cronbach alpha = 0.92–0.98), test-retest reliability (ICC = 0.98), and validity.[25]

**Timed up and go test (TUG).** TUG is a measure of functional mobility. Participants were instructed to stand up from a chair, walk 3 m, turn around, return to the chair, and sit down. Participants wore regular footwear and used their customary assistive device (cane, walkers, etc.). The time (s) taken to complete this task was recorded.[26] Prior use of the TUG provided support for reliability, internal consistency, and validity.[26]

**Six-minute walk test (6MWT).** 6MWT is a measure of overall mobility and physical function. Participants were instructed to walk on a straight, flat, non-slippery internal hallway (38.64 m) at the comfortable speed. They were allowed to use their usual assistive devices and walked at their own pace as far as possible. The maximum distance (m) walked in 6 min was measured.[27] Previous studies provided evidence of good reliability (ICC = 0.94–0.96) and validity.[27]

## Fear of falling

**Falls efficacy scale (FES).** The FES is a self-report 10-item measurement that was developed to assess fear of falling. Each item is rated on a 10-point continuum scale from 1 to 10, where 1 represents subjects that have extreme confidence and 10 represents subjects that have no confidence. The total score of the FES is 100.[28] The FES has good test-retest reliability and validity.[28]

## Mediating factors for residents

**Self-efficacy for exercise scale (SEE).** The SEE is a 9-item scale to assess confidence to continue exercising in the face of perceived barriers. The SEE consists of 9 situations that might affect participation in exercise. Items are rated from 0 (not confident) to 10 (very confident). The mean score of numerical ratings from each response indicates the strength of efficacy expectations.[29] The SEE scale has excellent internal consistency (Cronbach alpha = 0.89–0.94) and validity.[29,30]

**Outcome expectations for exercise scale (OEE).** The OEE is a 9-item measurement to identify perceived consequences of exercise for older adults. Items are rated from 1 (strongly disagree) to 5 (strongly agree) to assess the physical and mental outcomes of exercise. The scale is represented with the mean score of numerical ratings from each response. This OEE scale has good internal consistency (Cronbach alpha = 0.72–0.88) and validity.[30,31]

## Data analysis

The statistical software used for the analysis was SPSS version 19.0 (SPSS Inc., Chicago, IL, USA). Descriptive statistics were used for sample characteristics. Since the sample size was small, the non-parametric Wilcoxon signed-rank test was used to compare the values of all the measurement outcomes of the pre-test with the post-test. Significant results were considered if $p < 0.05$. An effect size was calculated for each outcome measure[32] and was interpreted based on the Cohen[33] recommendation.

# Results

## Acceptability

Prior to the Wii exergames intervention, 4 participants had experienced playing Wii sports, which was held monthly at the facility; however, no one had considered using Wii exergames as an exercise tool. After completing the 8-week program, participants reported using Wii exergames as an enjoyable experience. Five participants had great interest in exercising with Wii exergames again, and would like to recommend exergames to their family and friends. Participants stated they had a closer relationship with their exercise partners by sharing exercise experiences and life stories. All participants reported that "penguin slide" was their favorite game because of the music and visual motion of the presentation.

## Safety

All participants were able to complete each exercise session in the time allowed except the one participant with COPD. The participant with COPD experienced mild shortness of breath during exercise training, and required 40–45 min to complete 30 min exercise session. The participants with a diagnosis of stroke and/or Parkinson's disease, although they moved slowly, were able to complete the 30 min exercise session in the time allotted. Overall, participants tolerated the intervention. None of the participants experienced any fall or injury related to the intervention.

## Efficacy

**TABLE A.4** summarizes the effects of the intervention on the outcomes. The mean score on the balance showed a significant improvement from 40.9 ± 8.5 to 45.1 ± 6.3 following the 8-week program ($p = 0.017$). No significant differences were found between pre- and post-test scores in the other outcome measures. However, there were trends indicating that participants performed better with an average of 3.6 ± 4.8 s in

**TABLE A.4** Effects of intervention on the outcomes ($N = 7$).

| Outcome | Pre-test (mean ± SD) | Post-test (mean ± SD) | Significance | Effect size |
|---|---|---|---|---|
| Physical function | | | | |
| Balance (BBS-14; range: 0–56) | 40.9 ± 8.5 | 45.1 ± 6.3 | 0.017[a] | 0.64 |
| Mobility (s) (TUG) | 19.4 ± 5.5 | 15.8 ± 5.1 | 0.063 | 0.50 |
| Walking distance (m) (6MWT) | 177.2 ± 42.9 | | | |
| Fear of falling | | | | |
| Falls efficacy (FES; range: 0–100) | 31.3 ± 15.7 | | | |
| Self-efficacy for exercise (SEE; range: 0–10) | 5.9 ± 1.7 | 6.0 ± 1.5 | 0.600 | 0.14 |
| Outcome expectations for exercise (OEE; range: 1–5) | 3.9 ± 0.3 | 4.1 ± 0.6 | 0.344 | 0.25 |

*Note.* Cohen's effect sizes ($r$): 0.10 < small < 0.29; 0.30 < medium < 0.49; large ≥ 0.50; $p < 0.05$. BBS = Berg balance scale; TUG = timed up and go test; 6MWT = six-minute walk test; FES = falls efficacy scale; SEE = self-efficacy for exercise scale; OEE = outcome expectations for exercise scale.

[a] $p < 0.05$.

Reproduced from: Chao, Y., Scherer, Y. K., Wu, Y., Lucke, K. T., & Montgomery, C. A.(2013). The feasibility of an intervention combining self-efficacy theory and Wii Fit exergames in assisted living residents: A pilot study. Geriatric Nursing, 34, 377–382. doi: 10.1016/j.gerinurse.2013.05.006.

mobility ($p = 0.063$) and an average of 68.6 ± 70.1 m in walking distance ($p = 0.063$). Scores also showed higher confidence in performing daily activities without falling ($p = 0.058$). Yet, the mean scores of self-efficacy for exercise and outcome expectations for exercise were comparable between pre- and post-test.

## Discussion

Encouraging older adults to engage in exercise over time can be difficult. Boredom is one of the possible reasons for them to quit exercising.[34] Our participants reported

playing Wii exergames was an enjoyable experience and expressed the wish to continue to exercise. The results showed that Wii exergames could serve to motivate older adults to continue to engage in exercise. In addition, Wii exergames can be considered as a safe exercise tool since none of participants had falls or injuries during the exercise sessions. Nevertheless, guidance or/and supervision is needed for older adults using exergames in order to provide safety.

Our pilot study found that ALF residents had a significant improvement in balance after exercising twice a week for 8-weeks using the exergames intervention. A similar result was also found in Padala et al.[19] study in which ALF residents showed significant improvement in balance after Wii Fit training 5 days a week over 8 weeks. Although not significant, our participants showed improvements in mobility and walking endurance after the intervention as measured by the TUG and 6MWT. Similar findings were found in previous studies using Wii exergames as an intervention with the exercise prescriptions being varied from 2 to 5 days a week for 8 to 10 weeks with 30 min of exercise per session.[8,19] In addition, our findings showing no significant improvement in fear of falling were consistent with the previous studies.[7,35] Although not significant, the p values of the TUG, 6MWT, and the FES were very close to 0.05. One possible reason for not reaching significance may be due to insufficient power of statistical analyses. A larger sample size may have shown statistically significant results on these outcome measures. However, results showed that there were large effect sizes on mobility, walking distance and fear of falling, which indicated clinical significance in the frail ALF residents. Functional decline is one of the most common reasons for discharge from the ALF to a nursing home.[36] These results support that Wii exergames is a promising intervention to improve ALF residents' physical function thereby delaying and/or avoiding transfer to a nursing home.

Our pilot intervention integrated self-efficacy theory into Wii Fit exergames in order to strengthen an individual's level of confidence to exercise. For example, health education booklets and posters were distributed to each participant. Participants interacted and encouraged each other to exercise (e.g., "You are doing well," "good girl"). Despite the integration of self-efficacy theory, results only showed slight differences on the SEE and OEE. Some participants retained low confidence to perform exercise while having pain (e.g., arthritis pain or neuropathy pain) or feeling tired; while others retained low outcome expectations of exercise due to low scores in the gaming activities. However, McAuley reported that interventions integrating self-efficacy concepts could have a substantial influence on the maintenance of exercise participation in older adults. Self-efficacy has been shown to be a significant predictor of exercise adherence.[37,38] Although our results on the SEE and the OEE did not show significant improvement after the program, most participants expressed that they did experience improvements on balance and mobility for daily activities and they would like to continue to engage in exercise.

Wii exergames provided attractive graphics and audio feedback; however, some games provided negative auditory and visual feedback when participants did not perform well, which may have frustrated the participants. In addition, the Wii balance board was not sensitive enough for certain levels of functional ability and some movements within the games were difficult for participants to control.[39,40] This negative feedback did frustrate the participants who had functional disability or physical intolerance even though they had shown some improvement in the gaming activities. Further research is needed to determine whether the application of self-efficacy theory could effectively boost older adults' confidence to exercise while using Wii exergames.

## Limitations

There are some limitations to this pilot study. First, the study utilized a small sample size and a non-controlled design. This limited the generalizability of the findings. Second, the post-test was administered only 1 week following the 8-week exercise program. To more fully determine the effects of Wii exergames, measurements at 6 and 12 months would better determine the long-term effects of this intervention. Third, residents who participated in the study were those who were already more physically active at the facility, perhaps having higher confidence levels in their mobility. Residents who were less physically active or inactive possibly due to pain conditions or other disabilities, may have received more physical and psychosocial benefits, along with greater levels of improvements on the outcome measures from participation in the Wii exergames.

## Implications

Promoting physical activity for ALF residents requires the ongoing support from peers, friends, family members, and health care providers working in the facility. The charge nurses or administrative nurses are in an ideal position to support older adults in physical activity engagement. Advanced practice nurses with a specialty in gerontology have the knowledge and skills needed to participate in the design, implementation, and evaluation of such programs. Since there are limited nursing staff resources in the ALF, advanced practice nurses can work with other disciplines and support staff to facilitate the exercise. Selecting 2–3 gaming activities from the currently designed program and having the groups led by activity leaders or the activity trained nursing aides might make the Wii exergames program more translatable to clinical practice. Recommendations for future research include implementing the Wii exergames program in a larger sample size in this population and investigating the effects of different time lengths of Wii exergames program as well as numbers/selections of gaming activities.

## Conclusion

Our findings showed that integrating self-efficacy theory into Wii Fit exergames was an acceptable, safe, and potentially effective approach to improve physical function and decrease fear of falling in ALF residents. In addition, the study provides support for the application of self-efficacy theory into exergames as a mechanism to increase ALF residents' confidence to continue to exercise and perceived consequence of exercise, resulting in encouraging older adults to engage in exercise.

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## THEORY IN ACTION—ARTICLE QUESTIONS

1. How is exercise usually addressed in assisted living facilities?
2. Why is this a problem?
3. How was this problem addressed in the article?
4. How were the constructs of the Self-Efficacy Theory used to guide development of the intervention?
5. How did these compare to the ideas you developed before reading the article?
6. How effective was the intervention in improving exercise confidence, fear of falling, and balance?
7. What might have been done differently?

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