

# Nutrition Education Intervention with Community-Dwelling Older Adults: Research Challenges and Opportunities

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**Abstract** This study critically reviewed empirical literature examining nutrition education intervention studies with community-dwelling older adults over the period 2003–2012 to: (1) determine the number, (2) evaluate the research designs, and (3) report the study outcomes. A search of online databases yielded 74 studies six of which met our criteria. The studies reported favorable intervention outcomes. Because of the number, variability in the types, designs, measures, scope, educational and behavioral strategies, results can only inform future studies and encourage scholars to use strong evaluation design. We recommend the utilization of an ecological conceptual model when conducting nutrition interventions studies and discussed implications in terms of research and practice.

**Keywords** Nutrition education interventions · Community-dwelling older adults · Behavioral and theoretical strategies · Dietary intake factors · Nutrition intervention study designs

## Introduction

One of the primary goals of Healthy People 2020 is to “promote healthy development and healthy behaviors across every stage of life” [45]. To support this goal in the US some have used media and cyber technology to increase

public awareness through health promotion initiatives, a majority of which emphasize food and nutrition. One might ask: What is the targeted audience for these initiatives? For the most part, a majority of the nutrition education initiatives have targeted type 2 diabetic and obese children. While some mass media nutrition education campaigns are aimed at adults, they vary in scope and accuracy and may overwhelm some older adults [18], a segment of the population that has increased exponentially.

The benefits of nutrition has for long been of interest to multidisciplinary gerontologists and community health practitioners in their collective efforts to promote health and to prevent illnesses. However, the value of nutrition education for older adults has been underemphasized [38] and has received very little attention separately and specifically. A computer assisted literature search of the scholarly literature for the past two decades supports the claim that nutrition education studies focusing on older adults are scarce. Scholars have published systematic reviews of nutrition education intervention studies with older adults in the US and reported finding fewer studies than expected. For example, Higgins and Barkley [18] reported nine studies between 1993 and 2003, while Sayhoun et al. [39] reported 25 studies between 1990 and 2003 conducted in the US. These and other scholars have been encouraging nutrition educators to develop nutrition education strategies tailored to the needs of this expanding population. Recently, The Gerontological Society of America (GSA) endorsed the federal government’s release of the 2010 *Dietary Guidelines for Americans*. Dr. Donald Ingram, then GSA president stated that “The benefits of a healthy diet and regular physical activity may include a more robust immune system, higher energy levels, faster recuperation times, sharper mental activity, and better management of chronic health problems” [41]. Hence, it is

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important to explore the extent to which researchers have addressed nutrition education interventions with older adults over the past decade. This article offers some background information; reports the positions held by some stakeholders; describes nuances identified by scholars; and critically evaluates nutrition intervention studies from 2003–2012 meeting our criteria. Findings will inform multidisciplinary gerontologists and community health education practitioners about the related research issues.

## Background

The 2010 Census data indicate that the population of older adults 65 years and older is approximately 40 million, an increase of 15 % since the year 2000. This population is expected to grow to 72.1 million by 2030 and 65 year olds are expected to gain an average life expectancy of 19 years [2]. Although this gain represents continued progress in longevity, the increasing rates of obesity, type 2 diabetes, hypertension, and heart disease are concerns linked to this trend. For example, among older adults, 45 % of persons over 60 years old are obese; the age-adjusted prevalence of clinically diagnosed diabetes is about 59 cases per 1,000 [26]; the rates of uncontrolled hypertension and aggregated heart diseases are 34 and 32 % respectively [2]; and the rate of increase in two or more comorbidities has increased [16]. These statistics are disturbing because studies show that nutrition education appropriate to specific conditions targeting older adults' needs is beneficial in improving quality of life, preventing illnesses [6, 34, 46]; promoting personal independence and successful longevity, and in decreasing healthcare expenditures [10, 31].

### Nutrition Education Defined

Nutrition education is “any combination of educational strategies designed to facilitate voluntary adoption of food choices and other food- and nutrition-related behaviors conducive to health and well-being; ...it is delivered through multiple venues and involves activities at the individual, community, and policy levels” [11]. This definition is accepted by the Society for Nutrition Education and the Academy of Nutrition and Dietetics, formerly the American Dietetic Association and suggests that effective outcomes following nutrition education intervention are linked to many factors influencing behavioral change; varies according to the targeted population; aims to inform people about the role of foods in promoting wellness; fosters healthy eating habits; and empowers people to select appropriate foods. Additionally, nutrition education intervention strategies must consider comprehension,

duration, social, health, environmental and community factors [4, 11, 36].

### Nature of Nutrition Education with Older Adults

The paucity of nutrition education research among older adults is associated with arguments on both sides. Opponents include some practitioners who speculate that older adults are disinterested in modifying their eating habits [13] because of: life-long cultural and regional food preferences [21, 30]; lack of access to resources; inability to shop for and prepare appropriate healthy meals; indigestion associated with the diminished digestive enzymes and chewing capacity; and the fatalistic thought that death is inevitable. The Academy of Nutrition and Dietetics take the position that, for older adults in healthcare institutions, such restrictions might result in psychological and physiological concerns because unappealing foods can lead to under nutrition and unintended loss of fat and lean body mass [1], exacerbating Sarcopenia [32], and contributing to functional decline [23]. The American Heart Association [5], a proponent of nutrition education intervention for older adults recommends that older adults attempt to control their blood pressure through modifications in diet and lifestyle. Several nutrition related factors such as reduction in body weight, sodium, whole milk dairy products, saturated and total fats, and in consuming adequate amounts of potassium, fruits and vegetables are beneficial in controlling hypertension [29] and other comorbidities associated with disabilities. Intended weight loss in obese older adults improves physical functioning and quality of life and reduces medical complications [15, 46]. Diabetes mellitus, its morbidity and mortality rates and associated healthcare costs [14], can be controlled by nutrition management involving the selection of nutrient-sufficient low glycemic foods to control blood glucose, lipids and body weight [32].

### *Challenges, Benefits and Need for Nutrition Education Interventions*

While practitioners value respect for autonomy and individual rights and are charged with preserving life, a number of other issues converge to create food and nutrition induced challenges that are difficult for practitioners to handle, including enticing food commercials and the availability of processed and convenience foods. Conventional wisdom suggests that it is important to target community-dwelling older adults with nutrition education intervention to deter harmful dietary behaviors and to empower elders to take care of their nutritional health and ultimately their physical and mental health. Non-restrictive diets in healthcare institutions are understandable since

these facilities have built-in controls making it difficult, if not impossible, for the older adult to overindulge in potentially harmful foods. Nutrition education among community-dwelling older adults: are time efficient and cost effective; have been effective in increasing nutrition knowledge and in changing behaviors among older diabetic and other nutrition related life threatening conditions [2, 40]; can foster positive outcomes since group dynamics can enhance communication and the adoption of new behaviors resulting from shared peer experiences, ideas and support [18, 27]. Such initiatives among community-dwelling older adults should be an area of concern for, multidisciplinary healthcare and community health practitioners because positive outcomes support the goals of Healthy People 2020 [35]. The extent to which these practitioners can fully understand the relationship between eating behaviors and health outcomes is essential for making judgments about the effectiveness of nutrition education intervention strategies [28].

### *Nutrition Education Intervention Strategies*

The evidentiary benefits of proper nutrition and nutrition education intervention with community-dwelling older adults are appealing. The assumptions are that poor nutrition behavior is largely and solely due to nutrition-related knowledge deficits exclusive of other intervention components. Indeed, uncertainties about the exact components of intervention that result in empowered outcomes continue to exist [27]. Alternatives to simple didactic educational programs include practical applications since active participation is critical to behavior modification [43] and skill improvement and self-management enhance empowerment and autonomy [44]. Models related to intentional goal setting, problem solving skills for overcoming obstacles and the integrative model of social support and self-efficacy that consider the emotional context of health behaviors are all more important than access [27]. Intervention strategies should also include behavior change theories/models to aid in specifying and organizing desired objectives as appropriate [3]. Integrating certain attributes of multiple theories/models along with modifiable refined standardized strategies might prove to be helpful in explaining participants' behaviors [9].

### *Scholars' Suggestions Concerning Nutrition Education Studies*

Scholars previously drew conclusions from their respective reviews identifying issues concerning planning, designing, implementing, and evaluating nutrition education intervention studies with older adults [12, 18, 39].

These scholars offered suggestions regarding ways in which such studies could be strengthened in order to maximize proven benefits on a consistent basis. The recommendations include the use of a number of research elements as follows: (1) *strong evaluation design* that include: stratified random sampling, random assignment of participants to intervention and control conditions or matched comparisons, pre and post intervention analysis, tests for statistically significant outcomes; (2) *valid, reliable nutrition measures* appropriate for the purpose, participants and duration of study including: (a) knowledge defined as the acquisition of information and skills needed to take action, i.e., “how to” or instrumental knowledge. This knowledge facilitates the recognition and identification of specific foods, and the ability to link such foods to harmful or beneficial outcomes; (b) physiological or medical health indicators including blood chemistry, body mass index, blood pressure, etc. Changes in physiological measures are affected by factors including nutrient intake, which is reflective of sustained behavior changes over time; (3) educational and behavioral strategies including: (a) behaviors and dietary intake factors such as keeping food frequency records, consuming of specific foods and nutrients, the removal of chicken skin, and meat fats, eating small portions, and restricting sodium; (b) psychosocial factors such as the support system of family and friends, personal beliefs and attitudes about health, satisfaction, perceived quality of life; outcome expectations, self-esteem; (c) theory-based strategies used to predict: behavior change, health belief, social cognitive—stressing self-efficacy and outcome expectations, reasoned action, planned behavior and stages of change. These collective suggestions are the basis for the study objectives of this review. Hence, the purpose of this study is to critically review and synthesize nutrition education intervention studies with community-dwelling older adults from 2003–2012 to: (1) determine the number; (2) evaluate the research designs; and (3) report on study outcomes.

### **Methodology**

Data for the present study were drawn from the online databases Ebscohost, PubMed, Eric, Academic Search Premier, Cinahl, PsychInfo, PsycArticles, Medline, Google Scholar, and Cochrane Databases of Systematic Reviews. The investigator consulted with a university public health research librarian who suggested inclusion criteria, such as: availability via online university libraries or interlibrary loan, English, scholarly peer reviewed articles, full text, empirical study, humans, and publication dates between 2003 and 2012. The selected timeline builds on reviews up to 2003. Databases were searched using three sets of key

terms: (1) “nutrition education and older adults/elderly” which returned 42 articles; (2) “nutrition intervention and older adults/elderly” which produced 28 articles; (3) “nutrition outcomes and older adults/elderly” which yielded four articles. Seventy-four studies were found; only 15 focusing on older adults aged 65 were selected. The search was then limited to US studies by excluding all international studies because such participants varied in food habits, sociocultural factors, and racial and ethnic composition relative to the US. Finally, the search yielded six articles that met the criteria for this evaluative review. The author and two graduate assistants then checked all 74 studies retrieved initially to verify the accuracy of the electronic selections by performing a cursory review of the abstracts, research questions, methods and findings. Duplications, studies involving media campaigns, reviews, and earlier reviewed studies were excluded. IRB approval was not sought because this is not the protocol for review studies.

## Findings and Discussion

Table 1 of supplementary material, summarizes the currently reviewed nutrition studies, which are organized alphabetically and assigned a letter designation that corresponds with references (i.e., a = [7], b = [24], c = [25], d = [33], e = [37], f = [42]) for quick reference. Findings and discussion are organized as follows: interventions, evaluation designs, measures, educational and behavioral strategies and outcomes.

### Interventions

Dismayingly but not unexpectedly, only six studies published from 2003–2012 were found. Five studies targeted participants with chronic health conditions, and addressed a variety of topics including osteoporosis relative to adequacy of intake of calcium containing dairy products (a, c); heart disease focusing on sodium, fat and cholesterol reduction; diabetes emphasizing sugar reduction (c, e, f); portion control and Hb<sub>A1c</sub> (e); use of vitamins, minerals and herbal supplements (d); and obesity and cancer stressing increased fiber through fruits and vegetables (f). The cultural relevance of contents was explicitly stated in only one study (e). Though sparse, the intervention types and their respective foci seemed to make a difference in outcome. Interventions focusing on preventing conditions such as osteoporosis, diabetes, hypertension and heart disease tended to report more success. This might be related to their prevalence and the obvious burden and diminished quality of life that is known to be consequential of these diseases. Earlier reviews have reported similar observations [18, 39].

### Evaluation Designs

#### *Sample Size, Number and Duration of Sessions, Completion, Attendance, and Class Size*

The sample sizes for the studies were inconsistent ranging from n = 25 (c) to n = 720 (d). Only three studies (a, d, e), reported the duration of intervention sessions, while four (c, d, e, f) emphasized the number of sessions used to evaluate participants; completion, attendance and class size were provided for studies (a, d), (d) and (a), respectively.

Favorable study outcomes illustrate the feasibility of nutrition education interventions with community-dwelling older adults, but the results cannot be generalized to the population as a whole because of a lack of power due to small samples, confidence level/interval and effect size related issues [8]. Attendance, completion and duration of intervention sessions were nebulous at best making it difficult to determine the length of time for which participants were exposed to the treatments. Scholars have reported similar findings and suggested that studies are needed to determine how much time is needed to process and integrate information into the lives of participants for lasting effects since both under exposure to treatment and burdensome interventions can be fruitless [18, 39]. Nevertheless, it is important to give some credibility to study findings that provide preliminary results, which can be used for comparisons in the future.

#### *Demographic Characteristics*

Demographic description (age, sex and race/ethnicity) were reported in all six studies. Participants' ages ranged from 50 to 98 years old, with the mean age for the majority being in their 70 s. The vast majority (75–98 %) of the studied participants were females. Five studies (b, c, d, e, f) reported that a majority of the participants were Caucasians, with some Black participants; all participants in (a) were Black. Level of education was reported in three studies (a, b, d) and ranged from less than high school to graduate degrees with (a) being the most specific in reporting a range of levels of education; living alone was reported in two (b, d), while only study (a) reported marital status and only study (d) reported income, indicating that approximately one-half the participants had an income of <\$1 k per month.

A description of demographic characteristics is very important in understanding factors affected by heterogeneity. The age range of the participants spanned generations; an adult 60 years of age is very different from an adult 90 years of age. The pattern of a female majority is consistent with the general population of older adults in

actuality and in life expectancy. Race/ethnicity, socioeconomic status, living alone, availability of supportive networks, urban versus suburban and regional differences are all critical when planning for nutrition education interventions [18, 39]. Level of education is essential to the development of knowledge and skills in order to make informed decisions [12]. Factors such as living arrangements, supportive networks and geographic location are key to the availability and accessibility to appropriate foods and other factors essential to the intervention.

#### *Recruitment Process, Study Sites and Investigators' Backgrounds*

All six interventions for the current study recruited participants from, and conducted interventions at, existing congregate meal sites, health education classes, community centers, churches and community-based organizations. Study (a) used controlled, randomized sampling methods to select and assign participants to intervention and comparison groups; all studies are assumed to use convenience samples but only (a, e) reported same; study investigators are of a variety of backgrounds ranging from students (b) to experienced, trained interviewers (c, d).

Convenience samples and volunteers are sometimes not representative of the population because they are biased in favor of or against the intervention [8, 18, 22, 39]. Probability sampling methods provide a better representation of the population; however, it is very likely that there will be some degree of sampling error [8]. Using as large a random sample as can be managed is preferred [22]. Investigators' research expertise in working with older adults was not noted in the studies; working with older adults does not mean merely replicating treatment modalities used for adults in the same way that we would not and should not replicate treatments used for children when working with adults. It was not always clear whether the investigators already knew the study participants; prior relationships or lack thereof between investigators and participants can influence outcomes.

#### *Comparison Group Treatment*

Only (a) reported the inclusion of a comparison and (d) a waitlist control group. Comparison group random assignment is desirable since a range of differences is assigned to either group. Random assignment is not always an option particularly if all eligible persons must receive the treatment or if the intervention program is not large enough to accommodate all those who volunteered to participate [8, 18, 22, 39].

#### *Pre- and Post-Test, Follow-Up*

Pre and post intervention tests were used in three studies. Study (e) tested the participants' Hb<sub>A1c</sub> levels before and after the intervention; (a, f) used pre-test and post-test to examine the effects of nutrition education on nutrition knowledge and the ability to link the appropriate dietary behaviors to specific chronic conditions. The duration of time between pre-test and post-test was specified in studies (e, f). With the exception of study (e), which included a post/posttest follow-up, there was no mention of monitoring for maintenance purposes. Given the importance of pre and post intervention analyses in evaluating outcomes, the absence of this design element in some studies was disappointing in terms of corroborating cause and effect [8, 18, 22, 39].

#### *Statistical Analysis*

All six studies used descriptive and some used inferential statistics. Because of the small n, study (c) used descriptive statistics only to examine nutrition knowledge retained from heart disease and diabetes education. Inferential statistics were used as follows: study (a) used correlational analysis, regressions, and student's *t* test to analyze the consumption of dairy products; study (d) used hierarchical linear regression models to examine whether the acquisition of nutrition knowledge was associated with behavior change; (e) used non-parametric paired *t*-test and Spearman correlations to examine the same concept and to note whether there were improvements in lab values after eight lessons; and, (f) used paired *t*-tests, ANOVA and Tukey multiple comparisons tests to determine whether participants could apply the appropriate dietary modifications for specific chronic conditions. Study (a) used the test of covariates to assess education and marital status and for study (b), test of covariates to determine the relationship between assessed education and the respondent's ability to manage their own diets. All studies except study (c) tested for statistically significant changes. Only studies (b, e) reported statistically significant results. Studies that used inferential statistics are to be commended. However, while statistically significant changes in outcomes are great, the importance of such changes within the context of the study is the feature that is most noteworthy [18, 22, 39].

#### *Measures*

A number of instruments were used, some being pre-existing instruments checked for reliability and validity when developed (a, c, e); others were developed by the investigators specifically for the study (b, d, f); only study (f) reported testing for reliability and validity of the

instrument they developed. Instrument choices must consider variability issues particularly with multiple constructs, heterogeneous participants, study types (i.e. research study vs. educational programs in practice settings). This is important since sensitive, valid and reliable instruments specific to all elements of the study play a role in making judgments regarding intervention effectiveness [8, 18, 22, 39].

### *Knowledge*

All studies reported favorable knowledge change outcomes in the aggregate. Four studies asked (a, b, c, f) about food sources of nutrients; two (c, e) examined foods that are healthful for heart disease and diabetes; and one (d) focused on the risks and benefits of dietary supplements including vitamins, minerals and herbal remedies. It is unclear as to whether knowledge retained was linked to mediators such as the manner in which the information was presented (i.e., didactic lecture, practical application, handouts or a combination of all), instructor skill level, class size, length of exposure to message, participants' motivation and needs, demographic characteristics including reading level, etc. More studies are required to determine what combination of approaches best suit the older learner [18, 39].

### *Physiologic Indicators*

Only two studies included physiologic measures. These studies specifically measured blood pressure (c) and Hb<sub>A1c</sub> values among diabetics (f). It is understandable that only one-third of the interventions reviewed assessed physiologic or medical health indicators because sometimes it is neither appropriate nor feasible in some settings. In instances such as phlebotomy, the investigators must have the appropriate credentials.

### *Educational and Behavioral Strategies*

#### *Behaviors and Dietary Intake Factors*

Study (a) employed the Random Assessment Method (RAM) calcium checklist to assess amounts of calcium rich foods eaten; (d) examined intake of vegetables and fruits using cognitive and behavior change related interviews to determine the participants' ability to link the nutritional content of foods to diseases such as type 2 diabetes, cancer, obesity and heart conditions. The same study used didactic interactions, written material and video tapes to provide information on healthful dietary behaviors for specific chronic conditions; (a, b) used a food frequency questionnaire to examine dietary habits; the latter focused on dairy

intake. Tools such as food frequency/recall are helpful in decreasing food practices compared to questioning participants subjectively about perceived changes in their dietary habits [18, 39]. Scholars [12] argue that in dietary studies, the term "behavior" has no universal definition because it refers to intake of food and/or intake of nutrients as well as noticeable dietary activities; hence, it is difficult to differentiate what construct is being examined. These scholars recommended that studies examining the effects of diet on a specific "physiologic" outcome employ practices used by national surveys in acknowledging all foods containing the nutrients of interest wherein such foods are "disaggregated" and placed in different food groups.

### *Psychosocial Variables*

Four studies addressed psychosocial variables. Study (a) used Health Beliefs and Self-Efficacy Scales; (b) examined beliefs concerning nutrition benefits and supportive networks that might be influential; (d) addressed outcome expectations connected with social cognitive theory and (e) examined quality of life and self-management. Studies involving these concepts tend to enhance outcomes and have worked well with older adults in past studies [18, 39].

### *Theory-based Strategies*

Four of the six studies explicitly noted and provided descriptions for theory-based strategies used to predict behavior change. Study (a) used the Revised Health Belief Model to better predict behavior change, (b) the theory of planned behavior; (c) the health belief theoretical model and (d) social cognitive theory of behavior change stressing the importance of self-efficacy and outcome expectations. These strategies serve to heighten practitioners' ability to identify predictors of dietary behavior changes [17]. However, more studies are needed to ascertain which of these theories are most predictive of the behaviors of interest for the study being undertaken [12].

### *Efficacious Intervention Elements*

Overall, investigators must give attention to content, methodology and intervening factors when designing nutrition education interventions for older adults [18, 39]. Studies with positive outcomes included features such as "limited educational messages to one or two; reinforcing and personalizing messages; providing hands-on activities, incentives, cues, and access to health professionals; and using appropriate theories and behavior change" [39]. The Institute of Medicine (IM) suggested that when conducting nutrition interventions with older adults, employing the

ecological conceptual model [20] with multiple interacting factors and practices are most likely to sustain behavior change [19]. For future studies, Sayhoun, Pratt and Anderson [39] presented an intervention framework deemed to have the greatest potential for success that include features suggested by the IM and elements such as grouping older adults by characteristics such as health or functional status; allowing older adults to participate in goal setting; using targeted messages that are simple, practical and reinforced; accounting for the older adults' social support networks and physical environmental and provided access to health practitioners. The current author agree and would add: grouping participants within age cohorts, similarities in SES, culture, health literacy and using physiologic measures (when possible).

### Limitations, Conclusions and Recommendations

Current study limitations include the fact that there were very few studies meeting the criteria, and that such studies varied in their design, measures, scope, and participants' demographic characteristics. Although successful nutrition outcomes were reported, since validation is not specified, this author cannot say with any degree of certainty that the program elements employed contributed to the programs' success. Therefore, reported findings can inform future studies but cannot be generalized to a diverse population of community-dwelling older adults.

Findings for the current review support findings of earlier studies, and should heighten the awareness of interdisciplinary gerontologists and community-health practitioners about some of the nuances on the topic. Consistent with earlier study findings the online search for the present study was challenging because there were no standard keywords or descriptors that were likely to yield uniformity in the types and quality of studies sought. Overall the studies in this review did not differ considerably from earlier studies with respect to the under use of strong methodological designs. Indeed, there is a quandary in determining whether the interventions published are research studies or are evaluations of educational programs in practice settings. One might speculate that the critiques from prior reviewers might have influenced the way in which nutrition studies are currently classified for publication purposes, resulting in fewer studies meeting intervention research criteria.

For the planning of nutrition education intervention with older adults this author: echoes the sentiments of other scholars in commending investigators for their valuable contributions, urges others to do the same and encourages the use of the framework developed by Sayhoun et al. [39], since the additive effects of the combination of factors will

result in successful outcomes that should be validated and, where positive, replicated. Implications of the study are presented in terms of practice and future research.

Future nutrition intervention research and practice with older adults can be enhanced by using an approach involving assessment, process and evaluation. Assessment: of the needs, interests, desires, culture, level of health literacy, cognitive and functional status of the prospective participants. Process: determine intervention content; clearly define knowledge, behavior and outcome expectation goals; incorporate locally available and accessible foods/ingredients and their substitutes and/or ask local merchants to stock same; include different modes of delivery including didactic presentations, interactive audio visual demonstrations and video clips for the reinforcement of lessons taught particularly for those participants with lower levels of literacy; foster participants input and peer to peer reinforcement; encourage taste testing so that participants are not reluctant to use their scarce dollars to purchase new items only to discard them because of personal dislikes; and plan interventions with input from an interdisciplinary team consisting of trained nutrition and community health educators, researchers, investigators and statisticians. Evaluation: include strong evaluation design; valid, reliable nutrition measures and educational and behavioral strategies. Along with other before-mentioned strategies, this author believes these recommendations are important in determining whether nutrition education intervention with older adults can influence dietary modification, blood chemistry and anthropometric measures, all of which can and will improve/promote good health and avert disability among older adults. Given the exponential expansion of the aging population, it is imperative that multidisciplinary gerontologists and community health practitioners learn how to achieve and sustain long term improvements that can improve quality of life and reduce health care expenditures.

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