

# An Innovative Wellness Program Promoting Participation in Physical Activity of Community-Dwelling Frail Elderly

Bong-sam Choi, PhD, MPH, PT

Dept. of Physical Therapy, College of Health and Welfare, Woosong University

## Abstract

**Background:** Given the potential benefits of wellness programs promoting physical activity of the community-dwelling frail elderly, it is recommended that comprehensive wellness programs combined with the component of physical activity. This may improve overall health and potentially lower the health care cost of the frail elderly. In general, the frail elderly residing in community or those after being discharged from hospitals are often committed to enhancing the status of participation in physical activity.

**Objects:** The purposes of this study were to identify specific shortcomings of current wellness programs as part of continuum of community rehabilitation services and to propose alternatives for the care of the community-dwelling frail elderly. Through this study, geriatric health care professionals may be able to implement assessments and programs to successfully promote an effective continuum of care for the frail elderly.

**Methods:** Article reviews were summarized and evaluated.

**Results:** A model elaborating the relationship between components of successful wellness program and participation in physical activities for the community-dwelling frail elderly are recommended. First, periodic monitoring the levels of physical activity by the use of online measurement system should be considered. Second, individualized adaptive technologies for selecting optimal physical activities for the elderly may be better fit to individuals' current status of physical activity.

**Conclusion:** The current status of physical activity in community-dwelling frail elderly can be monitored by online assessment systems. Through the innovative measurement system, elderly may assess his/her physical activity status overtime, select optimal physical activities matching the status, and create the elderly's own adaptive wellness programs that match to the status while residing in his/her community.

**Key Words:** Assessment; Computer adaptive testing; Item response theory; Physical activity; Wellness program.

## Introduction

Globally, the older population is growing faster than any other age group. In 2015, an estimated 13 percent of the worldwide population was older population aged 65 or older, which is often referred to as the 'aging society'. By 2050, the percentage of the older population is projected to jump to nearly 17 percent of the world's population, so called 'aged society' (U.N., 2015). The United States (U.S.) Census Bureau reports that nearly 40 percent of the population re-

siding in community in the U.S. had one or more disabilities, with the most common difficulties being walking, climbing stairs, and doing errands alone (U.S. Census Bureau, 2010). In addition, 45 percent of community-dwelling elderlies aged 65 or older report at least a fall every year and the number of falls continue to increase as the elderly gets older (Soriano et al, 2007). These factors may lead to frailty and physical inactivity, which is the fourth leading cause of death of the elderly, worldwide. It is estimated that approximately 3.2 million deaths each year are

attributable to insufficient physical activity (Kohl et al, 2012). That is, physical inactivity is likely to be one of identifiers detecting limitations of physical activity and overall health status of the elderly. Many authors note that the promotion of participation in physical activity is critical to sustain healthy status of the elderly (Lachenmayr and Mackenzie, 2004; Murtagh et al, 2015; Snodgrass et al, 2005; Soriano et al, 2007; Sun et al, 2013). In addition, authors present participation in physical activity as one of the most consistent observations in the elderly community (Kuczmarksi and Cotugna, 2009; Sun et al, 2013). Indeed, identifying the elderly's limitations and the health status appear to outline the key implications of sustaining wellness in the elderly.

Participation in physical activity is a well established concept in the International Classification of Functioning, Disability, and Health (ICF) by World Health Organization (2005). The ICF classification system describes a conceptual basis for identifying primary and contextual factors associated with participation in community-based physical activity. That is, personal and/or environmental factors as well as the activity dimension of the model may influence the status of body functioning in the elderly population. The activity dimension includes various activities such as involving movement, moving around and daily life activities. The multidimensional construct of the activity interacts dynamically with the health status of the elderly, and with their personal and environmental factors. Due to the complex effects of those factors on the overall health of the elderly, identifying limitations in the participations in physical activity has emerged as a priority in the health care industry (U.S. Department of Health and Human Services, 2010). With an extensive study examining the elderly's potential to function in communities, there is a growing consensus on which physical activity influences the elderly's overall health (Fox, 1999; Goodwin, 2003; Larson, 2006). A study notes that community-based interventions may eventually be required because low adherence to the partic-

ipation in physical activity does not match well with the specific needs of the elderly (Murtagh et al, 2015). Investigators, in a review of longitudinal studies with community-dwelling frail elderly, indicate the associative relations between participation in physical activity and overall health (Koeneman et al, 2011) as well as other functions such as activity of daily living and gait speed (Stubbs et al, 2014).

As an initial means to increase the elderly's participation in community physical activities, wellness programs have widely been accepted and applied in real life (Matuska et al, 2003; Park and Steelman, 2008). Although the term "wellness" is vague in many ways, WHO comprehensively defines it as an optimal state of health of individuals and groups as well as an encompassing individual's spiritual, physical, social, psychological and economic potential, and expected role within family, workplace and community (Sturgeon, 2007). Thus the programs are commonly expected to benefit elderly's general health and comprehensive psychosocial well-being by improving their health and general sense of purpose and meaning via engagement in personally meaningful activity. Additionally, the advantages of wellness program for the elderly are well documented elsewhere by extensive research (Kuczmarksi and Cotugna, 2009; Matuska et al, 2003; Park and Steelman, 2008). It is well known that physical activity-based wellness programs play a primary role in every meaningful lifestyle intervention encouraging healthy behaviors as well as promoting successful aging.

The wellness program commonly aims to focus on reducing excessive body weight (Werkman et al, 2006), correcting health-related problems (Henchoz and Kai-Lik, 2008), preventing potential risk of falls (Snodgrass et al, 2005), or providing a community health care service in relation to rehabilitation programs (Hollis et al, 2006). With an almost endless array of studies to evaluate the potential gains of these programs, there are several aspects that need to be carefully taken into consideration. Although these programs are well targeted the commun-

ity-dwelling elderly's needs, most programs, if not all, are successful in generating initial interest but are often difficult to sustain long-term participation. Several reasons can be postulated for the elderly having a tendency to participate less over time. Since these wellness programs often target the average person, factors influencing community participation, such as non-driver, impact their participations (Matuska et al, 2003). Snodgrass and colleagues were the first to indicate that one of the most common barriers in attending a physical activity course in a wellness program is transportation. Due to this reason, programs focusing on the institutionalized elderly are recommended (Snodgrass et al, 2005). It is also recommended that comprehensive wellness programs be designed to include socializing opportunities for the elderly as well as a consideration for their quality of life. (Mann et al, 1986). Similarly, another study indicated that wellness programs promoting physical activity should be intervened in conjunction with activities that are personally meaningful and contextually anchored within the everyday lives (Clark et al, 2001).

For the wellness program to be successful, it is essential that the community-dwelling frail elderly, whether the program is sustained or not for long term participation, may need to be monitored by an online measurement system with innovative technologies. Although many conventional questionnaires have been shown to be reliable, valid, and sensitive enough to changes in functional status in the frail elderly, the overall design of the questionnaire was to use the instrument as a whole and to provide only a general appreciation of functional status of the elderly (Gloth et al, 1995; 1999). Without further clarification on a larger scale covering the wide range of the functional status, the value of separating the assessment into sections as an indicator of the functional status should not be addressed. In contrast to the conventional measurement systems, the online measurement system such as uses Item Response Theory (IRT) and Computer Adaptive Testing

(CAT) technologies can be used to measure the elderly overtime and elsewhere.

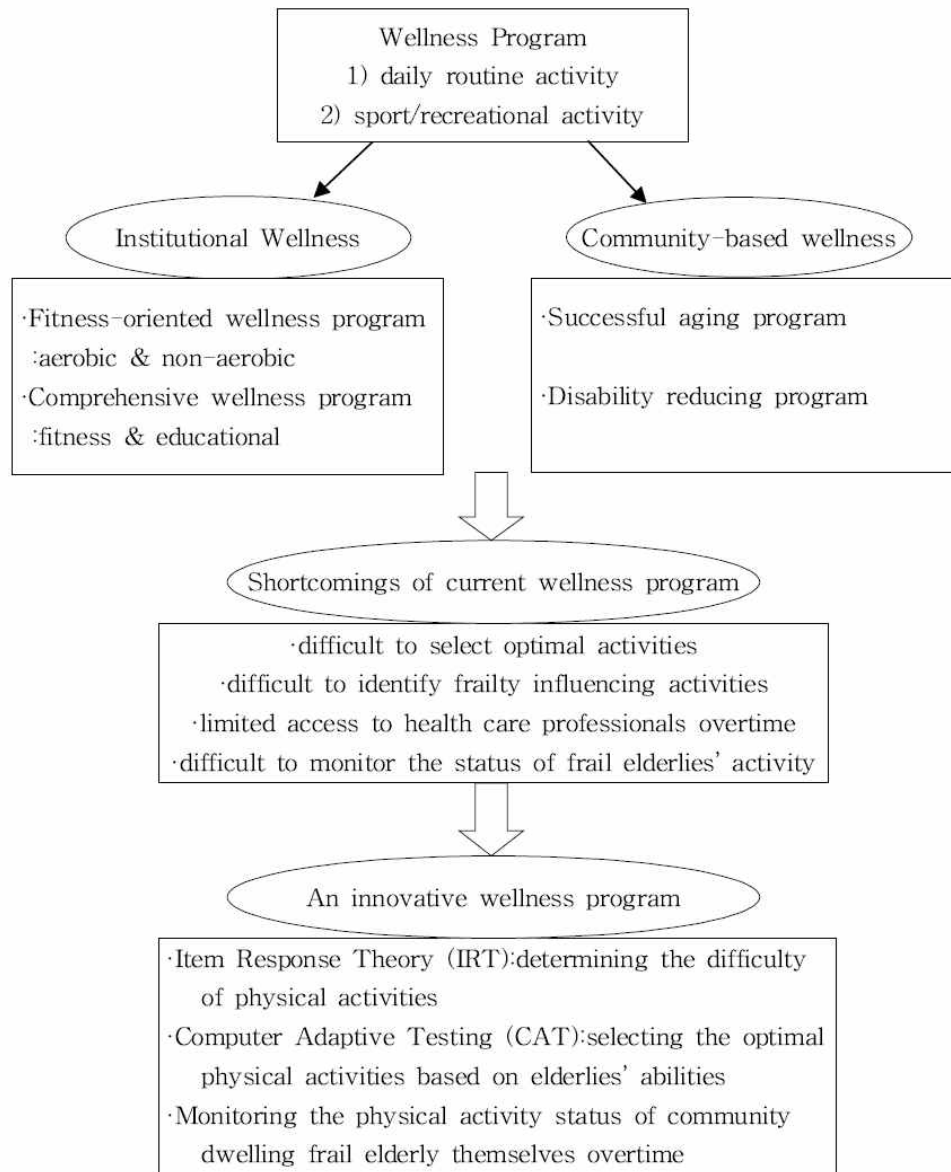
The purpose of this study is to review current wellness programs promoting participation in physical activity, shortcomings of the current programs, and introduce an innovative means of health-contingent wellness program for the community-dwelling frail elderly.

## Methods

### Overview of current wellness programs for the elderly

As the population ages, the incidence of illness and disability increases, which is why successfully becomes increasingly important in the elderly. While many studies define the issue as successful aging (Bowling and Dieppe, 2005; Kohl et al, 2012; Lachenmayr and Mackenzie, 2004; Palmore, 1979, Phelan et al, 2004), investigators view it as avoiding disease, anticipating high cognitive activities and physical function (Rowe and Kahn, 1998), and performing regular physical activity for the community-dwelling elderly's quality of life (Spirduso and Cronin, 2001). Few authors indicate that insufficient physical activity, as one of common negative effects, may be a direct link to the cause of death and illnesses (Booth et al, 2012; Hamilton et al, 2008). Thus, as a means to enhance the physical activity as well as overall health in the elderly population, wellness programs play a primary role (Matuska et al, 2003).

The wellness program, in a review of the conceptual basis of it, focuses on two domains: daily routine physical activity and recreational/sport activity, where priority is placed on how well sustained an optimal balance of energy level in physical and recreational/sport activities (Werkman et al, 2006). On or off-site wellness programs, sponsored by organizations, designed to promote good health or to identify potential health related problems, are most



**Figure 1.** A conceptual framework of this study. The figure represents two primary domains of wellness program, the characteristics of current wellness programs, their shortcomings and a proposed innovative wellness program.

commonly offered (Wolf et al, 1994). As previously stated, these programs are often referred to as institutional wellness programs which are classified as fitness-oriented and comprehensive wellness programs in the work force or retirement home. In general, fitness-oriented programs include aerobic and nonaerobic exercise components as well as weight training, while comprehensive programs include both

fitness and educational component (Parks and Steelman, 2008). Figure 1 represents a conceptual framework that illustrates two domains and characteristics of wellness programs as well as their shortcomings and suggestions being discussed later in this paper.

In addition to institutional wellness programs, community-based wellness programs have widely been introduced and developed for frail elderly fol-

lowing an emergency admission to a hospital or discharge from health care institutes (Chen and Berkowitz, 2012; Colligan et al, 2015; Ewen et al, 2017; Nicolaidis et al, 2013). Moreover, community-based programs have recently become one of the most successful models for elderly care due to its potential as a resource for any individual who may want to search for providing services within the community. That is, health care professionals may be able to assist in the translation of such resources into a sustainable community-based program to better understand the determinants of successful aging. For the community-based wellness program to be truly successful, it is suggested that healthcare professionals should shift their attention to community-based wellness programs so that propriety care can eliminate the elderly's need for hospital re-admission and the risk for developing a disability (Hollis et al, 2006; Lachenmayr and Mackenzie, 2004).

In comparison to the United States' wellness programs driven by the U.S. Department of Health and Human Services in which public health perspectives has been emphasized, most the European Union countries encouraged establishing a consortium with government-research institutes-health care professionals-user. Moreover, forming active assisted living communities and well-aging products for the elderly have strongly been supported by the government. In contrast to the program of western countries, Japan is the first country to use the concept of self monitoring online health care system. That is, online health care systems managed by insurance companies allow individual users to access their personal health-related information anytime/anywhere under physician's supervision. The system has proved to be successful with respect to providing an optimal environment for the health care efficiency. Similarly, the wellness program in Korea has been driven by non-health care related governments (i.e., the Ministry of Knowledge Economy or Ministry of Trade, Industry and Energy rather than the Ministry of Health and Welfare) (Kim, 2016). That is, wellness

programs in Korea were viewed as a business model rather than a health care model. While designed to support the wellness industry of Korea, it is now partly evolving into dealing with health promotions, disease prevention, public security for community-dwelling frail elderly and safety management (Song et al, 2017). However the wellness programs in Korea have primarily been limited to the development of ubiquitous health care management system to which remote health care based on information and technology applied.

In general, a primary goal of wellness programs for the elderly is to promote a healthier later lifestyle through health promotion and disease prevention. However, the program goal for the frail elderly should be differently defined by the status of vulnerability to subsequent adverse health outcomes. The adverse health outcomes may later be an increased risk for multiple adverse health outcomes such as disability or institutionalization. Since many studies consistently indicate that increasing physical activity with aging may be a critical factor in reducing the adverse health outcomes, maintaining or increasing physical activity in the frail elderly.

### **Shortcomings of current wellness programs for the frail elderly**

Since the frail elderly may be less able to perform than the non-frail elderly in daily activities, selecting optimal activities that best fit the physical activity status of the elderly may play a critical role in achieving goals. In addition to selecting the optimal activity, it is crucial to identify frailty influencing the activities. The frailty of the elderly is considered as the hallmark geriatric syndrome and one of predisposing factors to adverse health outcomes (Clegg et al, 2013). Despite the embedded frailty, many community-dwelling elderlies still remain active while some elderlies do not. As such, the probability of whether remaining physically active or inactive depends on the degree of frailty. It is a well known notion that aging itself may not determine the frailty

but became popular in geriatric care (Fried et al, 2001; Kiely et al, 2009).

For detecting the frailty in community-dwelling elderly, few screening assessments were developed and updated (Gloth et al, 1995; Washburn et al, 1993; Woo et al, 2015). Versions of those are validated in other languages and are provided for non-healthcare professionals (Woo et al, 2015). Moreover, few studies encouraged focusing on frailty transitions in which community-dwelling elderly recovered into the robust state after a frail state or the other way around (Espinoza et al, 2012; Fallah et al, 2011). By tracking the transition, one can determine whether the elderly individuals may naturally remain in the pre-frail state or improve back into a robust state. However, these assessments are frequently difficult to perform adequately in the frail, homebound or community-dwelling elderlies (Gloth et al, 1995) and are improperly validated by some selection biases (Gloth et al, 1999). This is due to the fact that these assessments do not have adequate breadth for all ranges of capabilities (i.e., test-dependent) and/or the assessment scores cannot be compared across different samples (i.e., sample-dependent) (Hambleton, 2000). To date, in a review of frailty specific assessments for the elderly, there is no gold-standard assessment for detecting the frailty in community-dwelling elderly.

In addition to lack of standardized assessment, there has been lack of strategies to promote physical activity for the community-dwelling elderly (Lachenmayr and Mackenzie, 2004). In general, it is well known that a greater percentage of community-dwelling frail elderly may remain physically inactive than younger community-dwelling adults. That is, factors associated with physical inactivity are likely to influence the status of frailty (i.e., older age, lower cognitive function, or previous medical history). Kahn and colleagues provide convincing arguments to determine the success of wellness programs for the community-dwelling frail elderly (Kahn et al, 2002). The authors note that wellness programs for

the frail elderly require a significant systematic leap for translation into assessing the capacity, accessibility and barriers in providing these programs. Their argument suggests strategies to expand infrastructure such as providing an optimal number of trained experts, adequate facility space, sufficient funding, and various transportation options. However, most wellness programs have exclusively been targeted for individuals with disabilities and for those who have access to the programs.

With an almost endless array of wellness programs designed to promote physical activity for the community dwelling elderly, little is known about wellness programs for the community-dwelling frail elderly. There are many programs focused on aerobics, but not many health-related wellness programs for the frail elderly are developed (Jackson et al, 1998). In general, wellness programs are geared more towards the elderly's general health and comprehensive psychosocial well-being via participation in meaningful physical activity compared to programs with aerobics. With the majority of the frail elderly having at least one chronic condition or multiple conditions, comprehensive wellness programs are more likely to be successful than those which focused on aerobics to promote the health. Presently, those with aerobics may not offer the wellness comprising general health status and comprehensive psychosocial well-being to prevent and/or maintain chronic conditions from worsening.

### **An innovative means of health-contingent wellness program for frail elderly**

As well as reviewing broader aspects of the terms, concepts, and limitations of current wellness programs, it is suggested for the successful wellness program to requires few things to promote participation in physical activity of community-dwelling frail elderly. First, periodic online measurement system monitoring of physical activity levels should be considered to detect periodically frailty of the elderly

and to provide early community interventions. It is well documented that the online measurement system using new technologies, IRT and CAT method, may provide a means of assessing the community-dwelling frail elderly overtime and elsewhere (Haley et al, 2008; Hart et al, 2006; Velozo et al, 1999). These two methods have been increasingly used to develop and validate a number of functional outcome measures in rehabilitation fields (Dobel et al, 1994; Haley et al, 2008; Hambleton, 2000; Hart et al, 2006; Velozo et al, 1999). In contrast to conventional questionnaires, the IRT focuses on the psychometric properties of test items and classifies the items by the invariant item difficulty. The IRT model yields the invariant item difficulty, which leads to test and sample free measurements. The CAT method promises a means for administering test items in a way that is both efficient and precise. The CAT method requiring a testing algorithm of which iterative complex processes specifying test items (i.e., precise) will administer test items to the elderly or care givers. Since a smaller number of test items (i.e., efficient), in a comparison to traditional testing methods, may be selected from a item pool that is most relevant and targeted to the elderly of a particular ability, less time will be required. Additionally the innovative online measurement systems can be used over time as needed and elsewhere. This type of online measurement system may play a primary role in detecting changes in functional status of the elderly over time. This type of measurement system has been proven to be efficient and precise in determining the levels of physical activity (Choi, 2012; Haley et al, 2008; Hart et al, 2006; Velozo et al, 1999). That is, the online measurement system using the IRT and CAT method permits accurate estimates of the status with less number of test items (i.e., efficient measure) and by selecting optimal test items in accordance to person ability (i.e., precise measure). Moreover, the estimates resulting from the methods are considered as invariant regardless of test items used and ability levels of sample applied. Later, this system would

lead to a useful tool for making clinical judgements as well as assessment itself.

Second, an individualized health-contingent wellness program for selecting optimal physical activities should be considered to be matched with the current physical activity status of the elderly. The hierarchically ordered physical activities can be acted as a determinant in decision-making process when monitoring any changes of the elderly's physical activity in earlier period. These two methods previously stated may allow one to examine which activities an elderly is having challenges and which they are not within the measurement system. Then the system will notify individual elderlies of what physical activities need to be focused on for the coming wellness program as well as assessing themselves while residing in communities. Meanwhile, the community health professionals will determine whether the elderly may require further medical assistances or continue the wellness program. This strategy can provide comprehensive information from elsewhere regarding whether the current status of physical activity links to overall health status or not. The initiative for the innovative online measurement system may draw community-dwelling frail elderlies into more attention to improve their overall health as well as participation in physical activity.

## Conclusion

The primary aims of this study aimed to review current wellness programs promoting participation in physical activity of the community-dwelling frail elderly, explore the shortcomings of the programs from the perspectives of measuring the physical activity and suggest an innovative means of health-contingent wellness program for the elderly. In summary, many existing wellness programs have designed in the context of health promotion as well as informatics and showed few limitations. Factors being considered in promoting physical activity as a

successful aging may be monitoring the elderly's activity overtime and elsewhere. In short, successful aging is dependent upon individual health behaviors. The key to successful wellness program for community-dwelling frail elderly is contingent on monitoring their physical activity overtime as well as selecting optimal physical activities that match to the status. This would lead to many advantages: 1) self-monitoring in the physical activity status of the frail elderly, 2) selecting optimal physical activities matching the current status to promote their physical activity, and 3) creating own adaptive wellness program while residing communities elsewhere.

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This article was received May 15, 2017, was reviewed May 15, 2017, and was accepted August 7, 2017.