**Increasing Physical Activity and Prevention of Frailty in the Elderly**

**Dual-Task Senior-Based Hiking Groups and Community Gardening Programs**

**Statement of Need:**

 “Health and aging are social and cultural concepts in addition to being biologically determined.”4 Health promotion programs and the interventions they employ such as community gardening and walk/hike groups are a valuable resource for older-adults to maintain and improve attributes constituting good health and quality of life. The magnitude of these benefits within the rural and underserved “high-country” communities of North Carolina (NC) such as Mills-River NC could be exponential.

Frailty is classified as a multi-system disorder and considered one of the three central geriatric syndromes.(1)  Frailty can be triggered by multiple pathophysiological processes such as malnutrition, hormonal imbalances or multi-morbidity and lead to rapid deterioration of functional reserve physical/cognitive function, mobility status, healing response.4  Clinical presentation associated with frailty include, acute/unintentional weight loss (>10 lbs/year), self-reported exhaustion, decreased activity level, undue weakness, decreased lean-body mass, decreased gait speed, history of falls and recurrent loss of balance.5  Clinical depression can easily be manifested and catalyze these comorbid interactions, further increasing healthcare usage and risk becoming homebound which account for roughly 70% of the Medicare cost annually.(6)

Malnutrition has been shown to play a prominent role in the development or progression of immobility and functional decline in older adults who are frail.1,2,3,5 Furthermore, malnutrition is more prevalent within the rural and underserved population.1,2,3,5 Malnutrition can result from decreased total caloric intake as well as macronutrient deficiencies and include vitamins, anti-oxidants, protein/amino-acids and trace minerals.1 At the cellular level, macronutrient deficiencies lead to greater proliferation of free radicals and increased levels of oxidative stress which accelerate the age-based deterioration of cells and thus contribute to the reduction in motor performance and decreased cognitive function.1  Elderly individuals who are malnourished may present with decreased energy reserve, diminished activity tolerance, low body weight, as well as severe atrophy and degeneration of skeletal muscle, bone, and collagenous tissues.5 As such, elderly individuals who are malnourished are at greater risk of becoming frail, or development of chronic diseases such as osteoporosis, osteopenia and sarcopenia, incurring a fall-related trauma and acute or chronic musculoskeletal pathology.5 A 2007 study by Houston et al. found strong cause-effect relationship as well as positive correlation regarding the presence and quantity of macronutrient deficiencies in older-adults who are frail. Fifty percent of frail subjects had blood-serum levels constituting at least one macronutrient deficiency with incidence of frailty coinciding with increased number of macronutrient deficiencies.6

The most effective treatment for frailty is the prevention of the condition all together. This can be more easily achieved by identifying factors that facilitate and hinder the implementation of early intervention, patient education and effective behavior change strategies.1,2,3,5 The extent to which health promotion focuses on the individual and individual choices while ignoring social and organizational contexts of health related behaviors may also affect a prospective programs ability to reach its population of focus.3 The socio-ecological model (SEM) operates under the assumption that appropriate changes in the social environment will produce greater change of behavior.3 Health promotion and wellness programs are more apt to promote individual adoption and maintenance of positive health-behavior through focusing on individual, social and environmental determinants with development and implementation of health promotion interventions. 3

Older adults residing in rural and underserved communities like Mills-River typically have higher rates of tobacco/alcohol abuse, obesity and malnutrition.3 Also, preconceived notions about their personal health, prior or current physical activity level or dietary intake have been highly reinforced.1 As such, older adults can be resistant to modifications in health behaviors, further contributing to a greater incidence of chronic diseases such as cardiovascular disease, stroke, chronic obstructive pulmonary disease, congestive heart failure, diabetes mellitus or multi-morbidity.1 The incorporation of functional tasks of moderate intensity or activities promoting targeted health behaviors in a functional environment indicate awareness of intrapersonal determinants of behavior change. Thus the implementation of community gardening and senior hiking groups more apt to provide positive reinforcement motivation, feelings of self-efficacy, and provides a rewarding experience of learning or re-learning a new skill helps to ensure the continuation of healthy dietary intake and adequate levels of moderate physical activity. (1)(2)(3)(5)

Within the underserved and rural environment, there is a decreased presence of community recourses to promote transition of positive outcomes and the prevention of chronic disease conditions upon discharge from primary healthcare entities. Furthermore, older-adults residing in rual and underserved communities tend to demonstrate decreased knowledge as well as awareness regarding the severity and seriousness of chronic disease conditions. These insufficiencies interact in a feed-forward negative fashion and at times, are present throughout life, further promoting inactivity and chronic diseases such as frailty and malnutrition during older-adulthood.5 Large “up-stream” organizations and public policies predispose rural and underserved populations to lower heath-related quality of life. Public funding allocated for parks & recreation departments is grossly inadequate, hinder participation in physical activity throughout life that leads to pronounced negative affects on the overall health and functional independence in older-adults.2 Also, hospitals located in underserved and rural communities are often not-for-profit. A large percentage of the prospective patient population in rural and underserved areas receive publicly funded healthcare (Medicaid and/or Medicare) throughout their life-span. Those who are under 65 years of age typically rely on Medicaid which at the present time offers limited coverage and allocates inappropriate amounts of skilled rehabilitation and preventative care. Instead these services are preset based on diagnosis and/or disease rather than socio-ecological factors of the patient or patient population and results in the increased rate of primary hospital admission, subsequent instances of readmission and the compounding of chronic disease conditions as the population ages. This feed forward negative cycle in turn, places enormous financial burdens on the local hospital itself and public healthcare system as a whole.

Doctors of physical therapy (DPTs) are currently recognized as a primary care entity. Many health officials and fellow health care professions believe DPTs are the ideal health care professionals for the development, initiation and continued implementation of health promotion programs for the elderly and their associated interventions. DPTs are trained in movement analysis, differential diagnosis of musculoskeletal injury or pathology and the developing a plan of care that is patient-centered at any point along the developmental lifespan and continuum of care. DPTs are able to make appropriate program referrals and ensure accurate selection and performance of task-based interventions that are both evidence based and modified for the elder adult to prevent negative effects of aging. As experts in functional movement, DPT’s will be able to instruct, train and monitor participants in the use of proper body-mechanics and ergonomic positioning and make necessary modifications in form or technique when completing functional tasks. This better enables achieving moderate intensity activity whilst preventing re-injury, the development of musculoskeletal overuse injuries and/or early identification and evidenced based treatment if injury/pathology did occur. DPTs are also well versed regarding balance, its integral components and falls prevention and best allows for the safe selection and development of hiking trails, gardening environment/parameters, and optimal utilization of the multi-sensory balance training to challenge postural control and static/dynamic balance within a functional environment.

 A health and wellness program for older adults in Mills-River will provide a consistent source of social networking and social support late in life.34 Also, older-adults who receive sources of primary care within the inpatient or outpatient settings are exposed to means of patient education regarding their current condition and/or maladaptive health behaviors. This concerted effort to improve awareness can promote the beginning of pre-contemplation, active contemplation or developing/initiating a plan of action for health behavior change.31 Program interventions such as community gardening programs as well as hiking groups can be considered a means of enhancing continuity of care regarding therapeutic activity among underserved populations (9)(10) and facilitate successful transition and long-term maintenance of positive outcomes.

Background:

Programs such as residential gardening or walking/hiking groups can be seen as an activity more suited to the underserved older adult population by being cost-efficient and flexible regarding there implementation. They can be completed within the community so that the skills learned can be transferred to independent participation at home with a spouse or family.11 A majority of rurally based elderly adults have prior vocational experience and/or strongly associate with task-based labor occupations within the industrial or agricultural setting. As such, implementation of a community gardening program is more tailored to the elderly population; more apt to generate larger initial and long-term interest and participation through continued motivation, positive reinforcement, increased self-efficacy and reconnection with previous life roles and family connections.11. Older-adults tend to rank gardening as their second most popular activity behind “socializing with friends”.12 Horticulture is thought to facilitate gains in emotional status and functional mobility in the older adult through reestablishing mutual accountability, responsibility, accomplishment, fulfillment and self-esteem while working with others and provide positive reinforcement for the maintenance of behavior change.8,9

 Produce gardening with nutrition programs would increase availability and intake of macronutrient-rich foods at a decreased overall cost to elder-adults who participate. A 2007 study by Houston et al. examined the effects of macronutrient deficiency and relationship to frailty.12 The authors found with daily caloric intake </= 21 kilocalories/kilogram BW/day was strongly associated with becoming frail12 and prevalent in the older-adult population at 20% of the total study population.12 The authors also found a strong causal relationship and positive correlation regarding the presence of macronutrient deficiency and becoming frail; finding 50% of frail subjects having at least one macronutrient deficiency and thought to be twice as likely to become frail with three or more macronutrient deficiencies.12 A 2007 study by Scmba et al. found that increased concentration of free radicals (protein carbonyls) and oxidative stressors indicative of malnutrition and macronutrient deficiency, were associated with decreased walking speed (< 0.4 m/sec) and walking ability over 36 months.2 Therefore, a program that improves availability of nutritious foods for older adults may serve to decrease incidence of frailty whilst improving overall functional mobility and activity tolerance.

Gerontologists have suggested for some time that the durability with health behavior change is proportional to the degree of active, rather than passive participation of the older learner.3 The implementation of a community gardening program would provide a supportive atmosphere in which a variety of health and psychosocial concerns can be directly and indirectly addressed through incorporation of an educational framework centered on participant contribution of their knowledge, life experiences and wisdom, better enlisting the individual and group in the change process and create a dynamic, interactive environment specificity targeted for the elderly to learn and adopt good nutrition habits.3 Hackman et al assessed nutrition education through gardening programs with seniors (>/= 62 years), measuring pre-to post-test changes of dietary behaviors and psychological well-being. The program was conducted over two gardening seasons.5 Monthly gardening classes provided technical information for the appropriate stage of the season. Nutrition classes were conducted every-other week for 90 minutes in a facilitative manner, to enhance perception of self-control and a social support system.5 Each nutritional meeting allotted a 30 minute period for each of three key elements of the educational intervention: a) providing nutrition information, b) developing an action plan to implement dietary improvements, and c) sharing successes and brainstorming ways to help each other eat well.5 Implementation of functional task training and peer-based education led to significant increases in dietary intake of all 7 food groups of focus.5 The implementation of a community gardening program enhanced neighborhood aesthetics and promoted social interactions associated with concordant task-based nutritional education and facilitated increased mean fruit and vegetable intake which meet or exceeded the 5 serving national recommendation.8 The combination of functional tasks and educational recourses also promoted an enhanced attitudinal change regarding nutrition fluency and gardening.5  Therefore, implementing dual-task health promotion programs which focus on task implementation and participant education can possibly promote adoption of positive heath behavior change with a greater likelihood of long-term maintenance of health behavior change.

Intrapersonal factors can be considered physiological characteristics central to a population and central determinant to achieving positive outcomes from program interventions. Older adults tend to have difficulty controlling their center of mass (COM) over their base of support as they step over, walk around and duck under objects to avoid imbalance and subsequent fall. 8 Increased instances of imbalance are considered a major risk factor for falling among elderly individuals. 8 Many studies have investigated how older adults step over single, ground-based obstacles in their path and have provided insight into potential risk factors for falling during maladaptive locomotion such as step parameters and foot clearance.(10) However, older adults often encounter more than one obstacle in their path and usually over varied surfaces in and out of the home that require real-time conscious or unconscious adjustment in their posture and gait pattern accordingly.8  Integration of functional environments with task-based therapeutic activities associated with gardening or walking/hiking outdoors include walking over variable uneven surfaces, digging, lifting or squatting and more able to incorporate multisensory balance training, postural stability, dual-task performance, increased weight-bearing at the upper and lower extremities, multi-joint coordination along with increased strength/endurance of skeletal muscle and aerobic capacity8; leading to greater adaptations in postural control as well as demonstrate consistent, accurate, and appropriate feed-forward proximal joint stability, automatic postural responses and movement adaptation.8 Utilizing these alternative forms of therapeutic activity may be well suited to decrease falls-risk and better prevent acute injury or development of musculoskeletal pathology within the elderly population11

 The American College of Sports Medicine (ACSM) and American Heart Association (AHA) recommend those </= 65 years of age complete moderate-high intensity aerobic activity for a minimum of 20-30 minutes, 3-5 days/week, respectively.19 The intensity of aerobic or anaerobic activities are defined by The Metabolic Equivalent of Task (MET); a [physiological](http://en.wikipedia.org/wiki/Physiological) measure expressing the energy cost of a physical activity. The MET is defined by a ratio that compares the rate of energy consumption during a specific physical activity to a reference metabolic rate, set by convention to 3.5 ml O2·kg−1·min−1.19 Activities of moderate intensity (3 to 6 METs) should noticeably accelerate the individuals heart rate. Alternatively, the recommended duration of moderate-level physical activity may be accumulated by performing intermittent bouts lasting 10 or more minutes rather than a continuous 30 minute bout.19 Therefore, functional tasks incorporated during gardening or hiking such as walking at a brisk pace (5.0 METs), light digging (3.0 METs), walking/hiking at moderate pace and grade (7 METs), carrying moderate loads (7.5 METs) or moderate to heavy digging (6.6-8.0 METs) are evidence-based with achieving improvements with individual aerobic capacity or activity tolerance.19

Recently completed 2014 randomized control trials (RCT) have presented evidence that indicates long term completion (9 months) of a one easy to moderate hiking session (500 meter altitude gain in 3 hours) per week elicited a mean net energy expenditure between 445-574 kcal per hike and thought to be a safe and viable means to elicit gains in aerobic capacity and improving severity of hypertension in the elderly adult.21 A RCT by Neumayr et al investigated the cardiovascular effects of a 3-week hiking program guided by health professionals four hours per week, average duration 2.5 hours per bout at 55-65% of maximum heart rate within a cohort of elderly males possessing multiple cardiovascular risk factors. The results showed similar benefits including significant decreases in body weight, subject’s weight to height ratio, decreased body fat percentage and waist circumference.22 The hiking regimen again showed a lowering effect in the blood pressure of participants; with deductions in SBP,DBP, mean arterial blood pressure as well as promoted lower heart rate with mean decreases between 3-5 beats/min.22  These results are again intervention specific and support hiking as an evidenced based means of achieving positive outcomes related to participation in outdoor hiking and the prevention and/or reversal of risk factors associated with the targeted chronic disease condition/s and prospective population of elder-adults within our health promotion model. Furthermore, the importance of integrating trained health care professionals such as physical therapist to ensure hiking and other forms of functional activity in more unpredictable outdoor environments are safe for elder adults with or without the presence of cardiovascular risk factors. Body weight is a common risk factor, which leads to chronic disease. Participation in community gardening has been shown to correlate with healthy body weight and appropriate BMI level compared to non-gardening neighbors, siblings and spouses adjusted for age and gender. Female community gardeners’ average BMI was 1.48 points lower than their neighbors and were 46% less likely to be overweight or obese.20 Male gardeners had an average BMI that was 2.52 points lower than their neighbors with a 62% reduction in the likelihood of being overweight or obese.20  This Translated into approximately an 11-pound weight difference for a 5’5” tall woman and 16-pound weight difference for a 5’10” man.20 These results indicate community gardens may be a valuable element of land use diversity that merits consideration by public health officials who want to identify neighborhood features that promote health.20

Group walks/hikes as well as gardening are able to integrate the targeted population’s outdoor environment and take into account population determinants such as interpersonal as well as intrapersonal factors when establishing positive health behavior change. Taking into account population determinants will better facilitate self-enjoyment, peer-interaction within the community and help establish an emotional sense of well-being.1,2,4 The Centers for Disease Control and Prevention recommends walking in a group to increase walking behavior, as the social environment of the walking group may augment adherence to walking.(26) Group walks in the natural environment has been shown to significantly improve emotions and self-esteem when compared to a group walk indoors.23 The rational explaining positive affects on emotional well being related to natural environment exposure have been extensively reviewed and a cornerstone to the enhanced efficacy of the health promotion interventions proposed in achieving long-term behavior change with the older-adult population and continued success within the rural and underserved community.11,12,13 The Attention Restoration Theory (ART) posits natural environments contain stimuli that allow for the restoration from mental fatigue due to unconscious attraction of an individual’s involuntary attention, allowing for the restoration of direct attention to themselves or others.(23) The psycho-physiological stress reduction framework, posits that nature initiates innate emotional, physiological, cognitive and behavioral responses including reduced negative affect and physiological arousal as well as enhanced positive effect on attention.24 Evidence also indicates the specific type of natural environment and whether this is urbanized or not can affect individual psychological/emotional well being, walking behavior and physical activity level achieve larger positive outcomes and further support implementing walk/hiking groups within the rural and underserved community.25 Walking in urban green space and urban public space is typically significantly less in duration compared to walks in natural environments, green corridor, and farmland.25 Additionally, walks in urban public space tend to be significantly less duration than walks in coastal and mixture environments25 Participants who frequently attend group walks in farmland environments are associated with greater mental well-being in comparison with those walking in urban public spaces.25

Community gardening programs, nature trails, and walking/hiking groups which take into account both intrinsic and extrinsic motivations for late-life leisure activity.32 Evidence indicates implementation of such interventions positively correlate with increased amounts of moderate-to-high level physical activity and improved overall health and emotional well-being of those who participate.32 The health promotion programs proposed for Mills-River have been both developed and formatted to be interdisciplinary oriented and to encompass multiple aspects of health and wellness simultaneously. Interdisciplinary programs are thought to be most beneficial in maintaining a high level of health and quality of life within underserved communities and work to combat socio-economic disparities in health-behaviors by offering a long-term recourse for the community of Mills-River and the older-adult population which reside there.33

**Program Description:**

Outcome Measures

* Functional outcome measures (6-minute walk-test, BERG balance scale, Timed-Up and Go (TUG), 10-time sit-to-stand) will be completed for all participants at baseline (prior to first completed session) and one-year following program initiation.
	+ For those who sign-up for programs after the initial start-up period, community center employees will be identified and trained in completing all functional outcome measures at time of sign-up.
* Subjective, participant-reported outcome measures of health-related quality of life (HRQoL) (SF-36) will be completed for all participants at baseline (prior to first completed session) and one-year following program initiation
* All ordinal data (fruit/vegetable servings, caloric intake, incidence of falls, frequency/intensity/duration of physical activity) tracked in an ongoing fashion via, activity-logs and dietary intake forms.
	+ Participants will be oriented to each form and instructed on accurate completion upon initial sign-up period and subsequently reviewed during associated education sessions.

Objectives:

1. At one-year post implementation, older-adults of Mills River participating in the prospective health promotion programs will demonstrate maintenance of behavior change by demonstrating good to excellent adherence and compliance regarding health promotion interventions with participants attending at least 50% of sessions offered between community gardening and walking/hiking groups.
2. To prevent and reverse incidence of malnutrition and/or macronutrient deficiency, older-adults who participate in the Mills-River community gardening program will achieve the recommended daily intake of fruits and vegetables (5.5 servings per day) as well as total caloric intake (2000-2500 kcal/day)cc after one year of program implementation (2 growing seasons) as measured by participant subjective reporting.
3. At one-year post implementation of community gardening and walking/hiking groups, older-adult participants of Mills River will meet the recommended amount of physical activity per week through community gardening, walking/hiking groups or a combination of the two interventions with regard to intensity (moderate-high), frequency (3-5 times per week) and duration (20-30 minutes) to maintain and/or improve physical activity tolerance and aerobic capacity as indicated by 6 min walk-test
4. At one-year post implementation of community gardening and walking/hiking groups, older-adult participants of Mills-River will demonstrate increased balance capability and functional mobility status with decreased incidence of falls annually (50% less than previous year), will be indicated as a “low falls risk” by performance on falls-assessments [BERG balance scale, and will require an assistance level of “supervision” based on functional independence measure performance [Timed-up and go (TUG); Timed 10 repetitions of sit to stand).
5. At one-year post implementation of the Mills River community gardening and walking/hiking groups, older-adult participants will demonstrate significant improvement in overall HRQoL as indicated by a minimum increase of 5 points on the SF-36 measure.

Methods

 Mills-River NC is a small rural, industrial/agriculturally based community outside of Asheville NC with access to a multitude of state/national forests that harbor many forms of outdoor recreation.. A large population of late-middle aged to elderly-adults (Female and Male; >/= 50 years old) reside in Mills-River and reported to have higher rates of obesity (29%), DM (10-12%) and levels of inactivity (31%) compared to other NC counties.1,2,3 As such this will be the prospective location and patient population targeted.

 Older-adults of Mills-River (>/= 60yo) will be the targeted demographic of the proposed health promotion programs. As such, to best achieve successful implementation and meet program objectives, the environment and interventions associated with community gardening as well as hiking groups will be tailored to promote maximal participation and optimal safety for the older-adult. Environmental characteristics and possible intervention modifications suited to the older-adult are outlined below in program methods.

The optimal location for implementing the community gardening initiative for seniors would be at the existing community center located in Mills-River. Being an extension of the community center along with other forms of marketing would divulge a more accurate estimation of potential interest, increased exposure of a greater breadth within the population targeted. The community center also provides a consistent location for implementing both task-based and educational components to facilitate program adherence. Finally, utilizing the community center will provide older-adults and more importantly, their potential ride/driver, convenient access to alternate forms of health & wellness based programs provided at the community center. The coordination between health and wellness professionals and the community center allows input and participation of local public service members/officials and further ensure successful, quality and cost-efficient implementation of the program interventions themselves and best suited to the community of Mills- River. Finally, adding to the community centers existing infrastructure will drastically lower the initial and overall start-up cost and thus, provide cost-effective service of greater value for the individuals who participate. Funds can be redirected and investments focused on marketing, construction of program facilities, purchasing a larger quantity of quality equipment and providing adequate materials and recourses for education most suited to the older-adult.

***Methods: Community Gardening Initiative and Hiking Groups for Seniors***

*\*\*\*This program proposal takes all necessary measures to insure maximal participation and safety of its participants. However, all participants will be required sign a consent form acknowledging they have been informed of the inherent risks with activity participation within the outdoor environment and those volunteering with the program (in the absence of direct negligence) are not held liable with the incidence of unforeseen injury or health complication.*

**Duration:**

This health promotion program is a one-year pilot program consisting of dual-task therapeutic activity interventions in conjunction with periodic educational components to reinforce active understanding and independent maintenance of positive health behavior change.

* The Gardening component will operate during the NC high-country growing season; March-November

**Garden Parameters:**

* Multiple fenced-in garden plots each 100-1000 sq ft
	+ Must allow sufficient space between fence and the border of garden bed to enable safe working space and decrease falls risk or incidence of injury
	+ Covered, shaded areas
	+ Tool-rack and tool modifications
		- Padded handles, larger gripped handles
		- Tools of multiple lengths
		- Lighter tools
		- Knee pads
	+ Doors that swing out
	+ Implementing garden beds of adjustable height to better accommodate patient ability and prevention of vertebral injury regarding bending, lifting, twisting, kneeling in the older adult
	+ Implementing attached seating along fence-line to allow for rest-breaks as needed

**Prospective Volunteer Staff:**

* Skilled Rehabilitation Health professionals and associated student clinicians.
	+ Physical therapy, occupational therapy, speech pathology, athletic training
* Community center employees
* Certified Nutritionist (educational component)
* Local Farmers, experienced gardeners (active or retired)
* Other community members well versed in manual labor

**Education component:**

Three patient education sessions will be offered monthly at 6:00pm on the first-day, fifteenth-day and last day of each month. Each session will focus on one of three components independently (listed below)

* Strength, Aerobic Conditioning and Ergonomics: (first day of each month)
	+ 90-minute session held monthly by skilled rehabilitation health professionals (PT/OT combo preferably) discuss/teach methods to optimize participation and prevent injury during the program as well as answer participant questions or possible problems.
		- Multi-sensory consideration with balance training
		- Muscle balance (strength vs extensibility)
		- Overall lower-extremity strength
		- Proper ergonomics, body mechanics and possible technique modifications with completion of labor-based functional tasks.
* Gardening/produce farming education: (fifteenth day of each month)
	+ Held every other month by local farmers and provide technical information dependent on appropriate season including potential recipes and healthy ways to prepare food grown.
	+ Topics to include planning and planting, watering, fertilizing, pest-control, composting and soil maintenance and preparation
	+ Proper ergonomics and techniques concerning all gardening practices will be conducted by the OT/PT and Farming entity together.
* Nutrition Education: (Last-day of each month)
	+ Taught by Nutritionist and held at community center
	+ Completed in a facilitative manner to enhance perception of control and peer supported learning atmosphere18
	+ Held every other week for 90 minutes and will target 7 areas for nutritional improvement (dairy, macronutrient rich foods, iron rich foods, dark-green leafy vegetables)18
		- Will allot 30 minutes for each element of educational intervention18
		- Providing nutritional information
		- Developing an action plan to implement dietary improvements
		- Sharing successes and brainstorming collectively as a group methods to better maintain healthy eating habits.
	+ Pot-luck dinner will be held monthly18
		- Composed of food prepared by community gardening participants

**Active Gardening Component:**

* The task-based activities will vary based on necessity, growing season period of growth cycle.
* Frequency:
	+ Offered 5 days during the week (MWF) 8am-5pm and weekends (sat/sun 11pm-5pm)
	+ Times/days offered will depend on how many sign up
	+ Overlapping schedules regarding both staff and gardening participants
	+ At least one PT/OT will be present onsite Saturdays and Sundays
	+ Student Clinicians of prospective healthcare professions as well as employees at the community center and community volunteers well versed in manual labor (Farmers, construction, landscaping) will be trained in the identification and basic modes of correcting maladaptive body positioning, signs of fatigue, and acute condition changes within elderly participants
	+ Ideally, achieve adequate volunteer and health professional participation to ensure at least one person of which is present daily. Otherwise participants will be informed of the days and/or times trained volunteer staff will be present during the week.
	+ Lower staff to patient ratio for more individualized attention and assistance when necessary
	+ Will inquire and enlist support and participation from the local chapter of “Future Farmers of America (FFA) to assist with the continued maintenance of the garden plots on days not offered.
* Gardening session Duration:
	+ Participants may stay the duration of the day however, time-slots will be offered in 3 hour increments with up to 20 being able to participate simultaneously
	+ Recommended participant complete two separate 30 min bouts or multiple shorter bouts of 10 min depending on preference and patient tolerance. Participants are strongly rest for at least 20 minutes during the 1 hour period
	+ Active group warm-up, therapeutic exercise and stretching can be completed at onset and completion of each three-hour session and is strongly recommended
	+ Exercises will relate to gardening practices and mimic static/dynamic functional movement and/or poses incorporated in yoga and Tai-Chi
	+ Staff onsite will monitor form and participant condition to insure any significant and acute change is identified and dealt with appropriately.

***Senior Walking/Hiking Group***

Multiple group hikes will be offered based on difficulty level on the weekends and last between 1-6 hours, cover 1-10miles with higher difficulty hikes lasting a greater length of time and duration. Initially senior hiking groups will contain a maximum of 6 participants per hiking group. To ensure adequate participant safety, a participant to volunteer ratio of 3:1 will be mandatory. Hikes will be lead by at least one skilled rehabilitation health professional and one volunteer with identical training as those participating in the community gardening program. These same volunteers will also scout and select the trails best suited to provide optimal safety, challenge and enjoyment. Initial group hikes will be completed at Dupont State Park, located 10 miles outside of Mills-River. This initial location offers extensive network of trails which are well maintained throughout the year, contain a hiking corridor/trail of larger width (>/= 10’) which allow for enhanced visibility and decreased risk of falls while also providing moderate to high levels of physical activity over variable terrains and degrees of incline whilst enjoying the natural environment in a social atmosphere with peers. The age range will be larger for the hiking groups (over 40 yo) to better facilitate attendance, adherence and prevention of multimorbidity, frailty and chronic disease in both the elderly-adult and middle-aged populations of Mills-river.

Developing a framework for program evaluation works to ensure accountability and commitment on the part of all those involved with the prospective program to achieving measurable health outcomes. Results and findings from the initial pilot implementation period will serve as the foundation for adequate modification and innovation regarding greater outcome improvement or use of alternate outcome measures which are better positioned to detect program effects on a targeted population.35 The value of health and wellness programs proposed is best determined by the programs merit, cost-effectiveness and importance to the older-adult population and overall community of Mills-River.35 This health promotion program has been tailored both for the older-adult and the rural and underserved community. The independent program interventions and associated components have been described above in full detail along with supporting evidence of their potential benefit for the older adult regarding targeted conditions of frailty, inactivity, chronic disease and malnutrition.32

The proposed health promotion programs are direct service interventions with multiple components. As such methods of evaluation must first be ethical and consider the welfare of those involved and potentially affected.37 Methods of program and outcome evaluation should be realistic, feasible to complete and serve the information needs of intended users.35 The components making up the health promotion interventions encompass multiple levels of health behavior change and thus, should also have multiple components to best gather necessary information and thus, better accounting for program effectiveness and results that are reliable and accurate.35 increased coordination between primary care entities, public service officials, and allied health professionals and serves to benefit the development, implementation and evaluation of program and associated interventions. This emphasis on interdisciplinary participation fosters a larger and more diverse source of input, greater level of participation and increases the chances that the evaluation tools will be useful, creditable and allow those involved to clarify roles, responsibilities, ensure participant safety and avoid real or perceived conflicts of interest.37

 Utilizing or implementing a turnstile at the community center entrance to sign in prior to the start of the session could easily achieve total attendance, participant adherance as well as overall attendance at the community center as a whole. Objectives which are quantified by ordinal-style data such as incidence of falls, program adherence, dietary and/or physical activity logs can be tied to routine program operations in a more ongoing fashion that involves all program staff, volunteers or stakeholders.36 Placing the community garden and conducting educational sessions at the community center was recommended to improve familiarity, and awareness of the centers recourses in their entirety. This continuity of location is hoped to bring greater comfort within the environment of the program interventions to better achieve program adherence of prospective older-adult participants whilst ensuring the results obtained during the evaluation are both reliable and valid.32

The actual activity and food-intake logs as well as patient-subjective assessments measuring HRQoL (SF-36) should also be tailored to ensure consistent and informed completion by the older-adult.32 Forms completed by the patient should integrate a format that is legible, straightforward, organized, where completion is most intuitive. Adapted versions (self-completed & interview administered) of the SF-36 were released in 1995 which addressed concerns regarding a small concentrated number of assessment questions frequently missed by older-adults who completed the assessment.38 These questions of concern all emphasized vocational tasks or vigorous activities and thus not tailored to or perceived as applicable by the older-adult.32 The Anglicized version of the SF-36 is suitable for those over 75 years old, quick to complete and is shown to hold its same or higher levels of sensitivity and validity.32

Program objectives are also centered upon the improvement and/or maintenance of independent functional mobility for the older-adult. To best acquire accurate measurements of functional mobility in the elderly, functional outcome measures were selected which measured multi-sensory components of balance (BERG), in-home functional ambulation (TUG) and functional strength and endurance of the lower-extremity. All functional outcomes selected allow for the use of assistive devices, are time efficient and require minimal space or equipment to complete. Furthermore the outcome measures chosen are valid and reliable when used in elderly cohorts, are simple to conduct, interpret and easily understood and completed by the older-adult.36

Evaluation tools function to identify if the program was effective or not. Allied health professionals such as DPTs are most qualified to correctly interpret result findings of the evidence based outcome measures chosen and thus indentify barriers to optimal effect. A score on the BERG of less than 45 indicates on is “at risk” for falling.40 Depending on the participants initial score on the BERG from highest to lowest balance capability, the minimal amount of change to be considered clinically significant (MCID) ranges between 3.3-6.3 points, respectively.40 Regarding the TUG, MCID is a reduction in time between 0.8-1.4 seconds.41 Participants who complete the instrument in less than 20 seconds typically indicates independence in most ADL’s and outdoor mobility while 20-29 seconds indicates probable need for a gait aid and supervision for outdoor mobility.41 Finally the MCID for the 30 second sit-to-stand test is an increase >/= 2.5 repetitions and correlated with “major improvement” on the Global Rating of Change Scale.42

Those principally involved in this health promotion program will also collaborate with larger public officials on the community, county or even state level to best advocate and most effectively publicize the potential benefit of allocating funds for interdisciplinary health promotion programs for the rural and underserved communities of North Carolina.35 One of the largest limitations but also strengths of the study is the large impact of volunteer participation. Presented in this proposal is the significant need across the country and state for interdisciplinary programs such as these within the rural and underserved community as a whole. These types of program interventions provide a valuable opportunity and incentive for current health professionals or student clinicians to practice or request clinical rotations in the rural and underserved environment. Practicing in the rural and underserved population requires embracing creativity rather than shying away from challenge when establishing evidenced based interventions that are of higher value and enable a larger impact regarding life-long positive health behavior change for all who reside rural and underserved communities

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