Incorporating Patient Input into Value-based Community Fall Prevention for Older Adults: Evaluating Patient Preferences and Willingness to Pay

by

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Abstract

Background:

Falls are the leading cause of injury-related death and non-fatal injuries in US older adults, including hip fracture and traumatic brain injury. Current evidence-based fall prevention programs exist in community settings. However, these programs remain severely under-utilized.

Objective:

The purpose of this mixed methods study is to address the question, "What are community-dwelling older adults' (65+) preferences for features of community-based fall prevention (CFP) programs?"

Methods:

Key features of CFP programs were identified through a systematic literature review and qualitative meta-synthesis of older adults' preferences for CFP program features, and interviews with older adults, caregivers, and a falls expert (Aim 1). A national online survey was used to quantitatively prioritize preferred CFP program features using a discrete choice experiment with conditional logit models (Aim 2). Willingness to pay for a CFP program, net benefit of program participation, and predicted uptake of several examples of CFP programs were also assessed from the perspective of older adults (Aim 3).

Results:

Fifty-four articles were retained in the systematic review, representing the views of 20,540 older adults (Aim 1). Three themes emerged from the qualitative meta-synthesis. The first theme was that older adults prefer CFP programs with immediate benefits, including two categories: social support; and physical & mental benefits. The second theme was that older adults prefer CFP programs that appear trustworthy and legitimate, including two categories: endorsement by others; and familiarity & learning resources. The third theme was that CFP programs should be easy to access and fit into older adults' daily routines, including two categories: ease of access & service utilization; and self-management & tailoring.

A total of 630 participants completed the discrete choice experiment survey (Aim 2). For the results reported here, only survey participants who made trade-offs between CFP program attributes and who correctly answered attention filter questions were included in analyses (n=328). Quantitative results of the discrete choice experiment showed that cost was the most important factor in older adults' choice between CFP programs, regardless of income (relative importance score of 77.05% in the lower income group, and 73.79% in the higher income group). For participants with lower income, program efficacy was the least important factor (relative importance score of 2.02%), while inclusion of a home safety consultation was least important for those with higher income (relative importance score of 1.14%).

Using results of conditional logit models (n=328), survey participants' mean marginal willingness to pay for five examples of hypothetical CFP programs in Aim 3 ranged from $56.10/month (95% CI=$49.21-$62.58) to $62.45/month (95% CI=$56.35-$68.23). For participants with lower income, willingness to pay for these hypothetical programs ranged from $53.95 (95% CI=$40.40-$66.93) to $64.81 (95% CI=$53.08-$76.82), and in the higher income group ranged from $56.20 ($51.52-$61.03) to $63.12 (95% CI=$56.19-$69.82). Net benefit/month ranged from $62.45 (95% CI=$56.35-$68.23) to $-49.10 (95% CI=$-53.25-$-45.31) for older adults who participated in the five hypothetical CFP programs, and predicted uptake among these programs was driven by cost.

Conclusions and Significance:

Self-management of when, where, and how older adults participated in CFP programs reaffirmed older adults' autonomy and independence and created a sense of empowerment for active, healthy aging. Results may be used to develop, modify, or evaluate CFP programs in order to design programs that incorporate older adults' preferences. This may help to improve older adults' enrollment, retention, and adherence to CFP programs, which may ultimately reduce falls and improve older adults' quality of life and health outcomes.

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List of Abbreviations

CFP   Community-based Fall Prevention

DCE   Discrete Choice Experiment

WTP   Willingness to Pay

NCOA   National Council on Aging

Chapter 1
Introduction

I. Background, Rationale, and Significance

Falls are the leading cause of injury-related death and non-fatal injuries in US older

adults.[1,2] More than one-third of ambulatory patients over 65 years of age and half of

those over 80 years of age fall annually.[1] One in five falls in older adults causes serious

injuries with lengthy and costly recovery times.[1,3,4] Indeed, 95% of hip fractures and

81% of traumatic brain injuries (TBIs) in older adults are caused by falls.[3,4] In US older

adults, over 700,000 hospitalizations, 2.5 million ER admissions, and over 500,000

nursing home admissions occur each year because of a fall injury.[1,5,6] In 2015, costs

associated with treating falls reached $31 billion for Medicare alone.[7] Current evidence-

based fall-prevention programs exist, including exercise, home modification, and

medication management components.[8,9] However, these programs remain severely

under-utilized,[10] even as falls in community-dwelling older adults continue to rise.[11]

Reducing the Risk of Falling is a Medicare Part C medical plan quality measure.

However, plan-level star ratings for this measure are low, averaging only 2.4 out of 5

stars in 2017.[12] One modifiable reason for this is poor care transitions between

institutionalized patients who are at risk for falling and community-based fall-prevention

(CFP) programs.[13] Our central operating tenet is that transitioning older adults with high

fall-risk from health systems to community-based fall-prevention programs requires

providers to make patient-centered decisions about the value of individual CFP

programs, including benefits and costs from patients' perspectives. However, no

structured tools exist for health systems and payers to incorporate patient values into

evaluations of CFP programs. Incorporating patient values into the design and

evaluation of CFP programs may increase patient engagement and utilization of CFP

programs. As low patient awareness of programs, low patient access to programs, and

lack of patient-led design hinder the reach and effectiveness of CFP programs,[13] this

study takes a patient-centered view.

Patient-centered CFP program design considerations may include things such as

program components (like exercise, medication management, education sessions, and

home hazards assessment), program structure (number of sessions offered, duration,

and frequency of sessions), and channel (online vs. in-person program). Patient-

centered concepts built into CFP programs may include things such degree of social

interaction (e.g., individual vs. group classes, or inclusion of caregivers), ease of

program access (e.g., location of the program and cost to participants), fit with

participants' daily routines, enjoyment, and degree of autonomy/self-management

afforded or taught to participants. The *Chronic Disease Prevention and Management

(CDPM) Framework* can be used to frame these considerations in the context of fall-

prevention and management for older adults.[14] The CDPM Framework describes

patient, family, and health system factors that influence self-management of chronic

conditions, including personal, social, and system factors.

This study identifies preferred CFP program features, willingness to pay (WTP), and net benefit of CFP program participation from the perspective of older adults. This will lead to development of a patient-centered value tool that can be used by health systems and payers to guide formulary decisions and development, evaluation, and recommendation of CFP programs for older adults. Other value tools exist for valuing treatments in different conditions, such as the American Society of Clinical Oncology (ASCO) value tool for cancer therapies,[15,16] but lack direct incorporation of patients' perspectives. The current study is necessary to inform development of a tool that facilitates direct, quantitative assessment of the value that older adults place on participation in CFP programs. This tool may be scaled to fit different communities, adapted for other types of community-based programs, and incorporated into existing cost-effectiveness and cost-benefit evaluations as a means to assess the value of program features most important to older adults. Heterogeneity in older adults' preferences was assessed based on socioeconomic status and physical functional status, predictors of community-dwelling older adults' risk of fall-related injury,[17] increasing generalizability of results.

This study used qualitative meta-analysis of published qualitative, mixed methods, and quantitative descriptive literature on older adults' preferences for CFP program features to generate rich qualitative data about which features of CFP programs matter most to older adults (Aim 1). Qualitative meta-analysis (or meta-synthesis) is a method of synthesizing qualitative and descriptive data from multiple published studies to draw overall conclusions using qualitative coding techniques. These key CFP program features were prioritized using a discrete choice experiment (DCE) (Aim 2), a quantitative

survey design and analysis technique.[18] DCEs fall under the umbrella of "conjoint analysis" methods, including traditional conjoint analysis and best-worst scaling, and are often used to study consumer behavior and uncover consumer preferences in a quantitative manner. This technique uses computer-generated survey designs to create respondent decision tasks (iterative choices between program features). Responses were analyzed using conditional logit models to generate quantitative patient preferences for program features, including benefits and costs. Also, willingness to pay (WTP) was assessed as a monetization of program benefits (Aim 3). This combination of qualitative and quantitative data strengthens the design.

II. Objectives and Specific Aims

The purpose of this mixed methods study is to address the question, "What are community-dwelling older adults' (65+) preferences for features of community-based fall prevention programs?" This was accomplished by addressing the following aims:

A. Aim 1: To Characterize Key Features Of A CFP Program From The Perspective Of Older Adults.

Key features were identified through qualitative meta-synthesis of patients' preferences for CFP program features, and interviews with older adults, caregivers, and a falls expert.

B. Aim 2: To Quantitatively Determine Older Adults' Preferred CFP Program Design And How This Is Modified By Socioeconomic Status And Physical Functional Status.

A national online survey was used to quantitatively prioritize CFP program features that are preferred by older adults, using a discrete choice experiment (DCE) and conditional logit models. Analyses were repeated in different sub-groups to determine differences in preferences between older adults who self-reported low vs. high annual household income level and physical functional status.

C. Aim 3: To Assess Older Adults' Willingness To Pay (WTP) For CFP Programs, Net Benefit Of Participating In CFP Programs, And Predicted Uptake Of CFP Program Designs, And How These Are Modified By Socioeconomic Status.

Willingness to pay for a CFP program and net benefit of CFP program participation were assessed from the perspective of older adults, using the results of the Aim 2 DCE. Analyses were repeated in different sub-groups to determine differences in WTP and net benefit of CFP program participation between older adults who self-reported low vs. high annual household income level.

III. Methods

A. Aim 1: To Characterize Key Features Of A CFP Program From The Perspective Of Older Adults.

i. Aim 1 Design:

Key features were identified through qualitative meta-synthesis of older adults'
preferences for CFP program features, and interviews with older adults, caregivers, and
a falls expert.

ii. Aim 1 Search Strategy:

To capture the full range of eligible data, a number of sources were systematically
searched for content pertaining to older adults' preferences for CFP program features,
including PubMed, CINAHL, PsycINFO, ERIC, ClinicalTrials.gov, and Google Scholar.
Search terms included variations on "older adult," "fall prevention," and "patient
preference."

iii. Aim 1 Study Selection:

Articles underwent initial title and abstract screening, followed by full-text screening.
Exclusions from each of these screenings were verified by a second independent
investigator, with discrepancies in retained articles resolved through discussion and
consensus. English-language articles were included for review if they met the following
criteria: 1) published between 2008 and 2018; 2) qualitative interviews or focus groups,

surveys, or mixed-methods studies containing a qualitative arm (study protocols, review articles, and case reports/series were excluded); 3) patients are CFP program users and include adults at least 65 years of age; 4) inclusion of preferred CFP program features; 5) ability to extract results (key CFP program features from the perspective of older adults). To capture preferences from different types of older adults, exclusions were intentionally not made based on older adults' functional status, disease states, dementia status, or number of previous falls.

iv. Data Extraction and Synthesis:

Patient preferences were assessed from each article (Within-Case analysis), and were also summarized across articles (Cross-Case analysis). To do this, pdf copies of each retained article were uploaded into Atlas.ti software for qualitative meta-synthesis. Synthesis of the data were performed using qualitative thematic and content analysis with a deductive coding approach and closed coding in Atlas.ti. *A priori* codes were applied to each document based on constructs from the *CDPM Framework*,[14] including: ease of access, social support, and self-management. An inductive analysis with open and in-vivo coding was also used to identify preferred CFP program features related to each *CDPM Framework* construct using a qualitative grounded theory approach.[19] Coding was verified by a second investigator, with inter-coder reliability assessed via Krippendorff's alpha. Codes were discussed by two investigators and used to generate final themes.

Quality assessment of each article was performed by the main investigator using the

Mixed Methods Appraisal Tool (MMAT) Version 2018,[20] simultaneous with data

extraction. The MMAT is a validated tool for assessing the methodological quality of

qualitative, quantitative, and mixed-methods studies, and the main investigator has

experience using this tool. The MMAT contains five study design categories:

qualitative, quantitative randomized controlled, quantitative non-randomized,

quantitative descriptive, and mixed-methods. Each category contains five criteria with

assessment options including "Yes," meaning that the MMAT's explanation criteria were

met after evaluation of information included in the article; "No," meaning that the

MMAT's explanation criteria were not met after evaluation of information included in the

article; and "Can't tell," meaning that a clear assessment could not be made based on

the information included in the article. Based on the number of criteria met, each

article's quality rating was scored on a scale from 0-5, with 0-1 rated as low quality (high

risk of bias), 2-3 rated as moderate quality (moderate risk of bias), and 4-5 rated as high

quality (low risk of bias). Quality scores were reviewed by a second independent

investigator, with disagreements resolved via discussion and consensus. Risk of bias

across studies was also assessed by the main investigator using the Confidence in the

Evidence from Reviews of Qualitative Research (CERQual) tool.[21,22]

v. Aim 1 Expected Results:

Content analysis and thematic analysis will indicate which features of CFP programs older

adults find most salient (in terms of CFP program "attributes" and "levels" for each

attribute), and reduce the number of potential CFP program features for inclusion in the

Aim 2 decision task. This will be used to inform evaluation criteria for inclusion in a value

tool, including preferred CFP program design (components, delivery method, structure,

effectiveness, and cost) and concepts (ease of access, social support, and self-

management).

B. Aim 2: To Quantitatively Determine Older Adults' Preferred CFP Program Design And How This Is Modified By Socioeconomic Status And Physical Functional Status.

i. Aim 2 Design:

Aim 2 used a cross-sectional online survey administered to a national sample of older adults. Preference weights were elicited to quantify preferences for alternative program components, delivery, structure, effectiveness, and cost options, using a structured decision-making process (DCE). Pre-testing and pilot-testing were performed prior to full survey launch to assess content and face validity and ensure adequate variability of responses.

ii. Aim 2 Recruitment and Sampling:

Older adults were recruited using a Qualtrics Panel. Qualtrics is a market research company that administers surveys to participants who have opted-in for ongoing market research. Recruitment was targeted to community-dwelling older adults ≥65 years who were at risk for falling. Sub-samples were based on income categories (low and high) and physical functional status categories (low and high), risk factors for falls-with-injury in older adults.[23] A total sample size of 620 was targeted for 80% power in the planned sub-sample arms,[18,24] based on effect sizes (DCE preference weights) obtained in previous studies of community programs for older adults,[25] and an anticipated 5% return of incomplete or unusable survey data.

iii. Aim 2 Survey Instrument Development:

The most salient CFP program features identified from Aim 1 were used to inform choice of CFP program features for inclusion in the Aim 2 decision task. Depending on what was found in Aim 1, these features were expected to include a combination of CFP program components (classes, consultations), delivery (in-person, online), structure (timing, duration), cost, and effectiveness. SAS macros for conjoint analysis survey design were used to determine 1) the number of choice tasks and 2) the decision task design (orthogonal).[18] This approach maximizes decision efficiency (D-efficiency), while creating a parsimonious decision task that minimizes participant cognitive burden, fatigue, and item non-response.[18]

iv. Aim 2 Data Collection and Analysis:

Qualtrics Panels were used to launch a national survey hosted on the Qualtrics survey platform. Preferences for CFP program design and differences based on socioeconomic status and physical functional status were assessed using a discrete choice experiment (DCE) with conditional logit models in SAS software. Older adults' willingness to pay (WTP) for a CFP program was also estimated using DCE results and used to calculate older adults' net benefit of CFP participation (WTP – participation cost).

v. Aim 2 Expected Results:

Results will quantify CFP program features that matter most to older adults (such as program components, delivery, structure, effectiveness, cost) and may be used to inform

development of a prototype tool for future feasibility, usability, and acceptability testing by

health system providers and payers.

C. Aim 3: To Assess Older Adults' Willingness To Pay (WTP) For CFP Programs, Net Benefit Of Participating In CFP Programs, And Predicted Uptake Of CFP Program Designs, And How These Are Modified By Socioeconomic Status.

i. Aim 3 Design:

Willingness to pay (WTP) per month for CFP programs and net benefit of CFP program participation was assessed from the perspective of older adults, stratified by socioeconomic status to determine differences between low- and high-income groups.

ii. Aim 3 Data Sources:

Preference weights obtained in Aim 2 were used to calculate WTP/month. Average monthly costs (in 2018 USD) were obtained from 2018 published CFP program costs on the National Council on Aging (NCOA) website. NCOA provides public access to CFP program costs reported by individual CFP program developers, including implementation and training costs for program providers and costs to participants. Costs are reported as costs per program, and costs per month were extrapolated by dividing by the reported number of months per program. NCOA program costs were extracted from the 13 CFP programs endorsed by NCOA and listed on NCOA's website and posted documents: https://www.ncoa.org/healthy-aging/falls-prevention/falls-prevention-programs-for-older-adults/.

iii. Aim 3 Analysis:

Older adults' WTP for five hypothetical CFP program designs was estimated using preference weight ratios with the preference weights obtained in Aim 2. WTP was also used to calculate net benefit for each hypothetical program (average marginal WTP/month for each hypothetical program minus average monthly cost of CFP program participation). Average monthly patient costs (in 2018 USD) were calculated from 2018 published NCOA program costs. One-way sensitivity analyses examined the robustness of net benefit estimates by varying program costs. 95% confidence intervals (CIs) around WTP and net benefit point estimates were constructed using 1,000 bootstrapped samples. All analyses used SAS software.

iv. Aim 3 Expected Results:

Results will quantify willingness to pay (WTP) for CFP programs and net benefit of CFP program participation from the perspective of older adults. These results can be used to inform a scoring algorithm (affordability threshold) in future value tools and directly inform payers' and health systems' formulary and reimbursement decisions for individual CFP programs.

IV. Impact

Results may be used to develop, modify, or evaluate CFP programs in order to design programs that incorporate older adults' preferences. This may help to improve older adults' enrollment, retention, and adherence to CFP programs, which may ultimately reduce falls and improve older adults' quality of life and health outcomes. This study is also significant in that it may lead to development of a patient-centered value tool for CFP programs. This value tool can be used by health systems and payers to guide systematic and structured formulary, development, evaluation, and recommendation decisions for CFP programs, and to guide improvements in program quality. The value tool may be tailored to fit different communities, regardless of whether differences in value weights are found here among socioeconomic groups. Future feasibility and usability studies may validate this tool in health systems and payers serving diverse populations of older adults. Randomized studies may also test the effectiveness of patient-centered CFP programs designed from this tool in improving program reach, engaging older adults in risk reduction behavior, and reducing falls in different types of older adults, thereby decreasing healthcare costs associated with fall-related injuries, maintaining older adults' quality of life, and improving older adults' and caregivers' satisfaction with care.

Chapter 2
Literature Review

The US Centers for Disease Control and Prevention (CDC) defines "older adults" as adults at least 65 years of age.[26] There is no clear consensus on the definition for "community-dwelling;" this may include ambulatory older adults, home-bound older adults, and/or those residing in assisted living centers. Steultjens et al. defines a "community-dwelling" older adult as living independently in the community or home setting.[27] For the purposes of this dissertation, community-dwelling older adults will be defined as older adults in an ambulatory care setting. This will not include older adults in inpatient or long-term care settings, rehabilitation centers or assisted living centers, or who are home-bound and may have reduced levels of independence.

I. The Problem: Falling in Older Adults

A. Falling In Community-Dwelling Older Adults Is A Major Public Health Problem.

Falls are the leading cause of injury-related death and non-fatal injuries in US older adults.[1,2] More than one-third of ambulatory patients over 65 years of age and half of those over 80 years of age fall annually.[1] One in four falls in older adults cause serious injuries and 6% of falls result in fractures.[1,3,4,28] These injuries often have lengthy and costly recovery times, including hip fractures and traumatic brain injuries (TBIs).[1,3,4,28] In older adults, 95% of hip fractures and 81% of TBIs are caused by falls.[3,4] In US older adults, over 700,000 hospitalizations, 2.5 million ER admissions, and over 500,000

nursing home admissions occur each year because of a fall injury.[1,5,6] Over 40% of nursing home admissions may be attributed to falls – of those admitted, 40% do not return to independent living and 25% die within one year.[29]

Falls are not just limited to community settings and older adults. In inpatient settings, incidence of falls ranges from 2.3 to 7 falls per 1,000-patient days, including falls in both younger and older adults.[30] Of these inpatients who fall, 30-50% may sustain injuries, of which 4-6% may be serious.[30,31] Certain sub-groups of inpatients may be at even higher risk of falling, including older adults admitted for psychiatric,[32] ischemic stroke,[33] or cancer diagnoses.[34-36] In the long-term care setting, 50% of residents fall annually,[37] with an annual average of 1.5 falls per patient bed, of which 10-25% results in fractures and/or hospital admission.[37-40] In acute rehabilitation centers, some patient populations, such as post-stroke patients, may experience up to 3.4 falls per patient bed annually.[37,41,42] While fall-rates for home-bound older adults and those residing in assisted living centers[43] are not well-documented, fall-risks for these older adults may vary based on individuals' functional status and environmental hazards. In all settings, issues of under-reporting falls, as well as not reporting "near falls" (such as stumbles), may mean that fall-rates and fall-risks are higher than data indicate.[43]

Compared to younger adults, older adults may have additional risk factors for falls resulting in injury, serious injury, or death.[30] Many factors may contribute to risk of falls in community-dwelling older adults, including history of previous falls; fracture history; fear of falling; functional limitations; age >80 years; female sex; low body mass index

(BMI); gait instability; loss of leg and ankle strength; cognitive impairment; diminished eyesight; depression; diabetes (due to risk of peripheral neuropathy and hypoglycemia); osteoporosis; arthritis or joint stiffness; undertreated pain; urinary incontinence; cardiac arrhythmia; orthostasis; stroke; cancer; two or more comorbidities; environmental hazards (slip, trip, and fall hazards such as loose rugs or uneven sidewalks); polypharmacy; and use of potentially inappropriate medications that increase risk of sedation, dizziness, altered cognition, hypotension, hypoglycemia, or blurred vision.[1,28,30] Institutionalized older adults (those in inpatient or long-term care settings), those in rehabilitation or assisted living centers, or those who are home-bound may have many of the same risk factors for falling as older adults in unassisted community settings, but may have additional risk factors such as specific diagnoses, altered environmental risks, additional physical or cognitive limitations, poorer functional status, and increased use of psychoactive and/or sedating medications.[30] *Older adults with at least 4 risk factors may have an almost 80% chance of falling.*[28]

Once an older adult experiences a fall, he or she is two to three times as likely to fall again.[1,29] Up to 40%-73% of older adults who fall (and up to 50% of older adults who have never fallen) may develop a fear of falling,[44] leading to decreased physical activity, loss of independence, social isolation, declining quality of life, depression, and muscle weakness that contribute to additional falls.[1] Injuries from falls also require recovery time that may further limit older adults' social interaction, muscle strength, and quality of life, again leading to increased risk for additional falls.[1] This problem is compounded by the fact that over half of older adults who fall do not report the fall to providers,

friends/family, or caregivers.[1,29] Thus, falls may become chronic and injurious before being recognized and addressed.

In 2015, direct costs associated with treating falls were $31 billion for Medicare alone and are projected to reach over $67 billion by 2020.[7,45] Two-thirds of these costs are hospital-related.[1] Once admitted to a hospital setting, additional costs may be at play. On average, patients who experience a fall while in a hospital setting prolong their inpatient stay by 6.3 days and add $4,200-$14,000 in additional inpatient treatment costs compared to inpatients who do not fall.[30,31]

Several national and state-level organizations identify fall-prevention in older adults as a research priority,[46,47] including the CDC's National Center for Injury Prevention and Control, the National Council on Aging (NCOA), the Administration for Community Living (ACL), Healthy People 2020, and state Departments of Public Health. Table 1 describes the fall-prevention goals of these national and state-level organizations.

Table 1. Public Health Initiatives for Fall Prevention

Organization	Goals
CDC	The CDC's National Center for Injury Prevention and Control identifies 5 research gaps and priorities for older adult falls between 2009-2018: 1. Measure provider and health system implementation of clinical fall prevention activities and use existing data systems to support routine reporting and evaluation. 2. Improve clinical fall prevention implementation in the primary care setting, including ensuring linkages with pharmacies and community-based prevention programs. 3. Evaluate the health benefits of conducting specific clinical fall prevention strategies (lie STEADI) in healthcare settings. 4. Estimate the cost of fall-related injuries and deaths and the economic efficiency of conducting clinical fall prevention strategies. 5. Explain the critical factors that influence changing tends in falls and fall-related injury rates among older adults.

NCOA	Starting in 2005 and updated in 2015, NCOA publishes national goals for fall-prevention in its Falls Free National Falls Prevention Action Plan as part of its Center for Healthy Aging: National Falls Prevention Resources Center. The action plan's goal is to: "Implement specific strategies and action steps to affect sustained initiatives that reduce falls among older adults through a framework of action over the next five to ten years." The action plan suggests 40 strategies for reducing falls and implementing sustainable, evidence-based fall-prevention programs in the community. The plan focus on 4 risk factors, plus cross-cutting issues:
	 1. Physical Mobility
	 2. Medications Management
	 3. Home Safety
	 4. Environmental Safety in the Community
	 5. Cross-cutting:
	    a. Funding and Reimbursement
	    b. Expansion of Evidence-Based Programs
	    c. Public Awareness and Education
	    d. Public Policy and Advocacy

ACL	The ACL funds communities and organizations to establish and maintain fall-prevention programs in the community through Prevention and Public Health Fund grants. The ACL's fall prevention goals include: 1. **"Goal 1:** Significantly increase the number of older adults and adults with disabilities at risk of falls who participate in evidence-based community programs to reduce falls and falls risks." 2. **"Goal 2:** Build partnerships and/or secure contracts with the health care sector and identify innovative funding arrangements that can support these evidence-based falls prevention programs while embedding the programs into an integrated, sustainable, evidence-based prevention program network."
Healthy People 2020	Older Adults 2020 Goal: "Improve the health, function, and quality of life of older adults." Injury Prevention, including fall-prevention, is a sub-category of this goal.
The Joint Commission	The Joint Commission's 2018 National Patient Safety Goals for Home Health include the Goal: "Prevent Patients from Falling" NPSG.09.02.01: "Find out which patients are most likely to fall. For example, is the patient taking any medicines that might make them weak, dizzy or sleepy? Take action to prevent falls for these patients."

	The Joint Commission's 2018 National Patient Safety Goals for Nursing Care Centers include the Goal: "Prevent Residents from Falling" NPSG.09.02.01: "Find out which patients and residents are most likely to fall. For example, is the patient or resident taking any medicines that might make them weak, dizzy or sleepy? Take action to prevent falls for these patients and residents."
Depts. Of Public Health; Depts. of Health Services; Area Agencies on Aging; Aging Disability Resource Centers (ADRCs)	Several state, regional, and local organizations promote aging services that include well-established fall prevention programs. **Example:** Wisconsin: https://www.dhs.wisconsin.gov/injury-prevention/falls/index.htm

*CDC=US Centers for Disease Control.

**NCOA=National Council on Aging, a national non-profit organization that partners with the ACL's Administration on Aging (AoA) and other aging organizations to improve older adults' health and wellbeing. NCOA has several centers and institutes under its umbrella, including: 1) the National Institute of Senior Centers, which recently established a national accreditation process for US senior centers, 2) Center for Benefits Access, and 3) Center for Healthy Aging, which includes the National Falls Prevention Resource Center and the National Chronic Disease Self-Management Education (CDSME) Resource Center.

***ACL=Administration for Community Living, an agency of the US Department of Health and Human Services (HHS); established in 2012. The Administration on Aging (AoA) is an HHS agency within the ACL. Within the AoA, the Office of Nutrition and Health Promotion is most involved with fall-prevention.

II. The Solution: Fall-Prevention Strategies

A. Institutional Fall Prevention Programs Exist.

Fall-prevention strategies are an important part of patient safety in hospitals and long-term care facilities.[28] This centers around humanistic, accreditation, and financial concerns.

Falls with serious injury are among the top 10 sentinel events reported to The Joint Commission's Sentinel Event database, with 465 reports of falls with injury between 2009 and 2015, mainly reported from hospitals.[31] Sixty-three percent of these falls resulted in death, while the remainder resulted in injury.[31] According to The Joint Commission, the most common factors contributing to falls with injury in institutional settings are:

1) Inadequate assessment of fall-risk;

2) Communication failures;

3) Lack of adherence to protocols and safety practices;

4) Inadequate staff orientation, supervision, staffing levels or skill mix;

5) Deficiencies in the physical environment; and

6) Lack of leadership.[31]

Hospital accrediting bodies, such as The Joint Commission, include fall-prevention and management in hospital accreditation standards. Joint Commission standards that directly apply to fall-prevention and management in hospital settings as of 2017 fall under the category "*Provision of Care, Treatment, and Services (PC)*," including PC.01.02.08: "*The hospital assesses and manages the patient's risk for falls*," with sub-parts EP 1: "*The hospital assess the patient's risk for falls based on the patient population and setting*," and EP 2: "*The hospital implements interventions to reduce falls based on the patient's assessed risk*."[31] Further, as of 2008, Medicare no longer reimburses hospitals for treatment of injuries sustained from inpatient falls.[48] Thus, hospitals have regulatory and financial motivations to implement effective fall-prevention strategies and continually re-evaluate existing fall-prevention and management programs. Similarly, The Joint Commission explicitly sets forth standards for fall-prevention and management in both home health and long-term care settings. The Centers for Medicare and Medicaid Services (CMS) also includes falls in many institutional or post-acute care measures of quality for older adults' care,[49] as described in Table 2.

Table 2. CMS Institutional and Post-Acute Care Quality Initiatives

CMS Initiative	Description	Measures Related to Falls in Older Adults
Nursing Home Quality Initiative (NHQI)	CMS evaluates US nursing homes based on a 5-star rating system, where 1=low-performing nursing home and 5=high-performing nursing home. CMS currently uses 5 "Short Stay" quality measures for residents with a stay of ≤ 100 days and 13 "Long Stay" quality measures for residents with a stay of >100 days, with data made publically available on the Medicare.gov Nursing Home Compare website. CMS is piloting a pay for performance model for nursing homes based on this quality initiative.	Percent of Residents Experiencing One or More Falls with Major Injury (Long Stay)(NQF #0674).
Long-term Care Hospital Quality Reporting Program (LTCH QRP)	The Patient Protection and Affordable Care Act (ACA) of 2010 and the Improving Medicare Post-Acute Care Transformation Act of 2014 (the IMPACT Act) require LTCHs to report and standardize the results of quality measures. Currently, LTCHs must report on 16 quality measures, with updates scheduled for July 2018. Financial penalties are incurred for non-compliance with reporting requirements.	Percent of Residents Experiencing One or More Falls with Major Injury (Long Stay)(NQF #0674). Data collection on this measure began in 04/2016.
Skilled Nursing Facility Quality Reporting Program (SNF QRP)	The Improving Medicare Post-Acute Care Transformation Act of 2014 (the IMPACT Act) requires SNFs to report and standardize the results of quality measures. Currently, SNFs must report on 6 quality measures. Financial penalties are incurred for non-compliance with reporting requirements.	Percent of Residents Experiencing One or More Falls with Major Injury (Long Stay)(NQF #0674). Data collection on this measure began in 10/2016.
Hospice Quality Reporting Program (HQRP)	The Patient Protection and Affordable Care Act (ACA) of 2010 requires hospice organizations to report the results of quality measures. Currently, hospice organizations must report on 17 quality measures, with data made publically available on the Medicare.gov Hospice Compare website. Financial penalties are incurred for non-compliance with reporting requirements.	None explicit. Data collection for other measures began in 2012.
Home Health Quality Reporting Program (HH QRP)	*"Home health is a covered service under the Part A Medicare benefit. It consists of part-time, medically necessary skilled care (nursing, physical therapy, occupational therapy, and speech-language therapy) that is ordered by a physician. In 2016, there were over 12,181 Medicare certified home health agencies throughout the United States. In 2016, 3,507,659 beneficiaries were served, and 110,277,728 visits made."* **-** CMS[50] The Improving Medicare Post-Acute Care Transformation Act of 2014 (the IMPACT Act) requires Home Health Agencies (HHAs) to report and standardize the results of quality measures. Currently, HHAs must report on 52 quality measures (outcome, process, and patient experience measures), with data made publically available on the Medicare.gov Home Health Compare website. Beginning in 2015, star	Reporting requirements have been in place since 1999 (OASIS dataset), with an updated OASIS-C2 reporting system implemented in January 2017. Fall-specific measure: Multifactor Fall Risk Assessment Conducted for All Patients who Can Ambulate (NQF 0537).

	ratings have been added to the Home Health Compare website to support consumer decision-making. Financial penalties are incurred for non-compliance with reporting requirements.	
Inpatient Rehabilitation Facility Quality Reporting Program (IR QRP)	The Patient Protection and Affordable Care Act (ACA) of 2010 requires IRFs to report the results of quality measures. Currently, IRFs must report on 19 quality measures, with data made publically available on the Medicare.gov IRF Compare website. Financial penalties are incurred for non-compliance with reporting requirements.	Percent of Residents Experiencing One or More Falls with Major Injury (Long Stay)(NQF #0674). Data collection on this measure began in 10/2016.
Ambulatory Surgical Center Quality Reporting (ASCQR) Program	Currently, ASCs must report on 9 quality measures. Financial penalties are incurred for non-compliance with reporting requirements.	ASC-2 Patient Fall. Data collection began in 2012.
End-Stage Renal Disease (ESRD) Quality Incentive Program (QIP)	The Medicare Improvements for Patients and Providers Act of 2008 (MIPPA) requires ESRD facilities to report the results of quality measures. Currently, ESRD facilities must report on 14 quality measures (1 Safety, 5 Patient and Family Engagement/Care Coordination, 3 Clinical Care, 5 Reporting), with data made publically available on the Medicare.gov Dialysis Facility Compare website. Financial penalties are incurred for low performance on these quality measures, and also affect reimbursements as part of the ESRD value-based purchasing program.	None explicit.
Hospital Outpatient Quality Reporting Program (Hospital OQR Program)	The Tax Relief and Health Care Act of 2006 requires hospitals to submit data on measures of quality of care in hospital outpatient settings. This may include measures of process, structure, outcome, and efficiency. This category includes emergency room (ER) and outpatient imaging and surgery services provided in hospitals. Currently, hospitals providing these outpatient services must report on 26 hospital outpatient quality measures, with data made publically available on the Medicare.gov Hospital Compare website. Financial penalties are incurred for non-compliance with reporting requirements.	None explicit.
Hospital Inpatient Quality Reporting Program (Hospital IQR Program)	The Medicare Prescription Drug, Improvement, and Modernization Act (MMA) of 2003 requires hospitals to submit data on measures of quality of care in hospital inpatient settings. Currently, hospitals must report on 37 hospital inpatient quality measures (process, outcomes, patient experience), with data made publically available on the Medicare.gov Hospital Compare website. Financial penalties are incurred for non-compliance with reporting requirements. Some of these measures also affect performance-based financial reimbursements as part of the Hospital Value-Based Purchasing Program, Hospital-Acquired Condition Reduction Program, and Hospital Readmissions Reduction Program.	None explicit.
Inpatient Psychiatric	The Social Security Act and the 2010 Affordable Care Act require inpatient IPFs to submit data on measures	None explicit.

Facility Quality Reporting (IPFQR) Program	of quality of care in inpatient psychiatric hospital settings. Currently, IPFs must report on 18 IPF quality measures, with data made publically available on the Medicare.gov Hospital Compare website. Financial penalties are incurred for non-compliance with reporting requirements.	
Prospective Payment System (PPS)-Exempt Cancer Hospital Quality Reporting (PCHQR) Program	The Social Security Act and the 2010 Affordable Care Act require PCHs to submit data on measures of quality of care in certain inpatient cancer hospital settings. Currently, PCHs must report on 28 PCH quality measures (6 safety and healthcare-associated infection, 7 clinical process/oncology care, 2 intermediate clinical outcomes, 1 clinical effectiveness, 1 claims-based outcomes, 11 patient engagement/experience of care), with data made publically available on the Medicare.gov Hospital Compare website. Financial penalties are incurred for non-compliance with reporting requirements.	None explicit.

*The National Quality Forum (NQF) reviews and endorses many standardized, cross-setting quality measures used by CMS, including medication measures.

**Additional information on general hospital inpatient, inpatient psychiatric hospital, inpatient cancer hospital, hospital outpatient, ambulatory surgical center, and ESRD facility CMS quality measures and reporting can be found on the QualityNet website: https://www.qualitynet.org/dcs/ContentServer?c=Page&pagename=QnetPublic%2FPage%2FQnetHomepage&cid=1120143435363. In addition to CMS reporting requirements, the American Medical Association (AMA) and its associated Physician Consortium for Performance Improvement (PCPI), the CDC's National Healthcare Safety Network (NHSN), Joint Commission, and various other professional organizations (e.g., nursing) also maintain reporting and quality requirements for hospitals and/or other healthcare institutions and organizations.

***CMS=Centers for Medicare & Medicaid Services.

Both The Joint Commission and the ECRI Institute recommend steps to reduce falls in institutional settings, which may help improve institutional quality ratings. These steps include:

1) Establishing a multidisciplinary fall-prevention team;

2) Requiring falls-risk assessment for patients;

3) Staff education on institution-specific fall-prevention steps;

4) Identifying appropriate fall-prevention interventions;

5) Reporting and analyzing falls; and

6) Monitoring and evaluating effectiveness of fall-management programs.[31,48]

Common patient-, provider-, and environment-level strategies used to prevent falls in institutional settings include: use of patient walking aids, more frequent rounding, patient and family fall-risk education, frequent mobilization (ambulation), nonslip footwear, bed alarms, call bells, and elimination of barriers to ambulation.[28] Several toolkits are available to help implement and evaluate fall-prevention programs in institutional settings, as in Table 3.

Table 3. Implementation and Evaluation Toolkits for Fall Prevention and

Management Programs in Institutional Settings

Toolkit	Description	Setting
Joint Commission Center for Transforming Healthcare: Preventing Falls Targeted Solutions Tool (TST)	Online tool to prevent falls using Lean, Six Sigma, and change management; collect fall data to assess contributing factors & solutions	Hospital inpatient (validated); piloted in long-term care & ambulatory settings
AHRQ toolkit: Preventing Falls in Hospitals	Fall-prevention program development, implementation, sustainability, and change process	Inpatient hospital
VA National Center for Patient Safety: Falls Toolkit	Fall-prevention program development	Inpatient hospital
VA National Center for Patient Safety: Implementation Guide for Fall Injury Reduction	Implementation guide; fall-prevention program infrastructure and capacity	Inpatient hospital, long-term care, home health
ECRI Institute: Falls	Summary of fall-prevention evidence, with program recommendations	Cross-setting: long-term care, nursing, home health, outpatient, pharmacy
ICSI: Prevention of Falls (Acute Care)	Fall-risk assessment recommendations, intervention strategies, implementation tools	Acute care settings
IHI: Transforming Care at the Bedside How-to Guide: Reducing Patient Injuries from Falls	Fall-prevention team approaches, program evaluation	Inpatient hospital

***AHRQ=Agency for Healthcare Research and Quality; IHI=Institute for Healthcare Improvement; ICSI=Institute for Clinical Systems Improvement; VA=Veterans' Affairs.

This also raises several questions regarding continuity of care:

1) Are older adults being re-admitted to hospitals and/or emergency rooms (ERs) due to repeated falls in community settings?

2) Are older adults who fall in institutional settings receiving follow-up care to prevent future falls if they are transitioned to other settings?

There is little evidence documenting fall-prevention strategies during or after transitions of care for older adults. Indeed, there is a lack of consistency and clear fall-prevention standards and guidelines across settings. For example, the CDC STEADI fall-risk assessment tool was originally designed for assessing older adults' risk of falling in primary care settings, and is just now beginning to be looked at for use in hospital settings.[51-55] While The Joint Commission explicitly sets forth fall-prevention and management standards for hospitals, home health, long-term care, and ambulatory surgery settings, they do not set equivalent regulatory standards for primary care settings. Table 4 describes examples of existing fall-risk assessment standards, guidelines, tools, and tests.

Table 4. Fall-risk assessment standards, guidelines, tools, and tests

Assessment	Description	Setting
CDC STEADI toolkit[52,54,55]	Fall-risk assessment tool, online education for providers and patients	Community / primary care
Morse Fall Scale (MFS)[56]	Fall-risk assessment tool	Cross-setting (acute care)
Hendrich II Fall Risk Model[34-36]	Fall-risk assessment tool	Hospital inpatient
St. Thomas Risk Assessment Tool in Falling elderly inpatients (STRATIFY)[57,58]	Fall-risk assessment tool	Hospital inpatient
Downton[57,58]	Fall-risk assessment tool	Hospital inpatient
Tullamore[62]	Fall-risk assessment tool	Hospital inpatient
Tinetti[62]	Fall-risk assessment tool	Hospital inpatient
RxFS[59]	Fall-risk assessment tool for medications; for use in conjunction with other fall-risk assessment tools, such as the MFS	Hospital inpatient
Institution-specific *(e.g., East Alabama Medical Center [EAMC] uses an EHR-integrated UPS tool [unpublished observations and interview, 2017])*	Fall-risk assessment tools and guidelines/standards	Hospital, long-term care, home care
Condition-specific *(e.g., Stroke Assessment of Fall Risk [SAFR])[60]*	Fall-risk assessment tools	Acute care
The Joint Commission[31]	Fall-prevention and management regulatory standards	Hospital, home health, long-term care
American Geriatrics Society (AGS) guidelines[61]	Fall-prevention, management, and assessment guidelines; includes a sub-section for persons with dementia	Cross-setting (community, long-term care)
National Institute for Health and Care Excellence (NICE)	Fall-prevention, management, and assessment guidelines	Cross-setting (community, inpatient)
American Medical Directors (AMDA) Clinical Practice Guideline	Fall-prevention, management, and assessment guidelines; fall-prevention program selection, implementation, and evaluation guidance	Long-term care
Rubenstein et al.'s Self-rated Fall Risk Questionnaire (FRQ)[62,63]	Fall-risk self-assessment tool for older adults and caregivers	Self-assessment
Timed Up and Go Test[64] (TUG)	Fall-risk assessment physical test	Community / primary care

***CDC=Centers for Disease Control and Prevention. STEADI=Stopping Elderly Accidents, Deaths & Injuries.

There is also a lack of clarity surrounding "inpatient" vs. "outpatient" fall-risk

assessments and interventions. What is meant by "community-dwelling" older adults?

Does this include older adults in assisted living centers, rehabilitation centers, long-term

care settings such as nursing homes or Skilled Nursing Facilities (SNFs), or only those

in home settings? Common definitions of community-dwelling older adults include

adults at least 65 years of age who live independently in the community/home setting

(i.e. not in a short- or long-term assisted care setting, and not who are home-bound and

may have reduced levels of independence),[27,65,66] and we will use that definition moving

forward in this proposal. By targeting community-dwelling older adults who may have

better functional status compared to older adults living in assisted or institutional care

settings, this proposal focuses on pro-active prevention of falls in older adults, with the

rationale of maintaining older adults' independence and unassisted living status for as

long as possible.

B. Evidence-Based Community Fall Prevention Programs Reduce The Risk Of Falls In Older Adults.

Evidence-based fall-prevention programs exist for community-dwelling older adults, including exercise, home modification, and medication management components.[8,9] In randomized controlled studies, these programs reduce fall rates by 30%-55%.[9,45,67] A 2012 systematic review of RCTs of fall-prevention interventions assessed the most effective components for CFP programs in terms of risk of falling and rates of falling in community-dwelling older adults and found the most effective programs to be group or home-based exercise programs (including Tai Chi, also referred to as taijiquan), home modification, and multi-factorial programs (e.g., exercise plus medication management, education, and/or home modification).[8] Benefits of Vitamin D supplementation were inconclusive.[8] Similarly, a 2015 umbrella review of meta-analyses of RCTs showed that exercise and "individually-tailored" multi-factorial programs were the most effective in reducing falls in community-dwelling older adults, with conflicting evidence for Vitamin D supplementation.[68]

CFP programs containing exercise and/or education components may also reduce older adults' fear of falling and improve other humanistic outcomes, such as caregiver burden.[44,62,69-75] Fear of falling may be defined as "a patient's loss of confidence in his or her balance abilities,"[44,76,77] "an ongoing concern about falling that ultimately leads to avoidance of the performance of daily activities,"[44,78] or "an unhealthy activity avoidance due to fear of falling."[44] Similarly, fall self-efficacy has been defined as "confidence or

belief in one's ability to perform activities without losing balance or falling."[79] A 2012

meta-analysis found that community-dwelling older adults' degree of fall self-efficacy is

positively correlated with their degree of engagement and participation in daily, social,

or physical activities.[79] Additionally, a 2008 meta-analysis showed that multi-component

fall-prevention interventions, exercise only fall-prevention interventions, and

interventions focusing on hip fracture prevention are all effective in reducing fear of

falling in institutional, community, and home health settings.[80] In this study, better

outcomes were obtained after longer time-periods (e.g., programs lasting four months

vs. three months), indicating that duration of programs may affect outcomes.[80] Several

validated instruments exist to measure fear of falling or fall self-efficacy in community-

dwelling older adults (Table 5). A 2012 review recommends the Fall Efficacy Scale-

International (FES-I) long form as the most appropriate measure for assessing fear of

falling in especially vulnerable community-dwelling older with low functional status,[81]

although other studies question if "fall self-efficacy" is an accurate proxy for "fear of

falling."[44]

Table 5. Measures and Instruments for Fear of Falling or Fall Self-efficacy

Measure/Instrument	Description	No. of Items
Fear of Falling		
Single item: Yes/No response	Are you afraid of falling? May be easiest for participants to understand.	1
Single 5-point Likert-item	Are you afraid of falling? 1=not at all afraid, 5=very afraid. Able to assess degree of fear; easy for participants to understand.	1
Survey of Activities and Fear of Falling in the Elderly (SAFFE)	Developed by Lackman et al., 1998. Questions are scored from 0 to 4, with a total score range of 0 to 33. Questions focus on activities of daily living (ADLs), instrumental ADLs, mobility tasks, and social activities. May be difficult for older adults to complete, and difficult for investigators to score.	22
University of Illinois at Chicago Fear of Falling Measure (UIC-FFM)	Developed by Velozo & Peterson, 2001. Questions are scored from 0 to 4 and focus on community-dwelling older adults' ADLs. Reliability of the scale has been measured as 0.93 (Cronbach's alpha).	16
Fall Self-Efficacy		
Fall Efficacy Scale (FES)	Developed by Tinetti et al., 1990. Instrument is scored from 0 to 100, with <70 indicating fear of falling. Includes only activities within the home, so may not be well-suited to highly mobile older adults. Has been extensively used in the community setting.	10
Modified Falls Efficacy Scale (MFES)	Developed by Hill et al., 1996. Instrument is scored from 0 to 140, where higher scores indicate more functional efficacy. Instrument was adapted from the FES and includes both home-based activities and activities outside the home. Has been used in multiple settings.	14
Activities, Balance, Confidence Scale (ABC)	Developed by Powell & Myers, 1995. Instrument includes visual analog scales and is scored from 0 to 100, where 0 indicates no confidence and 100 indicates high confidence. Activities in this instrument are more specific than in the FES and include activities outside the home. Has been extensively used in the community setting.	16

***Summaries of measures and instruments were extracted from Jung, 2008.[44]

Evidence-based CFP programs for older adults have demonstrated a 64% – 509% return on investment (ROI) to the healthcare system.[9,45,67] A 2015 economic analysis from a payer perspective showed the net benefit and ROI of The Otago Exercise Program delivered to adults aged 65 and over to be $121.85 per participant and 36% for each dollar invested, respectively.[67] When delivered to adults aged 80 years and older, these figures increased to $429.18 and 127%.[67] Tai Ji Quan: Moving for Better Balance had a net benefit and ROI of $529.86 and 509%, respectively, while Stepping On had a net benefit of $134.37 and ROI of 64%.[67] Similarly, the 2013 Report to Congress on CMS' Evaluation of Community-based Wellness and Prevention programs showed that older adults' participation in A Matter of Balance resulted in savings to CMS of $938 for unplanned medical costs per Medicare beneficiary, with most older adults (97%) stating they felt more comfortable talking about their fear of falling after participating in the CFP program, and 99% of older adults stating they planned to continue exercising.[9] In other literature, results of economic analyses vary. In the community setting, Jenkyn et al. and Peeters et al. report that multifactorial fall-prevention strategies _were not_ cost-effective,[82,83] while Rizzo et al. report that a multifactorial fall-prevention program _was_ cost-effective.[84] McLean et al. and Robertson et al. report that exercise-only fall-prevention programs were not cost-effective in either community group settings or individual, home-based settings, respectively.[85,86] From the results of a randomized, controlled trial of a community-based podiatry intervention to prevent falls, Cockayne et al. found there was a 65% chance of the intervention being cost-effective from a health system perspective when using the NICE cost-effectiveness threshold of 30,000 pounds (£) per QALY gained.[87] A 2011 systematic review, meta-analysis, and economic

analysis using decision analytic modeling found Tai Chi to be the most cost-effective falls intervention in the community setting, with cataract surgery and psychotropic medication withdrawal also being cost-effective.[88] Economic analyses have also been conducted in other settings. For example, Church et al. found that medication review and Vitamin D supplementation were the most cost-effective interventions in residential care settings.[88] Isaranuwachai et al. found that from a societal perspective, the cost-effectiveness of a multifactorial fall-prevention program in a home health setting was influenced by participants' age and decision-makers' willingness to pay (WTP) for the fall intervention; specifically, the fall intervention was cost-effective for adults age 75-84 years only at higher WTP values (at least $25,000), but was cost-effective at lower WTP values (<$5,000) for adults at least 85 years of age.[89] Similarly, Haines et al. found that a patient educational program for fall-prevention, in addition to usual care, was cost-effective in a hospital setting if the rate of falls in older adults (with intact cognition) was 4% or higher.[90] All of these results may be highly influenced by differences in participants' characteristics (e.g., age and socioeconomic status), the fall-prevention program used (evidence-based vs. not evidence-based and fit with the intended participants and setting), delivery of the program (delivered with high vs. low fidelity), participants' adherence to the program (Jenkyn et al. found that over 60% of participants had only low or moderate adherence to a CFP program), the perspective taken (societal, health system, payer, or patient), and differences in costs and discounting used between studies and over time.

Also, incentives exist for community centers and providers to implement CFP programs, including eligibility for federal Title III-D funds,[91] provider quality rating measures,[92] and Medicare Part C medical plan star rating measures.[92] These are described in greater detail below.

1) Institutions, community centers, or other organizations implementing CFP programs have a financial motivation for utilizing evidence-based programs and continually evaluating and improving institution-specific programs. As of October 2016, only organizations implementing Title III-D Highest Tier Evidence-Based Programs are eligible to apply for federal Title III-D funds.[93,94] The Older Americans Act (OAA) of 1965 established legislation to protect and provide services for older adults. In 1987, Title III-D funds were added to the OAA to help communities provide health promotion and prevention services for older adults. In 2012, an amendment to the OAA established the Evidence-Based Requirement for Title III-D-funded activities.

   To meet the Title III-D definition of "evidence-based," a program must meet at least one of these criteria,[93] as cited from the ACL:

   a. Meet the requirements for ACL's "Evidence-Based Definition:"
      i. Demonstrate through evaluation to be effective for improving the health and well-being or reducing disease, disability and/or injury among older adults; *and*
      ii. Be proven effective with the older adult population, using an experimental or quasi-experimental design (ACL definitions:

experimental designs use random assignment and a control group, *while quasi-experimental designs do not use random assignment*); *and*

iii. Have research results published in a peer-reviewed journal; *and*

iv. Be fully translated in one or more community sites (ACL definition: *the evidence-based program has been carried out at the community level, with fidelity to the published research, at least once before; sites should only consider programs that have been shown to be effective within a real-world community setting*); *and*

v. Include developed dissemination products that are available to the public.

b. Be considered an "evidence-based program" by the US Department of Health and Human Services (HHS) that has been demonstrated to be "effective and appropriate" for older adults. This means an HHS division has either included the program in a registry of evidence-based programs, or has reviewed the program and endorsed it as "evidence-based."

Only CFP programs meeting these criteria can be designated as Highest Tier Evidence-Based Programs for Title III-D funds. Since 2012, NCOA and ACL began evaluating and endorsing CFP programs for this Evidence-Based Requirement using their Aging and Disability Evidence-Based Programs and Practices (ADEPP) process.[94] Table 6 describes CFP programs endorsed by NCOA or ACL as of 2017.[95,96] The CDC also endorses several CFP programs, many of which are not (currently) explicitly endorsed by NCOA or ACL.[97]

Table 6. CFP programs endorsed by NCOA or ACL

Program	Description	Effectiveness	Costs

A Matter of Balance (MOB)[9,98,99]	▪ 8 weekly or twice weekly sessions
	  ▪ 2 hours per session
	  ▪ 8-12 group participants
	▪ Emphasizes practical coping strategies to reduce fear of falling and teach fall prevention strategies.
	▪ Structured group intervention activities include group discussion, problem-solving, skill building, assertiveness training, videos, sharing practical solutions and exercise training
		97% of participants feel more comfortable talking about their fear of falling
		
		97% of participants feel comfortable increasing activity
		
		99% of participants plan to continue exercising
		
		98% would recommend MOB
			Intervention cost: $985.76 (of this, $756 is attributed to participant workbooks & meals for a maximum class size of 14); plus $1,500 one-time fee per course instructor
			CMS perspective: $938 savings in unplanned medical costs (inpatient hospital, skilled nursing facility, home health) per Medicare beneficiary

CAPABLE[100-103]	▪ Individually-tailored, delivered at home ▪ 6 Occupational Therapy visits ▪ 4 Nurse visits ▪ Budget for home repairs, modifications, and installation of assistive devices ▪ Occurs over a 4-5 month period ▪ Is preventive in nature to optimize daily functional goals and decrease fear of falling through tailored action planning around participant-chosen goals such as being able to get into the bath safely	75% of participants had improved ability to perform activities of daily living (ADLs)	**Intervention cost:** $2,825 per participant (no cost to participant) **Medicare perspective:** $2,765 cost savings per quarter **Medicaid perspective:** $867 cost savings per participant per month (inpatient and long-term care savings)
Enhance Fitness[9,104-108]	An ongoing, low-cost, evidence-based group falls prevention and physical activity program developed specifically for older adults. The exercises focus on four key areas important to the health and fitness of participants: low impact cardiovascular; dynamic/static balance work; strength training; and stretching. Classes meet three times a week, an hour each session, providing social stimulation as well as physical benefits.	26% reduced risk of falls with consistent participation 13% reduced risk of falls with inconsistent participation Significant improvement in the Timed Up and Go test over time Decreased mortality rate: 1.4% vs. 2.9% in controls 1 unplanned hospitalization was prevented for every 20-	**Intervention cost:** $3,200 for Year 1; plus $50/site annual renewal; plus $200/year software license renewal; plus $2,000 for instructor training; plus $900 for participants' fitness equipment (class of 24) **CMS perspective:** $945 in total medical cost savings per participant

		25 Medicare beneficiaries who participated	
FallsTalk[109-113]	A one to six month personalized behavior change program delivered in two one-on-one sessions utilizing easy- to-use software (provided) that includes: a) evidence-based fall risk screening and standardized FallsTalk interview (10-20 minutes) which creates customized intervention components and reports; b) fall-related log training (5-10 min.); and telephone check-ins (2-5 min. each); c) follow-up interview and log review (10-20 min.).	In a sample of patients who self-reported falling at least once in the past year or who regularly lose their balance, those who had multimedia training (**FallScape**) survived longer without a second fall (p=0.016) compared to those who did not (**FallsTalk**). **Controls** experienced a 2nd fall significantly sooner (p<0.0001) than either **FallsTalk** or **FallScape** participants.	**Intervention cost:** $250-$395 one-time training fee, includes software; plus $250 annual subscription.
FallScape[109-113]	A one to six month personalized multimedia behavior change program delivered in two to four one-on-one sessions utilizing easy-to-use software (provided) that includes: a) evidence- based fall risk screening and standardized FallsTalk interview (10-20 minutes) which creates customized intervention components and reports; b) FallScape interactive multimedia training (one or two 15-30 min. sessions); c) fall-related log training (5- 10 min.); and telephone check-ins (2-5 min. each); d) follow-up interview and log review (10-20 min.); e) FallScape interactive multimedia evaluation (10- 15 min.).	In a sample of patients who self-reported falling at least once in the past year or who regularly lose their balance, those who had multimedia training (**FallScape**) survived longer without a second fall (p=0.016) compared to those who did not (**FallsTalk**). **Controls** experienced a 2nd fall significantly sooner (p<0.0001) than either **FallsTalk** or **FallScape** participants.	**Intervention cost:** $250-$490 one-time training fee, includes software, multi-media, and competency testing; plus $600 annual subscription.
Fit and Strong![96,114-116]	▪ Manage lower-extremity osteoarthritis through engagement in safe, balanced program of physical activity that builds lower extremity strength ▪ 8 weeks ▪ 3 times per week ▪ 90 minutes per session	Increased adherence to physical activity (56% increase compared to control group after 12 months), improved self-efficacy (SE) for exercise, reduced lower extremity joint stiffness (WOMAC measure), decreased lower extremity joint pain (WOMAC and GERI-AIMS), improved aerobic capacity (6-minute distance walk)	**Intervention cost:** $1,806.40 for exercise materials ($90.32 per participant); $1890 for instructor fees ($94 per participant); plus one-time $1,000 instructor training fee for a single site ($2,000 for a system plus $400 per site)

Healthy Steps for Older Adults (HSOA)[117-121]	• Healthy Steps for Older Adults (HSOA) provides screening, assessment, and education to reduce the incidence of falls. • Two 2-hour workshops are offered to interested individuals in the community at facilities such as senior community centers and healthcare organizations.	15% reduction in fall incidence 11.3% of the HSOA arm and 14.8% of the comparison group experienced $\geq$1 hospitalization (P= 0.04)	**Intervention cost:** No charge through Pennsylvania's Area on Aging centers; separate organizations can purchase a license and training information by emailing wellness@pa.gov **Societal perspective:** Expected costs per participant of $3,013 in the HSOA arm and $3,853 in the comparison arm, average savings of $840 per participant. Confirmed in Monte Carlo simulations ($3,164 vs. $3,882, savings of $718).

YMCA Moving for Better Balance[45,67,122-125]
 	
CDC partnered with YMCA to adapt this program from Tai Chi: Moving for Better Balance
	Moving For Better Balance is a 12-week evidence-based, instructor-led group program designed to help participants improve their strength, balance, flexibility, and mobility through the slow and therapeutic movements of Tai Chi, a form of exercise and deep breathing.
	
	Moving For Better Balance is:
	• a 12-week program which includes:
	  • 2 class sessions per week
	  • 2+ hours of at-home practice per week
	• A qualified instructor to teach participants
	• A small group to help support participants
	• A safe and comfortable environment to learn and practice
	• A convenient location in the community
		Improved balance, muscle strength, exercise self-confidence
		
		Tai Chi systematic review and meta-analysis: Falls absolute risk reduction of 10%
		
		Original TJQMBB showed 55% reduction in fall rate
			Intervention cost:
			$386 implementation cost; $70 participant cost (may have no extra charge for YMCA members)
			
			Payer perspective:
			Original TJQMBB showed $530 net benefit per participant; 509% ROI

The Otago Exercise	▪ 4-5 visits with a physical therapist (PT) over 8 weeks with monthly phone calls for a	35%-46% reduction in falls rate	**Intervention cost:** -Online instructor training $25; if

Program (OEP)[67,96,126-130]	year and optional follow up visits at 6, 9, and 12 months ▪ 17 exercises total – the PT evaluates the older adult and selects the most appropriate exercises from the 17 to challenge the older adult. ▪ The exercises are progressed to continue to challenge the older adult as they improve strength and balance ▪ Adjustable ankle weights are used for 3 of the exercises and weight is progressively increased over the course of the program ▪ The older adult does the exercises for approximately 30 minutes three times a week. ▪ When the older adult is strong enough to walk for exercise, a walking program is prescribed and progressed to up to 30 minutes three times a week ▪ The older adult can do their prescribed exercises in the home independently or with assistance, or in a group exercise setting as long as they do their prescribed exercises		patient has medical necessity and a physician referral, Medicare may cover cost of physical therapy under Part B (patient co-pay); exercise equipment costs may vary; exercises and patient resources can be downloaded for free (video or print) **Payer perspective:** Average cost per participant of $339.15, average expected benefit of $768.33 for participants over age 80. A $429 net benefit per participant; 127% ROI
Stay Active and Independent for Life (SAIL)[96,131-135]	▪ An on-going class that meets 3 times per week for one hour. Each class includes warm-up, aerobics, balance activities, strengthening, and stretching exercises that can be done seated or standing; and educational components. ▪Periodic Fitness Checks assess general mobility, arm strength, and leg strength. ▪SAIL Guides supplement class activities by providing written education information to prevent falls by addressing fall risk factors.	25% reduction in falls rate 93% of participants reported improvement in activities of daily living; 92% reported improved strength, balance, fitness, and/or flexibility; 80% were satisfied with the SAIL educational information	**Intervention cost:** $185 one-time fee for program leader training; no site license fee; exercise equipment costs may vary; no or little cost to participants
Stepping On[96,130,136-138]	▪ Offer strategies and exercises to reduce falls and increase self-confidence in making decisions and behavioral change in situations where older adults are at risk of	30% reduction in falls rate	**Intervention cost:** Instructor training, site license, education and exercise materials: $250 for Wisconsin

	falling ▪ 7 weeks ▪ 2 hrs per week ▪ A home visit or follow-up phone call by the program leader, to facilitate follow-through with preventive strategies and to assist with home adaptations ▪ 2-hour booster session after 3 months		instructors; $1,200-$1,500 for non-resident instructors to train in Wisconsin or $12,000 for large-group, on-site training, plus cost of materials **Payer perspective:** Average cost per participant of $211.38, an average expected benefit of $345.75, for a $134 net benefit per participant; 64% ROI
Tai Chi for Arthritis[96,125,139-142]	▪ Attend a minimum of 16 hours of Tai Chi per week. This can be accomplished by attending one hour per week for 16 weeks or two hours per week for eight weeks. ▪ Program must be led by a certified Tai Chi for Health Institute instructor. ▪ Instructors should strongly encourage participants to practice the Tai Chi program at home for half an hour daily, at least four days per week. This can be done in one half-hour session or two fifteen-minute sessions. ▪ Participants must attend at least one in-person class per week. ▪ An instructional DVD is available to help guide learning and home practice as well as other educational aids such as books, the handbook, and wall charts, as well as online videos. ▪ The program utilizes Tai Chi's Sun style for its ability to improve relaxation, balance, and its ease of use for older adults. The movements are taught to both left and right sides and with turns to move forward and backward to improve mobility and offer a variety of combinations.	Improved balance, muscle strength, exercise self-confidence, and reduced osteoarthritis pain Tai Chi systematic review and meta-analysis: Falls absolute risk reduction of 10%	**Intervention cost:** Instructor training fees: $275 per trainer; participant costs vary by facility, plus cost of optional DVDs for home (~$30 each)
Tai Ji Quan: Moving for	▪ Attend TJQMBB a minimum of 48 hours, preferably through	55% reduction in falls rate	**Intervention cost:**

| Better Balance (TJQMBB)[45,67,96,130,143-145]

Formerly Tai Chi: Moving for Better Balance | one 24-week class, twice a week. Two 12-week classes meeting twice a week for an hour per session are not recommended but are permitted as long as the program follows the protocol for weeks 1-24 as outlined in the Class Teaching Plan.
▪ The duration of each session is 60 minutes.
▪ TJQMBB uses an 8 form Tai Ji Quan core aimed at improving postural stability, awareness, and mindful control of body positioning in space, functional walking, movement symmetry and coordination, range of motion around the ankle and hip joints, and lower-extremity muscle strength.
▪ Recommended class size is 8-10 participants for new instructors and 10-15 for experienced instructors. | | $375 instructor training fee

Payer perspective:
Average cost per participant of $104.02, an average expected benefit of $633.90, and a $530 net benefit per participant; 509% ROI |

*CFP=Community Fall-Prevention; ROI=return on investment.

**Program descriptions are quoted from the National Council on Aging (NCOA) website and infographics.[45,96]

***Some programs have additional requirements, such as delivery by a certified fitness instructor, recreational therapist, occupational therapist, or physical therapist. Trainer and organization training sessions and materials are available for most programs, as well as participant materials.

2) CMS' Physician Quality Reporting System (PQRS), the Merit-Based Incentive

   Payment System (MIPS), and the Accountable Care Organization (ACO) all

   incentivize providers to perform fall-prevention assessments and activities with

   older adults through various quality measures.[92] The Medicare Access and CHIP

   Reauthorization Act of 2015 (MACRA) implemented the Quality Payment

   Program through CMS, which combined aspects of CMS' PQRS, Medicare EHR

   Incentive Program (EHR, electronic health record), and Value-based Payment

   Modifier to create MIPS. MIPS replaces these previous CMS quality incentive

   programs, and includes performance-based reimbursement adjustments for

   Medicare Part B services.[146] As of 2017, provider quality indicators related to

   falls include MIPS/PQRS measures 154: *"Falls: Risk Assessment"*, 155: *"Falls:*

   Plan of Care", and 318: *"Falls: Screening for Future Fall Risk"*.[147] According to

   data provided by NCOA,[92] financial incentives are also provided by MIPS/PQRS

   through CPT billing codes for performing falls screening (documenting an older

   adult's number of falls in the past year: 0 falls or 1 fall with no injury=1101F; 1 fall

   with injury or 2 or more falls=1100F), performing an annual fall-risk assessment

   in persons with a history of falls (3288F), and documenting a Fall Care Plan

   annually for persons with a history of falls (0518F). As of 2017, the ACO also

   provides provider quality measure 13: *"Screening for future fall risk at least once*

   within 12 months."

3) Several organizations examine prescription plan, medical plan, and/or wellness

   program quality. This includes the Pharmacy Quality Alliance (PQA), a non-profit

organization that develops prescription drug insurance plan quality measures (including Medicare Part D). This also includes the National Committee for Quality Assurance (NCQA), a non-profit organization that develops Healthcare Effectiveness Data and Information Set (HEDIS) quality measures,[148] which includes quality measures for healthcare providers, organizations, and medical insurance plans (including Medicare Part C)., and accredits US health plans based on NCQA accreditation standards. Since 2014, NCQA also offers Wellness & Health Promotion (WHP) accreditation for health insurance plans, vendors, or organizations that offer WHP services. Currently, NCQA assess WHP programs based on 12 standards focusing on process factors and 10 quality measures focusing on risk reduction for obesity, physical inactivity, and cigarette smoking.[149] Incorporating CFP programs into employer and/or health plan WHP services may be an avenue to encourage dissemination, implementation, and insurance coverage for CFP programs as the US workforce ages.

Medicare Part C medical plan HEDIS measures examine the quality of fall-prevention activities performed by providers through Measure C18, *"Reducing the Risk of Falling."*[92] Like other Part D prescription plan measures and Part C medical plan measures, this measure is rated on a 5-star scale (1=low performing, 5=high performing). While Prescription Drug Plans (PDPs) were assessed across 15 Part D quality measures in 2017 (including Drug Plan Customer Service; Drug Plan Member Complaints and Medicare Audit Findings; Member Experience with Drug Plan; and Drug Pricing and Patient Safety

domains), Medicare Advantage (MA) plans were assessed across 32 Part C quality measures, and Medicare Advantage Prescription Drug (MA-PD) plans were assessed across 44 Part C and Part D quality measures.[12] From 2014 to 2017, measure C18 dropped from a star rating of 3.4 to 2.4.[12] However, continual changes in methods for measuring Medicare quality indicators may contribute to star-rating changes across years.

III. Utilizing CFP Programs

A. Implementation Of Evidence-Based Fall-Prevention Programs Is Low In The Community Setting.

Despite the existence of real-world effectiveness data, cost and ROI data, federal funding mechanisms, and provider- and Medicare plan-level incentives for utilization of evidence-based CFP programs for older adults, these programs remain severely under-utilized,[10,150-157] even as falls in community-dwelling older adults continue to rise.[11] This poor utilization of CFP programs has been attributed to difficulties with dissemination and implementation of existing evidence-based CFP programs,[150,158] and may be partly explained by 1) lack of awareness and access to evidence-based CFP programs; 2) limitations of existing fall-risk assessment tools; 3) reimbursement limitations for providers' and patients' fall-related activities; 4) poor care transitions between institutional and community-based settings; 5) infrastructure limitations; 6) and lack of older adults' and caregivers' input in the design of evidence-based CFP programs and low program engagement.

i. Lack Of Awareness And Access To Evidence-Based CFP Programs:
Despite the existence of multiple tools and education materials to assist in fall-risk assessment, prevention, and management, it is unclear if and how primary care providers access information on CFP program resources. Qualitative studies with national samples of providers indicate that lack of resources remains a barrier to

providers' fall-prevention activities.[154-156] In a survey assessment of 38 providers' fall-prevention practices across 11 health system practice sites, Smith et al. found that among several conditions (falls, diabetes, cardiovascular disease, mental health, and musculoskeletal conditions), providers ranked falls as the lowest priority condition.[138] Less than 40% of providers surveyed had asked most of their older adult patients if they had fallen in the past year, less than 25% referred older adult patients to physical therapists for balance or gait education/treatment, less than 20% referred older adults to CFP programs, and less than 16% conducted standardized functional assessments at least once per year with older adults.[138] Additionally, in qualitative studies with primary care providers, perceived access to other healthcare providers, awareness of CFP programs, provider training, perceived appropriateness of referrals, perceived importance of falls compared to other competing risks, and tie-in with other activities familiar to the provider all influenced providers' fall assessment and referral activities for older adult patients.[159,160]

Also, evidence-based CFP programs may not be physically available in all communities or easily accessible to older adults and caregivers with limited transportation.[161] Online options may be feasible given recent increases in technology use among older adults, but internet access and computer literacy still remains a barrier for some older adults, including those who are in the oldest age brackets, are less affluent, and with more health or functional limitations.[162] From the results of a national 2012 survey, the Pew Research Center reports that 74% of US adults between 65-69 years of age regularly use the internet and 65% have high speed internet access at home; among US adults

age 70-74 years, these figures are 68% and 55%, respectively; among adults age 75-79 years, these figures drop noticeably to 47% and 34%, respectively; and among adults 80 years of age or older, these figures are 37% and 21%, respectively.[162] These statistics were also lower, on average, for older adults who self-reported having lower income and/or education levels.[162] Further, delivery of exercise-only CFP programs via telemedicine technology has been shown to increase older adults' adherence to the CFP program and reduce number of falls compared to the same program delivered in-person in a home setting.[163]

NCOA provides an online search function for providers, patients, and caregivers to find evidence-based CFP programs in their local communities.[164,165] NCOA also provides contact information for its State Falls Prevention Coalition members, which has 43 member states that participate in NCOA's national Falls Free Initiative.[166] When evidence-based CFP programs are not available, evidence-based exercise routines intended to improve overall fitness, balance, and gait stability in older adults, or non-evidence based exercise programs (such as non-standardized Tai Chi or aerobics classes at local fitness centers or senior centers), physical therapy sessions, or home-based exercise routines may be recommended to patients/caregivers by their providers. While exercise has been shown to reduce older adults' risk of falling, the extent of benefit gained from non-evidence based programs is unclear, and may vary based on process factors, such as number of sessions attended and degree of consistency in teaching methods between instructors and sites. Of note, one potential solution to increasing access to CFP programs may be to utilize community pharmacies and

pharmacists. Medication interventions may reduce falls by up to 70%,[167-169] and community pharmacies offer convenient access to healthcare professionals for education, counseling, and referrals.

ii. Limitations Of Existing Fall-Risk Assessment Tools:

Many fall-risk assessment tools are intended for use in the acute care/hospital setting, such as the Morse Fall Scale (MFS)[56] and the Hendrich II Fall Risk Model.[34-36] Translating these tools to community or primary care settings may pose a problem in terms of tool validity for specific settings and patient populations. Some well-established fall-risk assessment tools have been validated in multiple acute care settings and/or countries (MFS[56] and Hendrich II Fall Risk Model[34-36]), but heterogeneity in studies evaluating these tools means that there is no clear consensus on which tool is best-suited to particular settings and patient populations.[170,171] A 2015 systematic review and meta-analysis for several fall-risk assessment tools showed low prognostic accuracy in hospital settings.[172] An earlier 2007 systematic review and meta-analysis of these tools' predictive accuracy in hospital settings showed that nursing staff clinical judgement may have similar predictive accuracy as standardized fall-risk assessment tools.[170] These issues may contribute to provider perception that these tools do not contribute enough added clinical benefit to justify time spent using them. In turn, this may contribute to provider dissatisfaction with and lower utilization of standardized EHR-integrated or paper-based fall-risk assessment tools, and ultimately lower referrals of at-risk patients to CFP programs.

iii. Reimbursement Limitations For Providers' And Patients' Fall-Related Activities:

In qualitative studies with primary care providers, reimbursement limitations have been identified as a logistical barrier to referring older adult patients to CFP programs.[159,160,173] As of 2017, Medicare reimburses primary care providers for three different fall-related activities,[92] including:

1) The Welcome to Medicare Examination, which includes a fall-risk assessment as part of a beneficiary's initial preventative physical exam; however, this is only billable within the first 12 months of Medicare enrollment using CPT code G0402.

2) The Annual Wellness Visit (AWV), which includes a review of the beneficiary's functional level and safety, which may include falls. This may be billed at initial wellness visits (G0438), plus related follow-up visits (G0439).

3) Scheduled office visits that include fall-related activities. Evaluation and Management (E/M) codes can be used to bill for fall-related activities that are part of a scheduled office visit. However, this only applies if more than 50% of the visit's time is dedicated to face-to-face education or counseling on fall-prevention and management. Further, the visit must be billed under a reimbursable medical condition (i.e. fall-prevention, assessment, and management cannot be documented as the primary reason for that visit), with some variation in billing codes available for new vs. established patients. Billing with E/M codes also depends on documentation, time, and complexity

related to fall-prevention activities during the visit, with the option to add additional CPT codes for extra time and complexity.

For Medicare reimbursement, billing codes are available for a limited number of other fall prevention activities and equipment, including:

1) Physical Therapy (initial evaluation and re-evaluation).

2) Occupational therapy (initial evaluation and re-evaluation).

3) Home Health Care (certification, re-certification, and care plan oversight).

4) Chronic care management for conditions associated with falls, such as diabetes or hypertension (billing must document at least 20 minutes of non-face-to-face care).

5) Durable Medical Equipment, like canes and walkers (Medicare Part B).

Evidence-based CFP programs are not explicitly reimbursed by Medicare. Indeed, medical billing codes enabling submission of claims for providers' and patients' participation in these CFP programs do not exist. Rather, primary care billing is handled on a piece-meal basis as an add-on to other billing claims. Evidence-based CFP programs that include physical or occupational therapy sessions may be partially reimbursed by Medicare by billing for physical or occupational therapy sessions; however, this limits reimbursement to the number of covered physical/occupational therapy sessions per year (which may not coincide with an evidence-based CFP

program's specified number of sessions), and leaves other evidence-based components of these CFP programs without reimbursement (such as patient education and medication therapy management). Despite these reimbursement limitations, mechanisms to bill for fall prevention and management activities do exist, as outlined above. However, providers and billing personnel may lack awareness of the ability to bill for these services, familiarity with applicable billing codes or procedures, and/or time to learn and routinely implement these complex billing procedures. These issues present process barriers to CFP program dissemination, implementation, and utilization.

While participation in individual CFP programs is not directly reimbursed by Medicare, some Medicare Advantage managed care plans do offer preventative health services benefits that include membership in health and fitness clubs. For example, Ackerman and colleagues describe the "Silver Sneaker" program that offered beneficiaries in some West Coast Medicare Advantage plans the opportunity to voluntarily enroll in a health club benefit.[105-107] This benefit provided access to local health clubs, where enrollees could participate in unstructured fitness activities. While the health clubs offered exercise programs designed for older adults, enrollees could choose to participate in any activity available at the clubs (e.g., swimming), with voluntary attendance. In the 2012 Veterans Affairs (VA) Evidence-based Synthesis Program Report, King et al. reviewed over 3,000 articles in systematic literature review and found only four articles (one study) that assessed health outcomes associated with fitness club membership as a covered medical insurance benefit.[174] These four articles were authored by Ackerman and colleagues (Nguyen et al., 2008 and Berke et al., 2006) and discussed the

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aforementioned Silver Sneakers Medicare managed care benefit. Future research on

preventative wellness and health promotion services should consider assessing

associations between health outcomes and health and fitness club membership

benefits. Demonstrating this association in diverse populations of older adults may help

to influence formation of policies that directly affect health insurance coverage of CFP

programs for older adults, especially those who have the most risk of falls-with-injury.

iv. Poor Care Transitions Between Institutional And Community-Based Settings:[13]

Difficulty with coordinating care between providers and settings has been identified as a

barrier to community fall-prevention and management activities.[154-156,175] Qualitative

studies indicate this may partly be a result of communication barriers between

providers,[154-156] and low patient education on effective fall-prevention strategies when

transitioning from an institutional to community setting.[176] A 2013 randomized

controlled study assessed the impact of a tailored education program delivered to older

hospital inpatients prior to discharge to the community and found that older adults who

received the educational intervention had a higher degree of engagement in fall

prevention activities post-discharge, higher motivation, knowledge, and confidence

about fall prevention activities, and lower rates of falls compared to older adults in the

control group.[177] This suggests that including fall-prevention strategies as part of

discharge education for older adults may help to ease transitions between institutional

and community settings. Reimbursement barriers may also play into poor transitional

care. Currently, providers may bill Medicare for transitional care services within two

weeks of a patient's hospital discharge.[92] While not specific to addressing fall-prevention and management, these services may include medication management and assessment of home hazards. Extent of implementation of transitional care services may depend on institution-specific awareness of and capability for providing these services in terms of sufficient institutional procedures, staff, referral services, and billing mechanisms in place.

v. Infrastructure Limitations:

A 2008 review of the CDC's fall-prevention efforts from 1985-2005 highlighted several areas of need for the field of fall-prevention: "Gathering robust epidemiologic data on trends and patterns of fall-related injuries at all levels; researching risk factors by setting and sub-population; developing and testing innovative interventions; and engaging in translation and dissemination research on best practices to increase uptake and adoption of fall prevention strategies."[178] A subsequent 2010 review of the CDC's fall-prevention efforts further outlines areas of need: "Surveillance and data systems, fall risk factors, development, evaluation, and implementation of fall interventions, translation of interventions into programs, and promotion, dissemination, and widespread adoption of fall prevention programs."[179] The California Fall Prevention Center of Excellence also stated the following needs: "Establish fall prevention as a key public health priority in California; create, test, and evaluate effective and sustainable fall prevention programs; and build a comprehensive and sustainable fall prevention system in California. To accomplish these goals, the Center is currently engaged in developing and disseminating fall prevention tools and information resources directed at

the needs of both consumer and professional audiences; linking organizations involved in fall prevention while increasing awareness of fall prevention as an important public health issue; and helping communities build their capacity to effectively address falls in older adults though the delivery of integrated fall prevention services and "best practice" programs."[180] Despite the existence of patient and provider educational resources for community-based fall-prevention (CDC STEADI),[181] dissemination and implementation guides for CFP programs (CDC,[182] ACL,[94,183] NCOA,[184] EBLC,[185] Community Research Center for Senior Health[186]) and published studies reporting on lessons learned from dissemination and implementation of CFP programs,[108,127,128,187-190] community-based fall-prevention remains under-recognized by patients and providers. For example, Shubert et al. describe dissemination and implementation challenges with the Otago Exercise Program (OEP) that stemmed from lack of infrastructure for supporting home-based physical therapy and exercise interventions delivered by physical therapists.[127,128] To overcome this, fall-prevention research needs to be translated into infrastructure, tools, reimbursement options, and policies targeted to the community setting.

vi. Lack Of Older Adults' And Caregivers' Input In The Design Of Evidence-Based CFP Programs And Low Program Engagement:[13]

The CDC estimates that in 2016, only 15.3% of older adults aged 65-74 years and 8.7% of adults aged 75 years or older met recommended levels of aerobic and muscle strengthening physical activity.[191] Why do older adults tend not to participate in physical activity programs or other preventative health services? This may be partly explained by many factors, including lack of awareness of the problem and/or available

solutions/programs, lack of fit with personal routine, issues of convenience and time, lack of transportation, lack of family support, and functional limitations.[159] Older adults may also have a low level of engagement with preventative health services due to inaccurate risk perceptions and lack of service fit with individual preferences,[161] which may contribute to low program adherence.[159]

Studies have qualitatively examined older adults' preferences for CFP program components and structure, and ways to utilize technology to individualize fall-prevention strategies for use in the home ("aging in place").[192-197] A 2015 telephone survey using open-ended questions in a sample of 245 older adults found that participants' preferences for home-based CFP program structure and delivery, as well as perceived benefits and barriers to participation in a CFP program, influenced participants' program adherence.[193] Another 2016 telephone survey using open-ended questions in a sample of 97 older adults found that participants' preferences for group-based CFP programs revolved around program enjoyment, social interaction, and the program instructor's leadership qualities.[192] A 2004 systematic review of older adults' experiences with CFP programs found that adaptability of the program to fit into the lifestyle of individual older adults was a key factor for participants' adherence to CFP programs, as well as emphasizing the social value of CFP programs and addressing reasons for activity avoidance.[195] The review concluded that methods for synthesizing patients' views and preferences were needed to better inform evidence-based guidelines for fall-prevention.[195] Further, caregivers' preferences on this topic are not well-studied,[72]

despite care recipient falls having a negative effect on caregivers' own quality of life and ability to perform activities of daily living.[72]

All of the above point to a need for further dissemination of fall-prevention resources, provider and patient education on fall-prevention, and tools that can be used by providers, payers, and policymakers to translate fall-prevention research into patient-centered policies and practices to help older adults stay healthy longer.

IV. Measuring the Value of CFP Programs

Our central operating tenet is that transitioning older adults with high fall-risk from health systems to community-based fall-prevention programs requires providers and payers to make patient-centered decisions about the value of individual CFP programs, including benefits and costs from patients' perspectives. This differs from traditional quality of life measurements, requiring assessment of patient-elicited values. However, no structured tools exist for health systems and payers to incorporate older adults' values into evaluations of CFP programs.

A. Theoretical Framework.

Many aspects of CFP programs may potentially contain value from the perspective of older adults. For example, in addition to traditional program cost and effectiveness considerations, both CFP program design considerations and underlying concepts may play a role in how valuable the program is perceived to be by older adults. Program design considerations may include things such as program components (like exercise, medication management, education sessions, and home hazards assessment), program structure (number of sessions offered, duration, and frequency of sessions), and channel (online vs. in-person program). Underlying concepts built into CFP programs may include things such as degree of social interaction (e.g., individual vs. group classes, or inclusion of caregivers), ease of program access (e.g., location of the program and cost to participants), fit with participants' daily routines, enjoyment, and

degree of autonomy/self-management afforded or taught to participants. The *Chronic Disease Prevention and Management (CDPM) Framework* can be used to frame these considerations in the context of fall-prevention and management for older adults.[14] The CDPM Framework describes patient, family, and health system factors that influence self-management of chronic conditions, including personal, social, and system factors. Figure 1 illustrates the study conceptual model, in which *patient factors* are incorporated into Aims 1 and 2 as measures of patient preferences for features of CFP programs, including CFP program components, delivery, structure, cost, and effectiveness, as well as patient self-management skills taught by CFP programs. *Patient factors* may also include individual patient characteristics, such as demographics; this will be incorporated into the study by examining differences in preferences, WTP, and net benefit of CFP program participation between low- and high-income and low- and high-physical function groups in Aims 2 and 3. *Family* factors will be incorporated as measures of patient preferences for the level of social support offered by CFP programs (e.g. group vs. individual classes) in Aims 1 and 2. *Health system* factors will be incorporated into the study by assessing patient preferences for access- and service utilization-related factors in Aims 1 and 2, such as CFP program delivery (e.g. online vs. community center setting), program cost, and older adults' WTP for program participation in Aim 3.

Figure 1. Study Conceptual Model

Value-based CFP Program Decisions by Health Systems and Payers

Cost-benefit analysis ✚ Patient Preferences

CFP Program Features (components, delivery, structure, cost, effectiveness)   Social Support   Self-management   Health System (access, service utilization)

Improved patient engagement and utilization of CFP programs

Improved patient outcomes
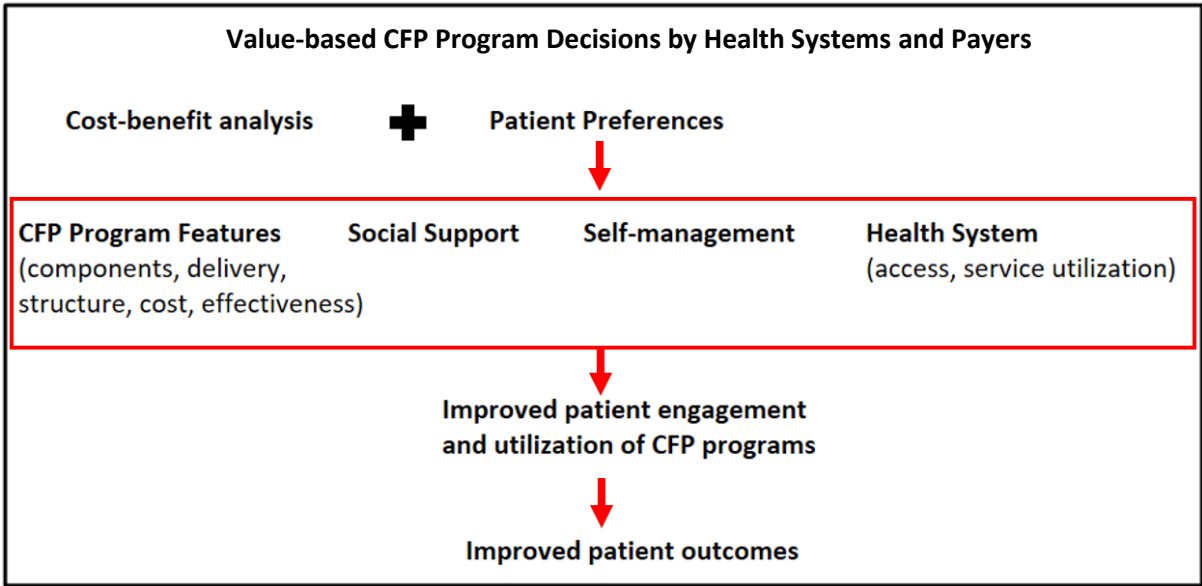
B. "Value" Measurement.

Value of health treatments, products, or services can be measured and defined in different ways. Value may be from the perspective of patients, providers, payers, or society. Methods of value assessment may include comparative-effectiveness studies using decision analysis techniques, health state utilities, patient-reported outcomes (PROs), preference-elicitation studies using direct observation or surveys, and qualitative methods like interviews or focus groups.

Across these different methods for measuring value, traditional assessments of health services have focused on cost, effectiveness, and quality of life. But, other aspects of value might exist from multiple perspectives. For example, providers may hypothetically value other aspects of CFP programs in addition to traditional cost and effectiveness measures, such as: ease of staff training, fit with existing workflow, and clarity of guiding documentation for implementation and evaluation. Similarly, payers might hypothetically place higher value on older, more established CFP programs compared to newer CFP programs. Patients may also value non-traditional aspects of CFP programs, such as the value of independence afforded by the program, degree of social interaction, or reduction in fear of falling. In other words, traditional measurements of patient quality of life may be broken down into more granular aspects that more clearly capture the most important aspects of "quality of life" from the perspective of patients.

V. Patient-Centered Value Assessment Frameworks

A. A Patient-Centered Value Tool Can Improve Implementation Of Community-Based Fall Prevention Programs.

Value tools are structured forms used by stakeholders to quantitatively score the value of comparative services using specified rating criteria and scoring algorithms to optimize value-based decisions in treatment choice, program uptake, or formulary coverage.

B. Recent Value Assessment Frameworks.

Literature reviews of recent value tools describe tool structure, scoring algorithms, and content.[198-206] However, existing value tools often lack a structured mechanism for incorporating patient values into treatment decisions, often do not take patient heterogeneity into account, and tend to focus on drug products instead of devices or health services.[205] The National Health Council's (NHC) recent Patient-centered Value Model Rubric[207,208] provides guidance on developing patient-centered value frameworks, focusing on: 1) Patient partnership; 2) Transparency to patients; 3) Inclusiveness of patient; 4) Diversity of patients and populations; 5) Outcomes patients care about; 6) Patient-centered data sources. PhRMA Foundation also provides guidelines on best practices for patient-centered value assessment framework development,[209] including: 1) Utilize open and transparent processes for developing value frameworks and reports; 2) Communicate results of final value assessments

consistent with the goal of patient-centered decision-making; 3) Undergo thorough

validation and testing; 4) Ensure a strong role for physicians and patients; 5) Clearly

state the intended use and audience; 6) Prioritize patient-focused value frameworks to

support individualized treatment decision-making; 7) Use rigorous methods and make

them transparent to researchers and users; 8) Ensure that models utilize accurate,

relevant data for assessing and reporting costs and economic outcomes; 9) Incorporate

a broad range of high-quality evidence; 10) Consider the broad effects of health

interventions; 11) Prioritize the inclusion of longer-term outcomes; 12) Value progress

against unmet medical needs; 13) Support value across the health system and

continuum of patient care; 14) Examine patient subgroups to meet individual patient

needs and optimize value; 15) Support availability of multiple value assessments from a

range of organizations. Additionally, the ISPOR Value Assessment Framework

Taskforce has begun a draft guidance on best practices for developing value

frameworks, with a focus on health technology assessment (HTA) and economic

analysis.[210] Avalere/FasterCures[203] also provides a high level overview of concepts that

might be important to patients when developing a patient-centered value framework.

Table 7 describes recent value assessment frameworks.

Table 7. Recent Value Assessment Frameworks

Framework	Description	Intended User
American Society of Clinical Oncology (ASCO)[15,16,198,199]	Facilitates shared decision-making between oncologist and patient for cancer drug/drug regimen decisions. Multiple attributes are assessed for each treatment and scored using an algorithm – scores are compared between treatments.	Physician-patient
National Comprehensive Cancer Network (NCCN)[211]	Facilitates shared decision-making between oncologist and patient for cancer treatment decisions using "NCCN Evidence Blocks."	Physician-patient
Memorial Sloan Kettering Cancer Center (MSKCC) DrugAbacus[212]	Facilitates health insurers' pricing decisions for cancer drugs using an online algorithm that includes insurers' WTP per QALY gained.	Payer
Institute for Clinical and Economic Review (ICER)[202]	Facilitates health insurers' formulary decisions for new drugs, medical devices, or health programs.	Payer
American College of Cardiology (ACC)/American Heart Association (AHA)[201]	Facilitates shared decision-making between cardiologist and patient for cardiology treatment decisions.	Physician-patient

*DrugAbacus and ICER may be used by payers, policymakers, physicians, or patients, but are generally considered to be payer tools.[205]

**These value frameworks are the focus of ISPOR's Value Assessment Framework draft guidance. Other value frameworks exist, as outlined in ISPOR's draft document.[210]

***WTP=willingness to pay; QALY=quality adjusted life year.

C. Development Options.

This study will inform development of a tool for health systems and payers to use as an adjunct to traditional cost-effectiveness or cost-benefit analyses when incorporating patient values into decisions about CFP program formulary decisions and program development, evaluation, and recommendation. To evaluate potential patient heterogeneity, value differences will be assessed based on older adults' socioeconomic status, a predictor of community-dwelling older adults' risk of fall-related injury.[17]

To accomplish our goal, we: 1) Characterized key features of a CFP program from the perspective of older adults (Aim 1); 2) Quantitatively determined older adults' preferred CFP program features and how this is modified by socioeconomic status and physical functional status (Aim 2); and 3) Assessed willingness to pay (WTP) for a CFP program and net benefit of participating in a CFP program from the perspective of older adults, and how these are modified by socioeconomic status (Aim 3). Findings may inform future feasibility, usability, and acceptability testing of a prototype patient-centered value tool by end-users and serve as a "proof of concept" pilot that can be repeated in larger samples.

VI. Future Directions

A. Overall Impact Of Developing A Patient-Centered Value Tool For Fall-Prevention Programs In Community-Dwelling Older Adults.

This study is significant in that it may lead to development of a patient-centered value tool for CFP programs. This value tool can be used by health systems and payers as an adjunct to traditional cost-effectiveness and cost-benefit analyses to guide systematic formulary, development, evaluation, and recommendation decisions for CFP programs, and to guide improvements in program quality and patient-centeredness. The value tool may be tailored to fit different communities, regardless of whether differences in values are found here among socioeconomic groups. Future feasibility and usability studies may validate this tool in health systems and payers serving diverse populations of older adults. Randomized studies may also test the effectiveness of patient-centered CFP programs designed with this tool in improving program reach, engaging older adults in risk reduction, and reducing falls in different types of older adults.

Chapter 3
Methods

I. Approach

Table 8 summarizes the questions addressed by this study and Figure 2 describes the

methods used across Aims 1-3.

Table 8. Questions Addressed by the Study, Relevant Aims, and Methods

Question	Aim	Method	Analysis	Results
What aspects of a community fall-prevention program do older adults prefer?	Aim 1	Qualitative meta-synthesis	Thematic and content analysis in Atlas.ti; inter-coder reliability via Krippendorff's alpha	Qualitative identification of key CFP program features for older adults
How do older adults prioritize benefits & costs of a CFP program?	Aim 2	Survey decision task	Discrete choice experiment (DCE) with conditional logit models	Quantitative weights for features obtained in Aim 1
How does prioritization of benefits and costs for a CFP program change based on older adults' socioeconomic factors?	Aim 2	Survey decision task	Stratification on income levels & DCE with conditional logit models for each sub-sample	Stratification of value weights based on socioeconomic factors
What is older adults' willingness to pay (WTP) for a CFP program?	Aim 3	Survey of older adults at risk for falling; online Qualtrics Panel with demographic quotas; decision task with continuous costs	DCE with conditional logit models; ratio of preference weights for WTP/month; bootstrapping for WTP confidence intervals	Quantitative WTP data

Figure 2. Diagram of Study Methods and Rationale

Aim 1

Purpose: The overall purpose of Aim 1 is to obtain a list of CFP program attributes and levels that can feasibly be included in the Aim 2 DCE, where they will be weighted relative to each other.

Plan: Exhaustively identify CFP program attributes and levels and narrow these features to those that are considered "key features" by older adults.

Method: Qualitative meta-analysis and interviews with older adults, caregivers, and a falls expert.

"Key features" data search

Find content assessing which CFP program features older adults consider to be "key features."

Qualitative data synthesis

Pool the results of retained content and perform thematic synthesis and content analysis using Atlas.ti.

Qualitative results and reporting

Report older adults' key CFP program features using a grounded theory framework and code frequencies.

Aim 2

Purpose: The overall purpose of Aim 2 is to weight older adults' preferences for CFP program attributes and levels relative to each other. This will be compared among sub-samples with low vs. high income levels and physical functional status.

Plan: Use the list of key CFP program attributes and levels obtained in Aim 1 and weight them relative to each other in the Aim 2 DCE.

Method: Discrete Choice Experiment (DCE) in a sample of older adults.

Determine DCE design

Use SAS macros to determine the optimal design of the DCE using preferences obtained from Aim 1.

Conduct the DCE

Online, national survey using Qualtrics Panels.

Weight preferences

Conditional logit models: obtain preference weights for each level and relative importance of each attribute.

Explore heterogenity

Stratify based on income levels and physical function levels to compare preference weights and relative importance of attributes.

Aim 3

Purpose: The overall purpose of Aim 3 is to obtain WTP and net benefit values for hypothetical CFP program designs. These will be compared among sub-samples with different income levels.

Plan: Estimate WTP per month for CFP programs and net benefit of CFP program participation from the perspective of older adults.

Method: Obtain WTP/month via ratios of preference weights from Aim 2. Calculate net benefit as WTP/month minus average monthly program participation cost, with one-way sensitivity analyses for cost uncertainty. Calculate 95% CIs via 1,000 bootstrapped samples in SAS.

Calculate WTP per Month

Ratio of preference weights (individual attribute level preference weights to the cost attribute preference weight) = WTP per month for individual attributes. WTP per month for a full program design = ratio of a program's utility to the cost attribute preference weight.

Obtain Costs

NCOA published program costs posted in 2018. Cost adjustment and discounting will not be used, since only one year of costs (2018) are considered.

Calculate Net Benefit

Average marginal WTP/month for each hypothetical program minus average monthly program participation cost for patients = net benefit for each hypothetical program.

Sensitivity Analyses

One-way sensitivity analyses (vary cost) to explore robustness of net benefit values. 95% CIs for point estimates via bootstrapping.

Explore heterogenity

Stratify based on income levels and compare WTP and net benefit values.

A. Aim 1: To Characterize Key Features Of A CFP Program From The Perspective Of Older Adults.

i. Aim 1 Design:

Aim 1 used a systematic review and meta-synthesis of qualitative, mixed methods, and quantitative descriptive studies, as well as interviews with older adults, caregiver, and a falls expert. The systematic literature review and qualitative meta-synthesis were conducted from July to September 2018, and interviews in October 2018. The review followed the Enhancing Transparency in Reporting the Synthesis of Qualitative Research (ENTREQ) reporting guidelines for qualitative meta-analyses.[213] The review protocol is described below.

ii. Aim 1 Inclusion Criteria:

English-language articles were included if they met the following criteria: 1) published between 2008 and 2018; 2) qualitative interviews or focus groups, mixed-methods studies containing a qualitative arm, and qualitative and/or quantitative survey research (study protocols, commentaries, case studies or series, and reviews were excluded); 3) inclusion of community-dwelling adults at least 65 years of age (when the age range was reported as not including ≥ 65 years, the mean age was reported as <65 years, or no age was mentioned, the study was excluded); 4) inclusion of preferred CFP program or exercise program features, including logistic features like session frequency, cost, and proximity to home; format features like group vs. home setting and inclusion of

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extra components other than exercise (like home safety checks or fall-prevention education); or existential features like the degree of social interaction, improvement in falls self-management skills, or improvement in falls self-efficacy offered by the program; and 5) ability to extract results (salient CFP program features from the perspective of older adults).

iii. *Aim 1 Data Sources and Search Strategy:*

We systematically searched for articles pertaining to older adults' preferences for CFP program features. Articles describing general exercise programs for older adults were also included, as these programs may serve a fall prevention purpose for older adults residing in areas without access to formal, evidence-based CFP programs, and many CFP programs include an exercise component.   Articles included published, peer-reviewed studies from PubMed, CINAHL, PsycINFO, and ERIC; so-called "grey literature" using ClinicalTrials.gov; and a high sensitivity search for published, peer-reviewed studies using Google Scholar. Hand-searched published studies were also included using a snowballing method from the citations of retained articles. Search terms included variations on "older adult," "fall prevention," and "patient preference." The Appendix contains a complete list of databases and search strings that were finalized with a medical librarian.

iv. Aim 1 Study Screening Methods:

Citations were downloaded into an Endnote library. Articles underwent initial title and abstract screening, followed by full-text screening. Each screening was first performed by the main investigator and then checked by a second independent investigator;[214] if articles were excluded by both investigators, then the article was excluded from the review. A standardized form based on article inclusion criteria was used to guide each screening (Table 9). Before use, two investigators met to pre-test this form with 5 purposefully chosen articles from the initial search to discuss and fine-tune the inclusion/exclusion criteria and ensure consistent application of these criteria. Articles were included for review if they met the inclusion criteria. Discrepancies in retained articles were resolved through discussion and consensus among the investigators. To capture preferences from different types of older adults, exclusions were intentionally not made based on older adults' functional status, disease states, dementia status, or number of previous falls.

Table 9. Standardized Article Screening Form

Study	English	2008-2018	Older adults	Fall prevention or exercise	Community setting	Preferences	Qual., mixed, or survey	Extraction	Inc.	Exc.

***Place a check mark in the criteria column if it is met. Title and abstract screening: at least 4 of these criteria must be met to be considered relevant for inclusion (English; 2008-2018; older adults $\geq$65 years included or average age $\geq$65 years; and fall prevention or exercise program for older adults). Full-text screening: all criteria must be met for article inclusion. Inc.=Include; Exc.=Exclude.

v. Aim 1 Data Items and Extraction:

This study focuses on older adults' preferences and opinions. To facilitate incorporation of diverse types of preference-related data, measures of interest were intentionally broadly defined as "older adults' preferences" for features of CFP programs.

Data were extracted by the main investigator during full-text screening by uploading the Results sections of retained articles into Atlas.ti qualitative data analysis software.

vi. Aim 1 Risk of Bias in Individual Studies:

Risk of bias within each study was assessed by the main investigator using the Mixed Methods Appraisal Tool (MMAT), Version 2018,[20] and was performed simultaneous with data extraction. Results were reviewed by another investigator for accuracy and completeness. The MMAT contains five study design categories: qualitative, quantitative randomized controlled, quantitative non-randomized, quantitative descriptive, and mixed-methods. Each category contains five criteria with assessment options including "Yes," meaning that the MMAT's explanation criteria were met after evaluation of information included in the article; "No," meaning that the MMAT's explanation criteria were not met after evaluation of information included in the article; and "Can't tell," meaning that a clear assessment could not be made based on the information included in the article. Based on the number of criteria met, each article's quality rating was scored on a scale from 0-5, with 0-1 rated as low quality (high risk of bias), 2-3 rated as moderate quality (moderate risk of bias), and 4-5 rated as high quality (low risk of bias).

vii. *Aim 1 Summary Measures and Qualitative Synthesis Methodology:*

Older adults' preferences were assessed across articles (qualitative cross-case analysis) by pooling the results of each article and performing qualitative analyses on these pooled results. To do this, pdf copies of each retained article were uploaded into Atlas.ti software for qualitative meta-synthesis. Synthesis of the pooled data was performed using qualitative content analysis and thematic analysis on the Results sections of each article, with a deductive coding approach and closed coding in Atlas.ti. *A priori* codes were applied to the pooled data based on constructs adapted from the *CDPM Framework*,[14] including: ease of access, social support, self-management, and service utilization. An inductive analysis with open and in-vivo coding was also used to identify preferred CFP program features that emerged from the data, and that may not be captured by the deductive analysis related to the *CDPM Framework* constructs. Codes were applied iteratively across all included articles, with new codes added as needed. Final codes were grouped into "descriptive themes" based on *CDPM Framework* constructs, and these were grouped into second-order "analytical themes" using a qualitative "thematic synthesis" approach, as described by Thomas et al[215] and outlined in Table 10. This method was chosen due to the aim of generating second-order "analytical themes" that describe older adults' preferences for CFP program features. A random 10% of the data was coded by a second investigator to verify coding, with inter-coder reliability assessed via Krippendorf's alpha.

Table 10. Examples of Methods Used for Qualitative Meta-Analysis in Healthcare

and Other Fields

Qualitative synthesis method	Description	Example
Narrative	Additively summarize both qualitative and quantitative studies using a qualitative narrative synthesis (i.e. descriptive text)	Cole et al.[216] Risk factors for depression among elderly community subjects: a systematic review and meta-analysis.
Meta-ethnography	Qualitative overview of retained studies to generate new interpretations and themes in a narrative manner.	Campbell et al.[217] Evaluating meta-ethnography: a synthesis of qualitative research on lay experiences of diabetes and diabetes care.
Thematic synthesis	Qualitative coding of the pooled results of qualitative studies, to generate multiple layers of themes (descriptive and analytical themes).	Young et al.[218] Barriers and facilitators to safe food handling among consumers: a systematic review and thematic synthesis of qualitative research studies.
Grounded formal theory	Qualitative coding of the pooled results of qualitative studies, to inductively generate themes and a conceptual framework.	Stall-Meadows et al.[219] Procedural methodology for a grounded meta-analysis of qualitative case studies (consumer services, e.g. nutrition, family housing, design).
Critical Interpretive Synthesis	Contrasting the results of qualitative studies in different populations to examine differences based on participant background.	Entwistle et al.[220] Qualitative comparison of similarities and differences between the experiences of diverse populations.

Frequency counts were also generated in Atlas.ti. Counts include article frequency by code, category, and theme (number of articles in which each code, category, or theme appears at least once), and code groundedness (number of times each code appears within and across all articles; i.e. code frequency). This allows for graphical comparison of CFP program features that are more or less preferred by older adults. While frequency counts generated from qualitative content analysis may be used to quantify qualitative data, this method may be sensitive to publication bias and authors' interpretations of patients' preferences. Thus, Aim 2 uses a discrete choice experiment (DCE) to elicit relative preference weights for CFP program features directly from a sample of older adults.

viii. Aim 1 Confidence in the Overall Body of Evidence:

1) CERQual.

Quality-of-evidence ratings for the meta-synthesis findings were generated using the Confidence in the Evidence from Reviews of Qualitative Research (CERQual) tool,[21,218,221] and reviewed by a second investigator for accuracy and completeness. This tool can be used to rate the overall quality of evidence generated for each conclusion in a qualitative systematic review or meta-analysis, with ratings of high, moderate, low, or very low confidence for each conclusion. Components considered in the CERQual evaluation of confidence include: methodological limitations (assessed via the MMAT quality scores), coherence (study findings that confirm vs. disconfirm each other, and consistency of study objectives and data collection across studies), adequacy of data (rich data vs. thin data, number of articles, and number of participants

represented), and relevance (generalizability, which may consider number of articles, study locations, participant characteristics, and CFP program characteristics).

2) Interviews.

To improve trustworthiness and credibility of findings, data source triangulation was also used.[222] Findings from the meta-synthesis were compared to findings of semi-structured interviews with older adults (≥65 years), caregivers, and a falls expert to gather their opinions on the most important features of exercise-based CFP programs, and preferences for frequency and cost of program sessions. Older adults/caregivers were recruited via verbal, face-to-face recruitment messages during regular clinic hours at an outpatient cardiac rehabilitation clinic located in the Southeastern US. Interviews lasted approximately 15 minutes (to reduce interruption of participants' exercise routines) and were conducted face-to-face by the main investigator in a quiet area in the clinic during breaks in participants' exercise routine, or while caregivers were waiting. After each interview, participants filled out a brief demographic questionnaire. Older adults/caregivers received $25 for interview completion. Additionally, a fall prevention expert was purposively recruited from an outpatient fall prevention clinic in the Southeastern US for a 30-minute telephonic interview by the main investigator.

Interview questions were designed to gather participants' opinions on the most important features of exercise-based CFP programs, and barriers and facilitators to participation. Interviews were also used to clarify preferences for the frequency and cost of program sessions, to facilitate design of the Aim 2 discrete choice experiment

(DCE) survey. Open-ended questions and probes were used to dig deeper into participants' responses and investigate the rationale behind participants' opinions and preferences. See Table 11 for a list of interview questions. Recruitment stopped after six interviews (five older adults/caregivers and one fall prevention expert), at which point saturation had been obtained given the consistency of interview findings with analytic themes and categories that emerged from meta-synthesis findings. To preserve the privacy of patients at the recruitment site, interviews were not audio-recorded. Written field notes were taken during the interviews and transcribed into Microsoft Word immediately after each interview by the main investigator. Typed field notes were assessed by hand using qualitative content analysis with open and in vivo coding by the main investigator. A subset of field notes (n=2) were coded by a second investigator, and differences and similarities in coding were discussed between the investigators until consensus was reached on the final coding scheme. The main investigator then recoded the field notes by hand with the final codes and generated initial themes that emerged from the data. Themes were discussed and finalized among the investigators and compared to themes that emerged from the meta-synthesis.

Table 11. Interview Question Guide

Older adults & caregivers	Fall prevention expert
1) What do you like most about participating in an exercise class?	1) How aware do you feel older adults are of fall prevention programs?
2) What makes it easier for you to participate in exercise classes?	2) To what extent do older adults think falling is a risk factor for them?
3) What makes it harder for you to participate in exercise classes?	3) What have you found that helps to engage older adults in fall prevention programs?
4) How many times per week would you want to attend an exercise class?	4) What are some barriers to older adults' attendance at fall prevention programs?
5) How much would you be willing to pay for an exercise class similar to this cardiac rehab program?	5) What structure do you recommend for fall prevention programs? In terms of… -location -exercise only or inclusion of extras -cost to the patient -number of times per week

B. Aim 2: To Quantitatively Determine Older Adults' Preferred CFP Program Design And How This Is Modified By Socioeconomic Status And Physical Functional Status.

i. Aim 2 Design:

This study used a discrete choice experiment (DCE) via a cross-sectional online survey administered by Qualtrics to investigate older adults' preferences for features of CFP programs.

ii. Aim 2 Attributes and Levels:

A preliminary list of attributes and levels for the DCE was created based on literature review and discussion between the investigators. This list was narrowed to the final list of attributes and levels using the results of the qualitative meta-synthesis, as well as interviews with older adults and a fall prevention expert (Aim 1). Each hypothetical CFP program in the DCE was presented as a profile with five attributes. Each attribute had either two or four possible levels. Attributes and levels included: 1) cost ($25, $50, $75, or $100/month); 2) effectiveness (25/100, 20/100, 15/100, or 10/100 people fall at least once each year; coded as a continuous variable for analysis as an approximate 10%, 30%, 50%, and 70% reduction in falls rate, respectively); 3) frequency (2, 3, 4, or 5 times per week); 4) class type (group class or home-based class); and home safety consult (yes, no). Attributes and levels were carefully worded in order to avoid implausible combinations. Final attributes and levels included in the survey are presented in Table 12.

Table 12. DCE Attributes and Levels

Attributes	Levels
Cost	$25 $50 $75 $100
Efficacy	10% reduction in falls rate 30% reduction in falls rate 50% reduction in falls rate 70% reduction in falls rate
Session Frequency	2 times per week for 1 hour 3 times per week for 1 hour 4 times per week for 1 hour 5 times per week for 1 hour
Location	Group location Home-based location
Home Safety Consultation	Home safety consult included Home safety consult not included

iii. Aim 2 Questionnaire Design:
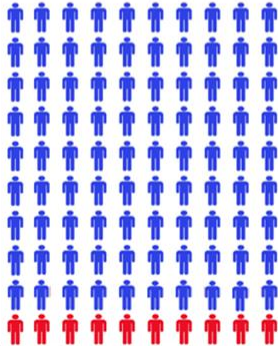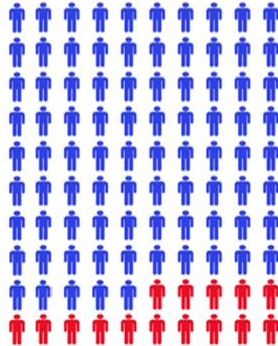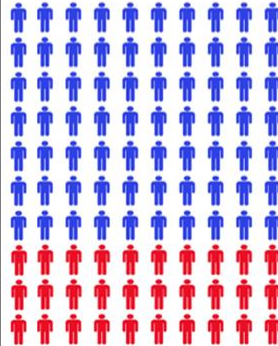
1) Discrete Choice Experiment (DCE).

There were 256 possible CFP program alternatives (4x4x4x2x2) from the study attributes and levels. It was not feasible to include all of them in the survey. An orthogonal D-efficient design was used to generate 32 choice tasks, divided into four blocks of 8 choice tasks each, using SAS macros. To reduce response burden, each participant was presented a randomly assigned block of 8 choice tasks. Further, each of these 8 choice tasks were presented in random order to participants to reduce ordering effects. Each choice task consisted of three alternatives: two alternatives described hypothetical CFP program designs and one was an opt-out option labeled as "No Program," as illustrated in Figure 3. Choice tasks were examined for dominance (i.e. one program is clearly "better" than another in a choice task, such as a program with identical structure and efficacy but lower cost than another program). Three dominant choice tasks were found and revised to remove the dominance while maintaining the DCE design as much as possible. Choice tasks were also examined to make sure there were no duplicates (i.e. identical choice tasks in the design).

The choice tasks included icon arrays to help participants understand program effectiveness (out of 100 people who choose that option, the number who fall at least once each year).[223,224] Icon arrays have been shown to increase the accuracy of older adults' risk estimation compared to risk information presented textually or numerically.[225] Indeed, in readability workshops for this survey, older adults were able to accurately interpret the fall risk presented in the icon arrays. To improve participant comprehension,

participants were shown examples of CFP program designs before completing the DCE, and completed a practice choice task. Prior to completing the DCE, participants were presented with a scenario asking them to imagine that their doctor told them that they are at risk for falling, and their doctor asked them to choose between the options presented in each choice task.

Figure 3. DCE Question Example

Which of these options would you choose, if these were the only options? **Select one**.

Program Description	Program A	Program B	No Program
Class type	At home with an exercise trainer	Group class	
Timing	Three times per week (3/week) for 1 hour	Four times per week (4/week) for 1 hour	Do not participate in a program.
Extras	One consultation with a home safety expert	No extras	
Cost	Fifty dollars per month ($50/month)	Twenty-five dollars per month ($25/month)	
Effectiveness	10 out of 100 people fall at least once each year	15 out of 100 people fall at least once each year	30 out of 100 people fall at least once each year

◯ **Program A**   ◯ **Program B**   ◯ No Program

*Icon arrays created using the University of Michigan Risk Science Center online tool.[223]

Validity and reliability of the DCE was examined by including one repeated DCE question to examine consistency of answer choices, and one "extreme choice" DCE question to examine if participants were answering the DCE questions in an expected and engaged manner (for a total of 10 DCE questions presented to each participant). The extreme choice task asked participants to choose between two CFP programs that were identical except for cost and effectiveness (plus an opt-out option), with the expectation that engaged participants would choose the lower cost, more effective CFP program over the higher cost, less effective option. One contingent valuation question (Aim 3), one attribute ranking task, and 3 multiple-choice items assessing participants' perceived difficulty with answering the DCE questions were also included to examine validity of DCE results.

2) *Participant Characteristics, Physical Functional Status, and Barriers to CFP Program Participation.*

Participants' characteristics were also collected in the questionnaire, including demographics (age, sex, race/ethnicity, income level, education level), fall history, and previous experience with exercise or CFP programs; a 10-item physical functional status scale via the SF-36 physical functional status domain; and ten 6-point Likert-type items exploring perceived barriers to participation in CFP programs (where 1=Strongly Disagree and 6=Strongly Agree). See the survey instrument in the Appendix for more detail.

3) *Survey Testing.*

Pre-testing and pilot-testing were used to assess the internal validity of the survey instrument. To pre-test the instrument, the online survey was sent to a sample of

healthcare providers and researchers at the study team's home institution (n=15) to assess construct and face validity.[226] Following two rounds of pre-testing, after which the survey was modified to improve reading ease and clinical applicability, the preliminary survey instrument was finalized. The preliminary survey instrument's readability and length were then tested in a think-aloud workshop with two older adults (65+) recruited from the local community via fliers, Facebook ads, and a local community outreach email list-service. Participants received $25 for completing the workshop. During the workshop, participants were given a paper copy of the survey and asked to take the survey while saying aloud their thoughts and opinions of questions that were confusing. The main investigator observed the workshop participants, took written field notes on participants' statements, and noted questions that participants appeared to struggle to answer or for which they asked for clarification. Participants were also asked to provide their interpretation of the pictograms in the DCE that portrayed CFP program effectiveness, to ensure accurate comprehension of risk. Additionally, workshop participants were shown an electronic version of a DCE choice task projected onto a monitor, and asked to provide feedback on the question format, colors, and general appearance of the electronic version. The preliminary survey instrument took workshop participants 20 minutes to complete; survey wording was simplified and the length was reduced based on workshop feedback. Subsequently, the revised survey instrument was pilot-tested (n=51) in an online soft-launch among the target population, via a Qualtrics Panel, to assess maximum completion time and variability in responses. Survey length averaged 15 minutes during pilot-testing and no changes were made to the survey questions. Thus, pilot participant responses were retained in the final analysis. A copy

of the final 64-item survey instrument is included in the Appendix, and survey domains

are described in further detail in Table 13.

Table 13. Survey Questions and Domains

Domain	Questions	Number & Type of Items
Screener questions	**1)** Age screener	1 multiple choice item
	2) Residence screener	1 multiple choice item
	3-5) Risk of falling screener	3 multiple choice items
Participant characteristics	**6)** Sex (Qualtrics quota)	1 multiple choice item
	7) Race (Qualtrics quota)	1 multiple choice item
	8) Ethnicity (Qualtrics quota)	1 multiple choice item
	9) Income (Qualtrics quota)	1 multiple choice item
	10) Number of adults living in the participant's household	1 numeric entry item
	11) Education	1 multiple choice item
	12) Age	1 numeric entry item
	13) Health insurance status	1 multiple choice item
	14) Chronic conditions	1 multiple response item
	15) Number of prescription medications	1 numeric entry item
	16) Personal perception of risk of falling	1 multiple choice item
	17) Number of falls in the past 12 months	1 multiple choice item
	18) Prior participation in a fall prevention program	1 multiple choice item
	19) Prior participation in an exercise program	1 multiple choice item
	20) Prior participation in a strength and balance program	1 multiple choice item
	21) For those that answered yes to any of 14-16, the method they found out about a program they participated in	1 multiple response item
	22) Most preferred method for receiving information about programs to improve balance and avoid falls	1 multiple choice item
	23) Preferred exercise location/scenario	1 multiple choice item
	24) Most preferred type of exercise	1 multiple choice item
	25) Preference for receiving information via a website or smartphone app about improving strength and balance to avoid falls	1 multiple choice item
Physical functional status	**26-35)** Physical function domain of the SF-36	Ten 3-point Likert-type items, reverse coded for presentation
Contingent valuation	**36)** Participants' willingness to pay for one example of a hypothetical CFP program	1 numeric entry item
DCE practice	**37)** DCE example and practice question	1 choice task
DCE	**38-45)** DCE with an orthogonal, D-efficient design and 32 choice tasks divided into 4 blocks of 8 choice tasks	8 choice tasks
DCE validation	**46-47)** Repeated DCE choice task and extreme DCE choice task	2 choice tasks
	48) Questions were easy to read and understand	1 multiple choice item
	49) Questions loaded easily on the participant's device	1 multiple choice item
	50) It was tiring to answer all the questions	1 multiple choice item
	51) Comments about the participant's experience filling out the survey	1 free response item
	52) Direct ranking of preferences for five attributes of CFP programs	1 ranking task
	53) Preference for a CFP program that allows socializing with other people vs. a program located close to home	1 multiple choice item
	54) Comments about what participants would like to see in a CFP program	1 free response item
Barriers and facilitators	**55-64)** Perceived barriers to participating in a CFP program	Ten 6-point Likert-type items

iv. Aim 2 Data Collection:

Following pilot-testing, the final survey instrument was launched. Recruitment was through a national, online Qualtrics Panel. Qualtrics aggregates panels of voluntary survey respondents from market research. Original respondent recruitment occurred through channels such as email requests, social media sites, or website recruiting ads. Qualtrics maintains a profile for each panelist, including demographic and health data, such as medical conditions and medication use. For the current study, email recruitment through Qualtrics began in November 2018 and continued until a goal sample size of at least 620 completed responses was reached, based on a sample size estimation in R using de Bekker-Grob's method.[24] To help ensure that only respondents who thoughtfully answered the questions were included in the final survey results, Qualtrics excluded all respondents who completed the survey in less than one-third of the median pilot-test completion time. Response rate was increased by Qualtrics through email reminders, as well as participant incentives administered by Qualtrics. IRB approval from the authors' institution was obtained prior to study recruitment, and informed consent was obtained from all respondents.

U.S. adults able to read and write in the English language were eligible for participation if they self-identified as being at least 65 years of age; living on their own or with friends/family/spouse in their own home or apartment (i.e. did not live in an assisted living facility or other situation, such as a nursing home or inpatient setting); and answered "yes" to any of these three questions: 1) Have you fallen in the past year? 2) Do you feel unsteady when standing or walking? or 3) Do you worry about falling? Older adults who

answer "yes" to any of these three questions are considered to be at risk for falling according to the CDC's STEADI fall-risk screening criteria. External validity was increased by use of Qualtrics recruitment quotas based on U.S. Census demographics for the 65+ population to obtain a nationally representative sample (Table 14).

Table 14. Aim 2 Qualtrics Demographic Quotas

Criteria	
Older adult ≥ 65 years	
Demographics of US Adults 65+	**US Census**
Gender	
Male	43%
Female	57%
Race	
White	85%
Black or African American	9%
Asian	3%
American Indian/Alaska Native	<1%
Native Hawaiian or Other Pacific Islander	<1%
More than one race	3%
Ethnicity	
Hispanic or Latino	7%
Not Hispanic or Latino	93%
Income	
Less than $25,000/year	32%
$25,000-$49,999/year	29%
$50,000/year or more	39%

***US Census data are for US adults 65+.

To improve data quality, final analyses were performed after excluding participants who "incorrectly" answered the repeated DCE question, the extreme choice DCE question, and/or marked the same answer choice to all DCE questions (straight-lining). Descriptive statistics were used to analyze participant characteristics. DCE data were analyzed using conditional logit models with effects coding to find relative preference weights for each attribute level. We also included an alternative-specific parameter in the models. To test the proportionality assumption, models were run with cost, effectiveness, and session frequency entered as categorical variables or as a continuous variable. To improve model fit based on AIC, cost and effectiveness were coded as continuous variables, and session frequency was entered as an effects coded categorical variable in final models. Relative importance of each attribute towards program preference was calculated for each attribute as the difference in utility between the most and least preferred attribute levels,[227] and ratios of these values were used to compare participants' trade-offs between attributes.   Relative importance scores for each attribute were also calculated as percentages on a 0-100 scale, where 0 is least important and 100 is most important. To investigate how socioeconomic status and physical functional level may influence older adults' preferences for program design, analyses were also repeated based on older adults' self-reported annual household income level (dichotomized into <$25,000 and $\geq$$25,000 based on older adults' median household income level in the U.S.) and physical functional status (dichotomized into high and low based on older adults' median score on the physical function domain of the SF-36, following standard scoring for the SF-36).[228] Scores on the physical function domain of the SF-36 range from 0-100%, with lower

scores indicating worse functioning and higher scores indicating better physical functioning. Final main-effects models are presented here. Analyses were conducted using SAS version 9.4 (SAS Institute, Inc., Cary, NC).

Conditional logit models with income and physical functional level interacted separately with each attribute level were also used to explore preference heterogeneity. Main-effects models and interaction models were also used to explore the influence of model-specific factors by changing session frequency from an effects coded categorical variable to a continuous variable expressed as minutes of exercise per week. Results of final interaction models and alternate specification models are presented.

**C. Aim 3: To Assess Older Adults' Willingness To Pay (WTP) For CFP Programs,
Net Benefit Of Participating In CFP Programs, And Predicted Program Uptake,
And How These Are Modified By Socioeconomic Status.**

i. Aim 3 Design:

This study used a discrete choice experiment (DCE) via a cross-sectional online survey administered by Qualtrics to investigate older adults' preferences for features of CFP programs. Survey development, data collection, and DCE analysis are described in Aim 2 Methods. Here, we describe the methods used to calculate older adults' willingness to pay (WTP) and net benefit for participating in CFP programs, and predicted uptake of hypothetical CFP program designs.

ii. Aim 3 Data Sources:

Preference weights obtained for the final analysis cohort in Aim 2 were used to calculate average marginal WTP per month. Average monthly costs (in 2018 USD) were obtained from 2018 published CFP program costs on the National Council on Aging (NCOA) website. NCOA provides public access to CFP program costs reported by individual CFP program developers, including implementation and training costs for program providers and costs to participants. Costs are reported as costs per program, and costs per month were extrapolated by dividing by the reported number of months per program. When program costs were reported per group/class, cost to a single participant was extrapolated by dividing by the reported number of participants per program. NCOA program costs were extracted from the 13 CFP programs endorsed by NCOA and listed

on NCOA's website as of December 2018: https://www.ncoa.org/healthy-aging/falls-prevention/falls-prevention-programs-for-older-adults/. If program costs were missing for any program on the NCOA website, they were obtained directly from individual CFP program websites, which are accessible via hyperlinks provided by NCOA. A standardized form was used to extract cost data, which included fields for program name; source of the cost information; total program cost; total training, software, and licensing costs; implementation cost per program; total patient cost per program; and total patient cost per month.

WTP for one example of a CFP program was also obtained from the results of a contingent valuation question included in the Aim 2 survey. Survey participants were given a description of a CFP program and were asked to indicate via a numeric entry item how much they would be willing to pay for this program per month. See Figure 1 for the contingent valuation question.

iii. Aim 3 Data Analysis:

1) WTP and Net Benefit.

Average marginal WTP per month for select hypothetical CFP program designs was calculated using preference weights from the Aim 2 DCE (using utility ratios of the cost parameter and linear combinations of preference weights) and the bootstrap percentile method using 1,000 bootstrapped samples (with replacement) to estimate 95% Confidence Intervals (CIs) around the WTP values (using the PROC SURVEYSELECT command in SAS). Bootstrapping was chosen because it is more robust compared to

other methods.[229] Bootstrapping does not assume the confidence intervals are symmetrically distributed, similar to the Krinsky and Robb method (parametric bootstrap), but unlike the Delta method. Bootstrapping also does not assume normality of the joint distribution of the parameter estimates, which is unlike both the Krinsky and Robb method and the Delta method.[230,231] This allows for more flexibility if the data contains a large degree of heterogeneity and a non-normal distribution.[231] In a comparison of these three methods for estimating WTP confidence intervals, the Centre for Health Economics at the University of York found results of all three methods to be similar, but indicated that bootstrapping may be preferred when sample sizes are small.[231] Average WTP was also calculated from responses to the numeric text entry contingent valuation question, to examine the validity of WTP estimates obtained from the DCE data.

Net benefit was defined here as the average marginal WTP/month for select examples of hypothetical program designs minus average monthly patient cost of CFP program participation. Average monthly patient costs (in 2018 USD) were calculated from 2018 published NCOA program costs for specific, evidence-based programs that were similar to the program examples included in the DCE. Also, 95% CI's were constructed around net benefit estimates using 1,000 bootstrapped samples. To account for uncertainty in program costs that relate directly to participants and examine robustness of net benefit estimates, one-way sensitivity analyses were performed based on the range of program and participant costs published on the NCOA website. Costs were unadjusted, as they represent costs at one point in time and were collected less than one year prior to data analysis.

WTP and net benefit were also examined by income sub-sample, since WTP for a program may be highly influenced by income level. Analyses were conducted using SAS version 9.4 (SAS Institute, Inc., Cary, NC).

2) Predicted Program Uptake.

Preference weights obtained in the Aim 2 DCE were used to calculate predicted uptake of select hypothetical CFP program designs using linear combinations of preference weights, and assuming that the total utility an older adult experiences from participating in a particular program is proportional to the probability of choosing that program from among a group of programs.[232]

Hypothetical program designs selected for comparison in Aim 3 were chosen to mimic commonly implemented and evidence-based CFP programs endorsed by NCOA, to the extent possible when considering the attributes and levels included in the Aim 2 DCE.

Chapter 4
Results

I. Results

A. Aim 1: To Characterize Key Features Of A CFP Program From The Perspective Of Older Adults.

i. Aim 1 Characteristics of Included Studies:

A total of 54 articles were retained in the review (Figure 4). A list of the included studies and a summary of their findings are presented in Table 15. Studies represented the perspectives of 20,540 older adults. These older adults were heterogeneous in age range, physical functional status, socioeconomic status, residential area (rural vs. urban), climate, and country. Some studies recruited older adults $\geq$65 years, $\geq$60 years, $\geq$55 years, or $\geq$45 years, which introduced the need to assume that studies reporting participant eligibility in this manner included a portion of participants who were 65+. In most cases, opinions or findings relating directly to participants 65+ could be extracted from individual studies, but opinions and findings were not always separated by older adults' age range. Most older adults were women and reported White race, although participant demographics were not always comprehensively reported in the included articles. Some articles focused specifically on men, Hispanic/Latino(a) participants, or Aboriginal and Torres Strait people. Fifteen studies (27.8%) took place in the US, 11 (20.4%) in Scandinavia, 10 (18.5%) in Australia, 8 (14.8%) in the UK, 3 (5.6%) in Southeast Asia, 2 (3.7%) in New Zealand, 2 (3.7%) in Canada, 1 (1.9%) in Europe, 1

(1.9%) in India, and 1 (1.9%) at multiple sites in Scandinavia, the UK, Europe, and Israel. Most studies had a qualitative (n=22; 40.7%) or mixed methods design (n=11; 20.4%), while 21 (38.9%) were quantitative cross-sectional or longitudinal surveys performed either as stand-alone studies or alongside a quasi-experimental study or RCT, and one was a best-worst scaling experiment. One study (1.9%) focused on older adults with osteoporosis, and four (7.4%) on older adults with dementia, stroke, Parkinson's Disease, or other neurological disorders. Also, three studies focused on a specific type of technology, equipment, or orthoses/walking aide as part of the CFP program or as important components of fall prevention efforts in general. Several studies (n=2; 3.7%) focused on development and evaluation of CFP program resources and materials, such as handbooks, CDs, or toolkits. Most studies focused on: 1) Developing, implementing, or evaluating a CFP program; or 2) Investigating older adults' experiences with or perceptions of falling and/or CFP or exercise programs, the quality of these programs, or their unmet needs, preferences, or barriers/facilitators regarding the format of CFP or exercise programs.
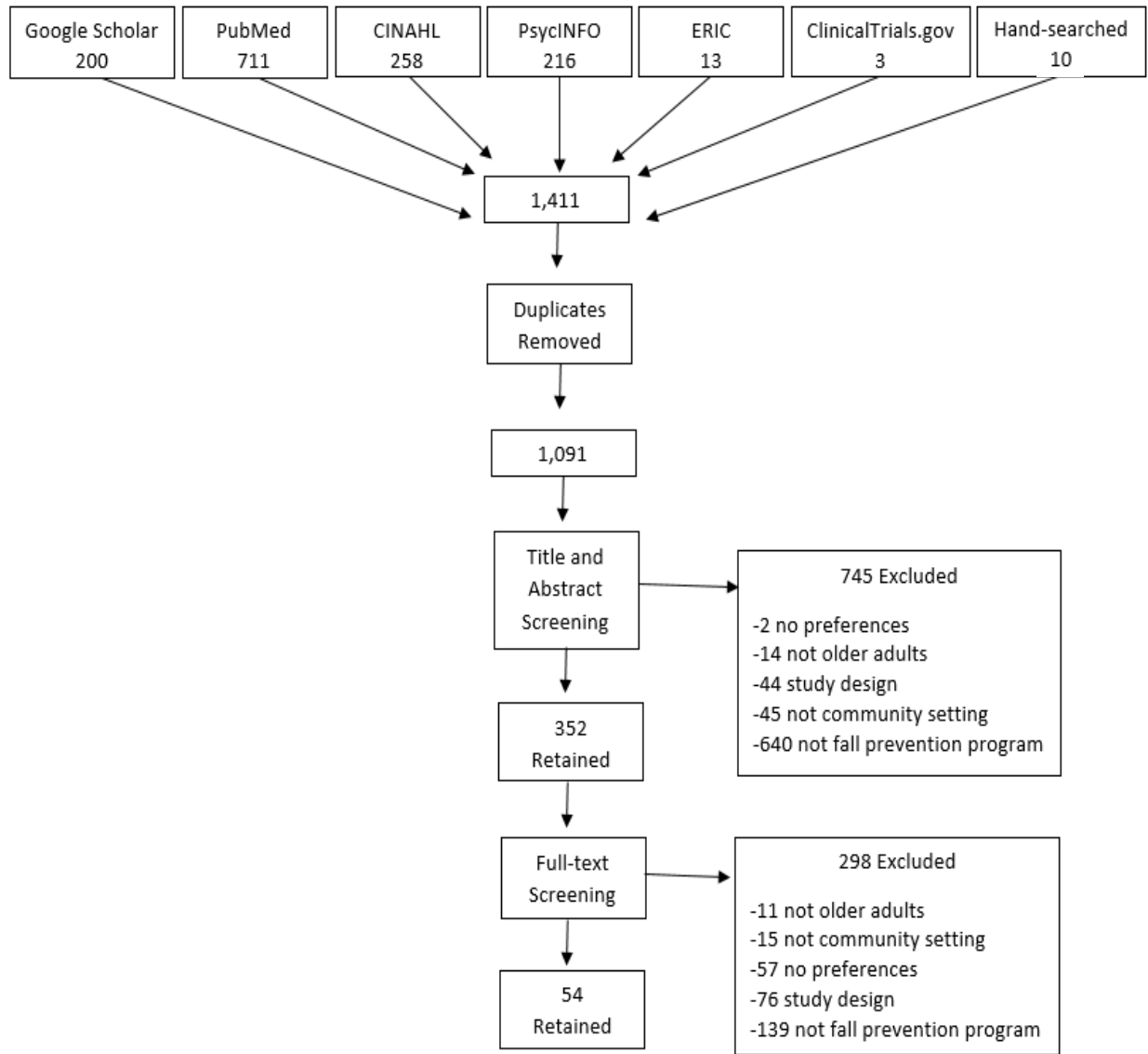
Figure 4. PRISMA Diagram

Table 15. Article Summary

Author, Year; Country	Relevant Objective(s)	Study Design	Sample Characteristics	Relevant Findings	Number of Coded Quotes*
Amacher et al., 2016; Switzerland[233]	Investigate perceived benefits and barriers of a multi-factorial home-based fall prevention program for older adults (including exercise and home safety consultation), general practitioners, home care nurses, and physiotherapists.	Mixed methods (interviews and mailed survey).	17 older adults (interview n=4; survey n=17). Mean age = 79.7 years.	Older adults perceived that the fall prevention program was useful for detecting fall hazards and risks in the home. Barriers to participation included lack of referral by healthcare providers; providers' differing opinions regarding the goal of the program; and older adults' perception that there was no need to change their home.	12
Arkkukangas et al., 2017; Sweden[234]	Describe older adults' experiences of a home-based exercise program for fall prevention (Otago) that included motivational interviewing (MI).	Qualitative (interviews).	12 older adults ≥75 years.	Four themes emerged: 1) Facilitators of exercise in everyday life, which included daily routines, personal exercise goals, easy and accessible exercises, and a supportive environment. 2) Importance of support, including from the physiotherapist and self-monitoring of exercise. 3) Perceived gains from exercise, including physical gains and functional gains. 4) Existential aspects of exercise, including emotional experiences, awareness of fragility, and reflections on aging.	76
Banez et al., 2008; Canada[235]	Determine if a multi-factorial fall prevention program (including group exercise and education) is effective in improving older adults' physical function, balance, and self-confidence, and reduces fear of falling.	Quantitative descriptive (pre-post design with surveys).	41 older adults ≥65 years (22 lived in their own home; 19 lived in a retirement home).	Survey results at the end of the 12-week program showed that 88% of respondents liked the individual counseling; 91% liked the exercise portion of the program; and 91% liked the education sessions.	1
Batra, 2012; US[236]	Evaluate effectiveness of lay leader models of A Matter of Balance (MOB) and Un Asunto de Equilibrio (ADE) to reduce fear of falling and improve older adults' physical activity.	Quantitative descriptive (pre-post design with surveys)	562 older adults ≥60 years.	Most survey respondents (87% in MOB and 89% in ADE) agreed that instructors were well-prepared for class and the workbook was helpful.	3
Bird et al., 2011; Australia[237]	Examine the benefits of a multi-component exercise program on balance,	Quantitative randomized (RCT	45 older adults. Mean age=67.1 years.	Survey respondents who continued to exercise at 1 year follow-up indicated a higher mean perceived level of benefit from the program	4

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				compared to those who did not continue to exercise (72.7 vs. 65.2), both of which were significantly different from control (31.4, p<0.05).	
Boyd et al., 2009; US[238]	Estimate the frequency of falls and prevalence of fear of falling and fall prevention beliefs and behaviors in older adults.	Quantitative descriptive (survey). Second Injury Control and Risk Survey (ICARIS-2).	1,709 older adults ≥65 years.	65% of survey respondents reported no change in physical activity level, 21.4% decreased physical activity, 96.5% made no change to medications, and 84.4% made no change to their home after reporting a fall.	2
Brach et al., 2016; US[239]	Translate a walking rehab program from one-on-one to a group-based program (On the Move) and evaluate implementation aspects.	Mixed methods (focus groups, intervention implementation).	31 older adults (recruited from a community center, apartment building, and two independent living facilities). Mean age 82.3 years.	Older adults suggested modifications to program format/length, music, education, group interaction, and level of exercise difficulty.	15
Bredland et al., 2018; Norway[240]	Describe challenges and motivators to physical activity among retired older men.	Qualitative (focus groups and diaries).	9 older adult men. Age range = 66-83 years.	Three categories emerged for challenges to physical activity: 1) Differences between men and women. 2) Meaningful physical activity. 3) Environmental constraints, especially socio-cultural. Categories of motivators included: 1) New activities to meet friends. 2) More information about coping.	25
Brooks et al., 2017; England[241]	Explore experiences of a falls clinic among older adults with varying health literacy.	Qualitative (interviews).	9 older adults. Age range = 75-99 years.	Two themes emerged: 1) Importance of trust and relationship building. 2) Importance of tailoring education and healthcare to individual needs.	23
Brown et al., 2017; US[242]	Evaluate feasibility of the Live Long Walk Strong program for community-dwelling older adults with mobility limitations.	Quantitative nonrandomized (intervention, with comparison of participants who completed all sessions and who did not complete all sessions of the program, with surveys).	147 older adults. Mean age = 81.6 years among session completers, 82.2 years among non-completers.	Reasons given for not completing all program session include: illness, personal preferences, too busy, transportation, pain, non-injurious fall, died, depression, weather, and program too hard. For those who declined program participation at all, reasons included: transportation, financial, illness, time constraints, hospitalization, competing home health service, medical procedure, and weather.	3
Buttery et al., 2014; UK[243]	Examine older adults' experiences with exercise as	Quantitative descriptive (survey).	1,768 older adults. Median age = 82 years.	Locations of selected programs included hospital (35%), community location like a church, sheltered housing, or day center (30%), own	15

				home (23%), leisure center/gym (6%), general practitioner's practice site (2%), other (11%), or a combination of these. Most survey respondents reported selecting exercise programs that were group-based (2/3 respondents), short duration (80% less than 12 weeks), low intensity (85% one session per week). For home-based programs, most reported one session/visit per week (41%) or one session/visit every two weeks (21%), with the largest portion reporting a 4-6 week program selection (38%). Exercises generally included strength and balance regiments. Older adults reported they would like follow-up classes.	
Calhoun et al., 2011; US[244]	Investigate motivators and barriers to participation in fall risk assessment and fall management programs for older adults with lower income who had fallen.	Qualitative (interviews).	39 older adults (n=20 who had accepted an invitation for assessment by a fall prevention program; n=19 who had not accepted an invitation). Mean age for a "joiner" = 77 years; mean age for a "non-joiner" = 76 years.	Themes included: 1) Loss associated with aging. 2) Independence. 3) Emotional response to falling. Those who joined a program stated that they needed the program, but those who did not join mentioned a lack of need. Transportation was mentioned as a barrier to participation.	7
Chien et al., 2016; Canada[245]	Evaluate mobility outcomes and concerns about falling among community-dwelling medically complex clients in an individualized fall prevention clinic.	Quantitative descriptive (pre-post design with survey).	69 older adults. Mean age = 77.6 years.	Participants indicated that the clinic encouraged personal goal-setting (83.6%), 93.8% felt safe and comfortable at the clinic, and 57.9% had a home safety assessment prior to program participation.	4
Chumbler et al., 2015; US[246]	Determine fall self-efficacy and satisfaction related to a multi-faceted stroke telerehabilitation program (STeleR).	Mixed methods (RCT with surveys, and exit interviews).	52 older adults. Mean age = 67.1 years in the intervention group, 67.7 years for controls.[247]	Core concepts that emerged were: 1) Beneficial impact of a trained assistant. 2) Exercises helpful. 3) Home use of technology.	6
Clark et al., 2013; US[248]	Explore older adults' attitudes and values related to balance classes for fall prevention held in churches (N'Balance).	Qualitative (community observation, interviews, and focus groups).	50 older adults ≥60 years.	Four themes emerged: 1) De-emphasizing fall risk and emphasizing strength and independence instead. 2) Moving older adults' out of a comfort zone to join group classes. 3) Identifying	56

				relationships to support fall prevention. 4) Gender differences in fall prevention approaches.	
Costello et al., 2011; US[249]	Investigate older adults' motivators, barriers, and beliefs about physical activity.	Qualitative (focus groups).	31 older adults ≥60 years.	Physically active older adults were motivated to exercise due to health concerns, socialization, staff and programming, accessibility, facilities, and physician encouragement. Their barriers to exercise included lack of time, potential injury, and lack of discipline. They preferred exercise programs that were accessible and safe, free, with knowledgeable staff. They saw advantages of exercising as health benefits and emotional benefits, and disadvantages as potential for injury and/or falling. Physically inactive older adults' exercise motivators were socialization and purposeful activity; barriers were lack of time, potential for injury, lack of discipline, inadequate motivation, boredom, and intimidation. Ideal exercise programs for them should be convenient, and fun and social. They saw advantages as health benefits and emotional benefits, and disadvantages as potential for injury and/or falling.	32
de Groot et al., 2011; Norway[250]	Describe motivators and barriers to adherence to group exercise classes for fall prevention among older adults.	Qualitative (interviews).	10 older adults. Age range = 71-91.	Motivators included wanting to stay independent, maintaining health status improving balance and walking ability. Barriers included educed health status, lack of motivation, unpleasant experiences during prior exercise group sessions, environmental factors like weather and season, variations in functional status of participants within the group, and lack of transportation. Participants wanted to receive information about benefits of exercise from health professionals. Older adults enjoyed social interaction in group exercise, and instructions and supervision given by instructors were viewed positively.	36
Dockx et al., 2017; Belgium, Israel, UK, Italy, Netherlands[251]	Investigate attitudes towards fall prevention exercise with and without virtual reality; attitudes; and satisfaction among healthy older adults, those with Parkinson's Disease, and those with Mild Cognitive Impairment.	Quantitative randomized (RCT with survey).	281 older adults. Mean age = 74.2 years for intervention group, 73.3 for controls	Respondents indicated that the virtual reality exercise program was fun and enjoyable (99.2%). Both groups indicated the program was safe (88.3%), engaging (74.1%), and beneficial for physical wellbeing (84.2%) and concentration (60.2%).	12

Dohrn et al., 2017; Sweden[252]	Describe perceptions and experiences with physical activity among older women with osteoporosis, impaired balance, and fear of falling.	Qualitative (interviews).	18 older women. Age range = 66-86 years.	Personal preferences and osteoporosis-related factors influenced physical activity, and tailoring and individualization were important to participants.	71
Dorresteijn et al., 2012; Netherlands[253]	Explore older adults' preferences about program format for falls programs.	Quantitative descriptive (survey).	2,498 older adults ≥70 years.	Survey respondents indicated that most (62.7%) were not interested in any program, regardless of format. Willingness to participate in different program formats was 21.5% for a home-based program, 18.7% for a home-based plus telephone program, 17.7% for a telephone-based program, 17.5% for a television program, 17.2% for a group program, and 9.4% for an Internet-based program. Higher levels of fall-related concerns were associated with higher home-based program preference, and poor perceived health and higher age (≥80 years) were associated with less preferences for group programs. Higher education level had a greater preferences for Internet-based programs compared to participants with a lower education level.	10
Dorresteijn et al., 2013; Netherlands[254]	Examine feasibility and acceptability of a home-based cognitive behavioral program for older adults with fall-related concerns and activity avoidance (AMB-Home).	Quantitative descriptive (survey alongside an RCT).	194 older adults ≥70 years.	Participants mentioned they wanted a reduction in repetition of parts of the program (n=9); fewer/no telephone contacts due to hearing problems (n=8), a more simplified program (n=8), and more program sessions (n=5). Number of sessions and session length were viewed as sufficient.	15
Franco et al., 2015; Australia[255]	Investigate the relative value that older adults with a previous fall or mobility-related disability place on various attributes of exercise programs.	Quantitative descriptive (best-worst-scaling survey).	220 older adults ≥60 years.	Home-based exercise, no need to use transport, improvement of 60% in ability to do daily tasks at home, no costs, and decreasing the chances of falling to 0% were the attributes with the highest utility values. Attributes with the lowest utility values were travel time of 30 minutes or more and out-of-pocket costs of AUD50/session.	35
Gryffin et al., 2015; US[256]	Identity facilitators and barriers to Tai Chi participation, using the Health Belief Model and a fishbone diagram, among users of a fitness facility in an active living community.	Qualitative (focus groups).	21 older adults. Age range = 62-80 years.	Barriers to participation in Tai Chi included lack of awareness of benefits, need for evidence-based benefits, and limitations due to instructors' teaching style.	17

Hackney et al., 2013; US[257]	Determine feasibility and satisfaction of an adapted tango program for oldest-old adults with visual impairment.	Quantitative descriptive (repeated measures design with exit survey)	13 older adults. Mean age = 86.9 years.	Older adults reported a median score of 1 for enjoyment of the program, on a 5-point scale where 1=strong agreement and 5=strong disagreement.	1
Hallrup et al., 2009; Sweden[258]	Explore experiences of living with fall risk for older women with previous fragility fractures.	Qualitative (interviews).	13 older women. Age range = 76-86 years.	Four themes emerged: 1) Changing body. 2) Living with precaution. 3) Ambiguous dependency. 4) Influence and need for understanding. Healthcare providers were viewed as trusted sources of information. Choice of exercising at home or in group classes was influenced by exercise difficulty level, stigma/embarrassment, and degree of difficulty with getting to the location.	14
Hanlin et al., 2013; US[259]	Investigate barriers and facilitators to fall prevention and interest for specific fall prevention methods among older Latino(a) adults.	Quantitative descriptive (survey).	103 older adults. Mean age = 73.2 years.	Participants were interested in receiving more information about falls. Preferred methods of receiving health information about falls included talking with a healthcare provider (78%) and participating in exercise classes (65%).	3
Hawley-Hague et al., 2013; UK[260]	Examine the influence of participant, instructor, and group factors on older adults' attendance and adherence to community exercise classes.	Quantitative descriptive (survey).	193 older adults. Age range = 60-100 years.	Participants' housing, education, mental wellbeing, group cohesion, and attitudes were predictors of program attendance after 3 and 6 months. At 3 months, the instructor's personality, age, gender, experience, and motivational training were predictors. Instructor personality was also important at 6 months. Adherence at 6 months was associated with previous attendance at the program for longer than 6 months, participants' attitudes, weeks offered, and the instructor's personality and experience.	14
Hawley-Hague et al., 2017; UK[261]	Evaluate a strength and balance program step-down model to encourage long-term exercise via community classes for older adults (Community Otago followed by Active Always).	Mixed methods (intervention and focus groups).	79 older adults. Age range = 56-96 years.	Continuity of delivery, role of the instructor, health professional, and social and physical outcomes were important for encouraging older adults to continuing participating in maintenance strength and balance group exercise programs.	43
Hedley et al., 2010; UK[262]	Describe and evaluate the implementation of an evidence-based fall prevention program in a local community (Staying Steady).	Mixed methods (intervention, interviews, focus group).	5 older adults. Age range = 60-88 years.	Themes that influenced maintenance of exercise included: 1) Clinical outcomes (balance, strength, gait). 2) Adherence to exercise (emotional reaction to exercise, social support, benefits, self-efficacy). 3) Acceptability of the program (multidisciplinary structure, group venue at a	50

				community location, transportation difficulties, referral process, and organization).	
Host et al., 2011; Denmark[263]	Investigate older adults' perceptions of falls, coping with falls, and motivators to join fall prevention programs.	Qualitative (interviews).	14 older adults >65 years.	Five categories and 15 subcategories emerged: 1) Emotional perceptions about falling. 2) Consequences of falling. 3) Coping with the situation. 4) Social network support. 5) Motivation and demotivation. Family members and general practitioners were sources of help. Motivators included autonomy, competence, relatedness. Preferred activities should be social in nature, provide happiness, make older adults feel useful, and be flexible and allow older adults to choose when and how they participated. Barriers included lack of motivation and just wanting to relax, and high cost.	19
Hughes et al., 2008; Australia[264]	Examine older adults' attitudes related to falls and implications for designing fall prevention awareness campaigns.	Mixed methods (surveys and focus groups).	3,275 older adults >60 years (n=3,201 survey participants, n=73 focus group participants).	Fall prevention messages should promote health, wellbeing, and independence in order to promote uptake of fall prevention programs.	10
Jitramontree et al., 2015; Thailand[265]	Develop and investigate lessons learned from a multi-factorial fall prevention program including fall risk assessment, education, exercise, cane use training, fall prevention handbook, home safety assessment, home visits, and reminders.	Qualitative (focus groups and interviews).	50 older adults >60 years.	Themes included: 1) Improved communication about falls. 2) Mutual learning about falls, such as from friends. 3) Motivation via reminder calls.	16
Keay et al., 2018; India[266]	Evaluate the feasibility, acceptability and impact of a yoga-based fall prevention program for older adults.	Mixed methods (intervention, interviews, focus groups).	50 older adults. Age range = 60-81.	Participants mentioned preferences for class format, including session times early in the morning, a space that is large and free of distractions, and supervision to help with remembering the exercise movements/sequences. To meet these preferences, many participants preferred group venues; one participant preferred a home-based location with the tv as a guide. Some were concerned about privacy when exercising in public/group locations. A good audio system was needed in group locations, as well, to overcome hearing impairments.	14

Keuter et al., 2015; US[267]	Evaluate a fall prevention toolkit in terms of ease of use and user satisfaction, and investigate preferred distribution channels.	Mixed methods (usability testing, surveys, focus groups).	68 older adults (n=32 survey, n=30 focus groups, n=6 usability testing). Mean age of survey respondents = 75 years; mean age of focus group participants = 74 years; mean age of usability testing participants = 79 years.	Most participants mentioned a preference for fall prevention information, such as the toolkit, to be introduced by their healthcare provider or in a social setting.	6
Kittipimpanon et al., 2012; Thailand[268]	Develop and evaluate a community fall prevention program in an urban area of Thailand, using the PRECEDE-PROCEED framework.	Mixed methods (intervention, surveys, focus groups, workshops).	41 older adults. Mean age = 72.93 years.	Participants were most satisfied with the exercise, multi-factorial risk assessment, and environmental activity components of the program. After the intervention, 100% of participants who reported slippery bathroom floors had started using anti-slip mats, and 100% who reported having a house with steps had painted the steps/doorsills in easily visible colors. Some participants reported it was too expensive to make other changes to the home. Signs were successfully posted in the community to alert older adults to uneven sidewalks.	2
Kraft et al., 2015; Australia[269]	Investigate older adults' perception of the degree of difficulty and challenge involved in complex motor skills, such as dancing and ball games.	Qualitative (focus groups).	36 older adults. Age range = 61-92 years.	Physical effort and pace influenced older adults' perception of difficulty. Challenges in performing activities included high skill level required, environmental conditions, and variations/complexity of the activity. Embarrassment, relationship with instructors, prior experience and familiarity, and physical effort required were the focus of physical activity perceptions. Facilitators included age appropriate modifications, enjoyment, social nature of the activity, past experience, and experienced instructors.	30
Li et al., 2008; US[270]	Develop and evaluate a package of materials for implementation in a community fall prevention	Mixed methods (workshops, surveys, intervention, exit interviews).	121 older adults (n=20 workshops, n=81 surveys, n=20 intervention/exit	Among survey respondents, 18% would join a Tai Chi program that was offered once per week, 59% twice per week, and 23% three times per week. Participants in the Tai Chi program intervention reported that the videotape and user's guide were	12

	program (Tai Chi: Moving for Better Balance).		interviews). Mean age of workshop participants = 75.4 years; mean age of intervention/exit interview participants = 74 years.	useful resources. Among those who used the videotape at home to practice Tai Chi, 19% reported 1 session per week with an average of 15 minutes per session, 50% reported 2 sessions per week at an average of 17 minutes per session, and 31% reported 3 more sessions per week at an average of 16 minutes per session.	
Liddle et al., 2018; Australia[271]	Explore older men's experiences with falling, to inform engagement of men with fall prevention programs.	Qualitative (interviews).	25 older men. Age range = 70-93 years.	Older men were willing to consider attending fall prevention programs. Willingness to engage in these programs was related to their perceptions of fall preventability, personal prevalence of falls, age, health status, capability, and problem-solving style	15
Loke et al., 2018; Malaysia[272]	Evaluate older adults' knowledge and perceptions surrounding medication-related falls and preferred medication-related fall prevention programs.	Quantitative descriptive (survey).	86 older adults. Age range = 60-88 years.	Preferred preventative interventions for medication-related falls were participation in strength and exercise classes (43%), education (22.1%), home assessment and modification (16.3%), training on how to use an assistive device (14%), and medication management (4.7%). Those who preferred strength and balance training tended to have a higher number of medications compared to those who did not prefer strength and balance training (mean=6.18, SD=2.6 vs. mean=4.77, SD=2.3, p=0.03).	2
Lukaszyk et al., 2018; Australia[273]	Identify perceptions and beliefs about falls, and identify preferred program elements for fall prevention programs among Aboriginal and Torres Strait people.	Qualitative (focus groups or yarning circles)	76 older adults $\geq$45 years (the authors mention that a larger degree of chronic conditions may affect Aboriginal and Torres Straight people at a younger age; thus, the age of $\geq$45 years was used for eligibility instead of the age of $\geq$65 years to classify an older adult).	Many participants did not have fall prevention programs available in their area, had no referral by their general practitioner, or were unaware of fall prevention programs. Preferred program elements ere that a program be Aboriginal-specific, group-based, ongoing, flexible, tailored to specific communities, with free transportation. Participants were willing to pay between $1-$10 AUD per week to participate in a program.	23

Mathews et al., 2010; US[274]	Identify perceived barriers and facilitators to physical activity among older adults, and how this may differ based on race/ethnicity.	Qualitative (focus groups).	396 older adults. Mean age = 71.0 years.	Respondents reported that barriers to physical activity sere health problems, fear of falling, and inconvenience. Facilitators were positive outcome expectations, social support, and access to physical activity programs. The community built environment and lack of knowledge about physical activity were mentioned as barriers to physical activity, while health benefits were mentioned as facilitators of physical activity, more often among American Indian participants compared to other participants. Whites and American Indians especially focused on the importance pf physical activity programs tailored for older adults.	29
McPhate et al., 2016; Australia[192]	Identify older adult's preferences for delivery of group exercise programs for fall prevention.	Qualitative (open-ended telephone survey questions).	97 older adults ≥70 years.	Participants most commonly reported short-term advantages and disadvantages regarding preferences for group exercise, including enjoyment, social interaction, and instructor qualities.	15
Mehra et al., 2016; Netherlands[275]	Investigate motivators and barriers to adherence to a blended exercise program including group-based exercise and tailored home-based exercise facilitated via technology.	Qualitative (focus groups).	30 older adults. Mean age = 74 years.	Motivators for group exercise included self-reliance and keeping in touch with others. Barriers to home-based exercises included lack of guidance by an instructor, safety and motivation. Some participants had negative views about using technology at home to help with a tailored exercise program, but the majority of participants had positive views on this.	19
Menz et al., 2013; Australia[276]	Investigate older adults' perceptions of balance, foot and ankle strength, perceived difficulty of the exercise program, and satisfaction with footwear/ orthoses in a multifaceted fall prevention program.	Quantitative descriptive (survey alongside RCT).	134 older adults ≥65 years.	Most (86.6%) of respondents thought the level of exercise difficulty was "about right." Exercises involving toe flexors were reported to be too difficult.	1
Moschny et al., 2011; Germany[277]	Investigate barriers to physical activity among older adults in Germany, with comparisons by sex and age group.	Quantitative descriptive (survey).	1,937 older adults. Median age = 77 years.	Of those reporting insufficient levels of physical activity (n=286), the most common barriers were poor health (57.7%), lack of company (43.0%), and lack of interest (36.7%). After controlling for age, more common barriers among women vs. men were lack of opportunities for sports or leisure activities (30.3% vs. 15.6%, p=0.003), and lack of transportation (29.0% vs. 7.1%, p<0.001). After controlling for sex, poor health was more	8

				often a barrier to physical activity in those $\geq$80 years vs. younger participants (71.1% vs. 51.5%, p=0.002).	
Nyman et al., 2009; UK[278]	Investigate the usability and acceptability of a website for tailored physical activity to prevent falls in older adults.	Qualitative (think-alouds and interviews).	16 older adults. Mean age 70.81 years.	Among participants, 44% selected a home-based program on the website, 19% a program located outside, 25% a group class, and 12% a combination. Most chose activities they enjoyed or that held their interest, such as Tai Chi, and that fit into their daily routine. Action plans were difficult to fill out for those without information on local classes and those who had difficulty with keeping routines. Some participants were unsure about particular types of exercise, such as Tai Chi involving meditation. Balance training information was viewed positively.	4
Peach et al., 2017; UK[279]	Explore perceptions of falling, fall risk, and acceptability of fall prevention programs among older adults with mild dementia/ cognitive impairment, and family caregivers.	Qualitative (interviews).	20 older adult/family caregiver dyads. Older adults' age range = 70-93 years.	Older adults reported it was difficult to do the same exercises every day, exercises were too difficult, had not been demonstrated, and were not relevant, may need supervision, were hard to fit into the daily schedule, or there was no motivation to do them. Participants did not know where to find exercise programs in the community and felt awkward exercising in public. Some participants wanted to exercise in a group setting due to the social interaction, but others (1/3) did not prefer a group setting because it might be unhelpful, patronizing, boring, take up too much time, not age appropriate, not tailored to participants' needs, or were uncomfortable if the participant did not know anyone in the group. Barriers to exercise included location, environment, transportation, services, cost, time, health, emotions, and motivation. Facilitators included support and supervisions when doing exercises, and tailoring the program to the participants' needs.	16
Robertson et al., 2014; New Zealand[280]	Explore sustainability of a community-based fall prevention program (SAYGO) led by older adult peer leaders.	Qualitative (focus groups, interviews, observations).	63 older adults (n=57 program participants and n=6 peer leaders). Age range = 65-90 years.	Themes included: 1) Physical and wellbeing benefits. 2) Social benefits. 3) Support needs. Participants were most enthused about the social nature and value of the group-based program. Participants had a positive view of the peer leaders, who were similar in age and functional status to participants, and serve as an information resource.	14

Sandlund et al., 2016; Sweden[281]	Design and develop a mobile exercise application for fall prevention.	Mixed methods (workshops, focus groups, surveys).	60 older adults (n=18 workshop, focus group, and survey participants; n=42 additional survey participants from another community location). Mean age for workshop and focus group participants = 74.6 years.	Participants mentioned a need to know why and how specific exercises were being performed. They expressed preferences about the instructors' age, sex, clothing, and personality. Many participants preferred to exercise outside and to work exercises into their daily routines.	5
Simek et al., 2015; Australia[193]	Investigate older adults' preferences for the structure and delivery of home-based exercise programs for fall prevention, and perceived benefits and barriers to participation.	Qualitative (open-ended telephone survey questions).	245 older adults >70 years.	Participants' program adherence was influenced by perceived effect on physical and mental health, autonomy, and fit with individual exercise and lifestyle preferences. Participants were motivated when they enjoyed the exercises (mental benefit). They disliked repetition in the exercises and lack of social opportunities in the home-based program. Some exercises were too difficult or the home environment lacked space or handholds. Flexibility of choosing when and how to perform exercises was viewed positively. Instructors, equipment, and cost comparisons to group programs were made. However, some participants reported difficulty with self-initiating home-based exercises. Preferred home exercises included balance with or without strength (n=21), strength (n=14), flexibility (n=9), and endurance (n=6), exercises to music (n=2), and exercise done in a standing position (n=2).	20
Stavric et al., 2017; New Zealand[282]	Investigate the impact of circuit classes on balance and mobility for older adults with neurological conditions, and participants' perceptions of the class.	Quantitative descriptive (pre-post design with survey).	13 older adults. Age range = 60-79 years.	Participants had positive views about the class' organization, the level of staff skill, and amount of assistance provided to them at classes. Less positive views were mentioned about the degree of difficulty/challenge and session frequency. Socialization was also reported as improved by 46% of participants.	7
Steltenpohl et al., 2018; US[283]	Examine how exercise motivation differs for older vs. younger adults, using the	Qualitative (focus groups).	39 older adults. Mean age of older adults= 69.82 years. Compared	Most older adults preferred to exercise with others and enjoyed the social interaction, feeling encouraged by others. On the other hand, younger adults most often preferred to exercise	24

	socioemotional selectivity theory (SST).		to 39 younger adults. Mean age of younger adults = 20.23 years.	alone to meet instrumental exercise goals and have personal time to themselves. A few older adults and younger adults had opposite preferences to this, showing heterogeneity of preferences.	
Tiedemann et al., 2013; Australia[284]	Investigate the feasibility and effect of a yoga program for balance and mobility among older adults.	Quantitative descriptive (surveys alongside RCT).	54 older adults. Mean age = 68 years (intervention n=27; control n=27).	Intervention participants enjoyed the program (81%). Reasons given for nonattendance at program sessions included traveling/holiday (n=4), illness (n=3), medical problem exacerbation due to yoga (n=2), lack of time (n=1), and yoga was too difficult (n=1). At the conclusion of the program, participants perceived that potential barriers to ongoing participation might include lack of time (n=6), cost (n=4), lack of motivation (n=2). Reported barriers to ongoing participation after 4 months were lack of time (n=7), health problems (n=7), inconvenient class time (n=5).	4
Yardley et al., 2008; UK[285]	Determine the extent that older adults are willing to engage or participate in different fall prevention programs or activities, especially among lower socioeconomic participants.	Quantitative descriptive (survey).	5,440 older adults ≥55 years. Age range 55-64 years n=2,440 (44.9%); age range 65-74 years n=1,530 (28.1%); age range ≥75 years=1,305 (24.0%).	Among respondents, 36.4% responded "definitely yes" to participating in strength and balance training at home, 25.4% "maybe yes"; 20.5% "definitely no." For group-based strength and balance classes, 22.6% responded "definitely yes," 17.6% "maybe yes," and 41.1% "definitely no." Older age, having a recent fall(s), lower socioeconomic status were associated with greater willingness to participate in strength and balance training at home (vs. not participating in a program) and get help with home hazards. More women than men indicated they would attend group sessions, but a larger proportion of women vs. men also indicated they would participate in home exercises (vs. no program). Participants age 64-75 were more likely to attend group sessions compared to younger participants, while those above 75 were less likely to attend group sessions compared to the youngest participants (vs. no program). For willingness to accept advice and support regarding home hazards, 37.7% responded "definitely yes," 19.9% responded "maybe yes," and 26.6% responded "definitely no."	7

*Quotations were coded within the article Results text, tables, and/or figures.

ii. Aim 1 Risk of Bias in Individual Studies:

The risk of bias in individual studies is described in Table 16. MMAT quality assessment ratings ranged from 3-5, with 8 studies (15%) achieving a rating of moderate quality and 46 studies (85%) achieving a rating of high quality. The most common reason for deductions in quality ratings was the potential for nonresponse bias or inability to assess this potential based on information presented in the article. Quality assessment ratings were determined using the evaluator's viewpoint of whether each criterion was met based on information presented in each article; therefore, quality ratings were subjective in nature and may not reflect the actual quality of the individual studies.

Table 16. Risk of Bias in Individual Studies (Quality Assessment)

Article (Author, Year)	MMAT Design Category*	Quality Score*		
		Criteria	Criteria Met	Total Quality Score*
Amacher et al., 2016[233]	Mixed methods	Is there an adequate rationale for using a mixed methods design to address the research question?	✓	4
		Are the different components of the study effectively integrated to answer the research question?	✓	
		Are the outputs of the integration of qualitative and quantitative components adequately interpreted?	✓	
		Are divergences and inconsistencies between quantitative and qualitative results adequately addressed?	✓	
		Do the different components of the study adhere to the quality criteria of each tradition of the methods involved?		
Arkkukangas et al., 2017[234]	Qualitative	Is the qualitative approach appropriate to answer the research question?	✓	5
		Are the qualitative data collection methods adequate to address the research question?	✓	
		Are the findings adequately derived from the data?	✓	
		Is the interpretation of results sufficiently substantiated by data?	✓	
		Is there coherence between qualitative data sources, collection, analysis and interpretation?	✓	
Banez et al., 2008[235]	Quantitative descriptive	Is the sampling strategy relevant to address the research question?	✓	5
		Is the sample representative of the target population?	✓	
		Are the measurements appropriate?	✓	
		Is the risk of nonresponse bias low?	✓	
		Is the statistical analysis appropriate to answer the research question?	✓	
Batra et al., 2012[236]	Quantitative descriptive	Is the sampling strategy relevant to address the research question?	✓	5
		Is the sample representative of the target population?	✓	
		Are the measurements appropriate?	✓	
		Is the risk of nonresponse bias low?	✓	
		Is the statistical analysis appropriate to answer the research question?	✓	
Bird et al., 2011[237]	Quantitative randomized	Is randomization appropriately performed?	✓	4
		Are the groups comparable at baseline?	✓	
		Are there complete outcome data?	✓	

		Are outcome assessors blinded to the intervention provided?	✓	
		Did the participants adhere to the assigned intervention?	✓	
Boyd et al., 2009[238]	Quantitative descriptive	Is the sampling strategy relevant to address the research question?	✓	5
		Is the sample representative of the target population?	✓	
		Are the measurements appropriate?	✓	
		Is the risk of nonresponse bias low?	✓	
		Is the statistical analysis appropriate to answer the research question?	✓	
Brach et al., 2016[239]	Mixed methods	Is there an adequate rationale for using a mixed methods design to address the research question?	✓	5
		Are the different components of the study effectively integrated to answer the research question?	✓	
		Are the outputs of the integration of qualitative and quantitative components adequately interpreted?	✓	
		Are divergences and inconsistencies between quantitative and qualitative results adequately addressed?	✓	
		Do the different components of the study adhere to the quality criteria of each tradition of the methods involved?	✓	
Bredland et al., 2018[240]	Qualitative	Is the qualitative approach appropriate to answer the research question?	✓	5
		Are the qualitative data collection methods adequate to address the research question?	✓	
		Are the findings adequately derived from the data?	✓	
		Is the interpretation of results sufficiently substantiated by data?	✓	
		Is there coherence between qualitative data sources, collection, analysis and interpretation?	✓	
Brooks et al., 2017[241]	Qualitative	Is the qualitative approach appropriate to answer the research question?	✓	5
		Are the qualitative data collection methods adequate to address the research question?	✓	
		Are the findings adequately derived from the data?	✓	
		Is the interpretation of results sufficiently substantiated by data?	✓	
		Is there coherence between qualitative data sources, collection, analysis and interpretation?	✓	
Brown et al., 2017[242]	Quantitative nonrandomized	Are the participants representative of the target population?	✓	5
		Are measurements appropriate regarding both the outcome and intervention (or exposure)?	✓	
		Are there complete outcome data?	✓	
		Are the confounders accounted for in the design and analysis?	✓	

		During the study period, is the intervention administered (or exposure occurred) as intended?	✓	
Buttery et al., 2014[243]	Quantitative descriptive	Is the sampling strategy relevant to address the research question?	✓	5
		Is the sample representative of the target population?	✓	
		Are the measurements appropriate?	✓	
		Is the risk of nonresponse bias low?	✓	
		Is the statistical analysis appropriate to answer the research question?	✓	
Calhoun et al., 2011[244]	Qualitative	Is the qualitative approach appropriate to answer the research question?	✓	5
		Are the qualitative data collection methods adequate to address the research question?	✓	
		Are the findings adequately derived from the data?	✓	
		Is the interpretation of results sufficiently substantiated by data?	✓	
		Is there coherence between qualitative data sources, collection, analysis and interpretation?	✓	
Chien et al., 2016[245]	Quantitative descriptive	Is the sampling strategy relevant to address the research question?	✓	3
		Is the sample representative of the target population?		
		Are the measurements appropriate?	✓	
		Is the risk of nonresponse bias low?		
		Is the statistical analysis appropriate to answer the research question?	✓	
Chumbler et al., 2015[246]	Mixed methods	Is there an adequate rationale for using a mixed methods design to address the research question?	✓	3
		Are the different components of the study effectively integrated to answer the research question?	✓	
		Are the outputs of the integration of qualitative and quantitative components adequately interpreted?	✓	
		Are divergences and inconsistencies between quantitative and qualitative results adequately addressed?		
		Do the different components of the study adhere to the quality criteria of each tradition of the methods involved?		
Clark et al., 2013[248]	Qualitative	Is the qualitative approach appropriate to answer the research question?	✓	5
		Are the qualitative data collection methods adequate to address the research question?	✓	
		Are the findings adequately derived from the data?	✓	
		Is the interpretation of results sufficiently substantiated by data?	✓	
		Is there coherence between qualitative data sources, collection, analysis and interpretation?	✓	

Costello et al., 2011[249]	Qualitative	Is the qualitative approach appropriate to answer the research question?	✓	5
		Are the qualitative data collection methods adequate to address the research question?	✓	
		Are the findings adequately derived from the data?	✓	
		Is the interpretation of results sufficiently substantiated by data?	✓	
		Is there coherence between qualitative data sources, collection, analysis and interpretation?	✓	
de Groot et al., 2011[250]	Qualitative	Is the qualitative approach appropriate to answer the research question?	✓	5
		Are the qualitative data collection methods adequate to address the research question?	✓	
		Are the findings adequately derived from the data?	✓	
		Is the interpretation of results sufficiently substantiated by data?	✓	
		Is there coherence between qualitative data sources, collection, analysis and interpretation?	✓	
Dockx et al., 2017[251]	Quantitative randomized	Is randomization appropriately performed?	✓	4
		Are the groups comparable at baseline?	✓	
		Are there complete outcome data?	✓	
		Are outcome assessors blinded to the intervention provided?		
		Did the participants adhere to the assigned intervention?	✓	
Dohrn et al., 2017[252]	Qualitative	Is the qualitative approach appropriate to answer the research question?	✓	5
		Are the qualitative data collection methods adequate to address the research question?	✓	
		Are the findings adequately derived from the data?	✓	
		Is the interpretation of results sufficiently substantiated by data?	✓	
		Is there coherence between qualitative data sources, collection, analysis and interpretation?	✓	
Dorresteijn et al., 2012[253]	Quantitative descriptive	Is the sampling strategy relevant to address the research question?	✓	4
		Is the sample representative of the target population?	✓	
		Are the measurements appropriate?	✓	
		Is the risk of nonresponse bias low?		
		Is the statistical analysis appropriate to answer the research question?	✓	
Dorresteijn et al., 2013[254]	Quantitative descriptive	Is the sampling strategy relevant to address the research question?	✓	4
		Is the sample representative of the target population?	✓	
		Are the measurements appropriate?	✓	
		Is the risk of nonresponse bias low?		

		Is the statistical analysis appropriate to answer the research question?	✓	
Franco et al., 2015[255]	Quantitative descriptive	Is the sampling strategy relevant to address the research question?	✓	4
		Is the sample representative of the target population?	✓	
		Are the measurements appropriate?	✓	
		Is the risk of nonresponse bias low?		
		Is the statistical analysis appropriate to answer the research question?	✓	
Gryffin et al., 2015[256]	Qualitative	Is the qualitative approach appropriate to answer the research question?	✓	4
		Are the qualitative data collection methods adequate to address the research question?	✓	
		Are the findings adequately derived from the data?	✓	
		Is the interpretation of results sufficiently substantiated by data?		
		Is there coherence between qualitative data sources, collection, analysis and interpretation?	✓	
Hackney et al., 2013[257]	Quantitative descriptive	Is the sampling strategy relevant to address the research question?	✓	4
		Is the sample representative of the target population?	✓	
		Are the measurements appropriate?	✓	
		Is the risk of nonresponse bias low?		
		Is the statistical analysis appropriate to answer the research question?	✓	
Hallrup et al., 2009[258]	Qualitative	Is the qualitative approach appropriate to answer the research question?	✓	5
		Are the qualitative data collection methods adequate to address the research question?	✓	
		Are the findings adequately derived from the data?	✓	
		Is the interpretation of results sufficiently substantiated by data?	✓	
		Is there coherence between qualitative data sources, collection, analysis and interpretation?	✓	
Hanlin et al., 2013[259]	Quantitative descriptive	Is the sampling strategy relevant to address the research question?	✓	3
		Is the sample representative of the target population?		
		Are the measurements appropriate?	✓	
		Is the risk of nonresponse bias low?		
		Is the statistical analysis appropriate to answer the research question?	✓	
Hawley-Hague et al., 2013[260]	Quantitative descriptive	Is the sampling strategy relevant to address the research question?	✓	4
		Is the sample representative of the target population?	✓	
		Are the measurements appropriate?	✓	
		Is the risk of nonresponse bias low?		
		Is the statistical analysis appropriate to answer the research question?	✓	

Hawley-Hague et al., 2017[261]	Mixed methods	Is there an adequate rationale for using a mixed methods design to address the research question?	✓	4
		Are the different components of the study effectively integrated to answer the research question?	✓	
		Are the outputs of the integration of qualitative and quantitative components adequately interpreted?	✓	
		Are divergences and inconsistencies between quantitative and qualitative results adequately addressed?		
		Do the different components of the study adhere to the quality criteria of each tradition of the methods involved?	✓	
Hedley et al., 2010[262]	Mixed methods	Is there an adequate rationale for using a mixed methods design to address the research question?	✓	5
		Are the different components of the study effectively integrated to answer the research question?	✓	
		Are the outputs of the integration of qualitative and quantitative components adequately interpreted?	✓	
		Are divergences and inconsistencies between quantitative and qualitative results adequately addressed?	✓	
		Do the different components of the study adhere to the quality criteria of each tradition of the methods involved?	✓	
Host et al., 2011[263]	Qualitative	Is the qualitative approach appropriate to answer the research question?	✓	5
		Are the qualitative data collection methods adequate to address the research question?	✓	
		Are the findings adequately derived from the data?	✓	
		Is the interpretation of results sufficiently substantiated by data?	✓	
		Is there coherence between qualitative data sources, collection, analysis and interpretation?	✓	
Hughes et al., 2008[264]	Mixed methods	Is there an adequate rationale for using a mixed methods design to address the research question?	✓	5
		Are the different components of the study effectively integrated to answer the research question?	✓	
		Are the outputs of the integration of qualitative and quantitative components adequately interpreted?	✓	
		Are divergences and inconsistencies between quantitative and qualitative results adequately addressed?	✓	
		Do the different components of the study adhere to the quality criteria of each tradition of the methods involved?	✓	
Jitramontree	Qualitative	Is the qualitative approach appropriate to answer the research question?	✓	5

et al., 2015[265]		Are the qualitative data collection methods adequate to address the research question?	✓	
		Are the findings adequately derived from the data?	✓	
		Is the interpretation of results sufficiently substantiated by data?	✓	
		Is there coherence between qualitative data sources, collection, analysis and interpretation?	✓	
Keay et al., 2018[266]	Mixed methods	Is there an adequate rationale for using a mixed methods design to address the research question?	✓	4
		Are the different components of the study effectively integrated to answer the research question?	✓	
		Are the outputs of the integration of qualitative and quantitative components adequately interpreted?	✓	
		Are divergences and inconsistencies between quantitative and qualitative results adequately addressed?		
		Do the different components of the study adhere to the quality criteria of each tradition of the methods involved?	✓	
Keuter et al., 2015[267]	Mixed methods	Is there an adequate rationale for using a mixed methods design to address the research question?	✓	4
		Are the different components of the study effectively integrated to answer the research question?	✓	
		Are the outputs of the integration of qualitative and quantitative components adequately interpreted?	✓	
		Are divergences and inconsistencies between quantitative and qualitative results adequately addressed?		
		Do the different components of the study adhere to the quality criteria of each tradition of the methods involved?	✓	
Kittipimpanon et al., 2012[268]	Mixed methods	Is there an adequate rationale for using a mixed methods design to address the research question?	✓	3
		Are the different components of the study effectively integrated to answer the research question?	✓	
		Are the outputs of the integration of qualitative and quantitative components adequately interpreted?	✓	
		Are divergences and inconsistencies between quantitative and qualitative results adequately addressed?		
		Do the different components of the study adhere to the quality criteria of each tradition of the methods involved?		
Kraft et al., 2015[269]	Qualitative	Is the qualitative approach appropriate to answer the research question?	✓	5
		Are the qualitative data collection methods adequate to address the research question?	✓	

		Are the findings adequately derived from the data?	✓	
		Is the interpretation of results sufficiently substantiated by data?	✓	
		Is there coherence between qualitative data sources, collection, analysis and interpretation?	✓	
Li et al., 2008[270]	Mixed methods	Is there an adequate rationale for using a mixed methods design to address the research question?	✓	3
		Are the different components of the study effectively integrated to answer the research question?	✓	
		Are the outputs of the integration of qualitative and quantitative components adequately interpreted?	✓	
		Are divergences and inconsistencies between quantitative and qualitative results adequately addressed?		
		Do the different components of the study adhere to the quality criteria of each tradition of the methods involved?		
Liddle et al., 2018[271]	Qualitative	Is the qualitative approach appropriate to answer the research question?	✓	5
		Are the qualitative data collection methods adequate to address the research question?	✓	
		Are the findings adequately derived from the data?	✓	
		Is the interpretation of results sufficiently substantiated by data?	✓	
		Is there coherence between qualitative data sources, collection, analysis and interpretation?	✓	
Loke et al., 2018[272]	Quantitative descriptive	Is the sampling strategy relevant to address the research question?	✓	4
		Is the sample representative of the target population?	✓	
		Are the measurements appropriate?	✓	
		Is the risk of nonresponse bias low?		
		Is the statistical analysis appropriate to answer the research question?	✓	
Lukaszyk et al., 2018[273]	Qualitative	Is the qualitative approach appropriate to answer the research question?	✓	5
		Are the qualitative data collection methods adequate to address the research question?	✓	
		Are the findings adequately derived from the data?	✓	
		Is the interpretation of results sufficiently substantiated by data?	✓	
		Is there coherence between qualitative data sources, collection, analysis and interpretation?	✓	
Mathews et al., 2010[274]	Qualitative	Is the qualitative approach appropriate to answer the research question?	✓	5
		Are the qualitative data collection methods adequate to address the research question?	✓	
		Are the findings adequately derived from the data?	✓	

		Is the interpretation of results sufficiently substantiated by data?	✓	
		Is there coherence between qualitative data sources, collection, analysis and interpretation?	✓	
McPhate et al., 2016[192]	Qualitative	Is the qualitative approach appropriate to answer the research question?	✓	5
		Are the qualitative data collection methods adequate to address the research question?	✓	
		Are the findings adequately derived from the data?	✓	
		Is the interpretation of results sufficiently substantiated by data?	✓	
		Is there coherence between qualitative data sources, collection, analysis and interpretation?	✓	
Mehra et al., 2016[275]	Qualitative	Is the qualitative approach appropriate to answer the research question?	✓	5
		Are the qualitative data collection methods adequate to address the research question?	✓	
		Are the findings adequately derived from the data?	✓	
		Is the interpretation of results sufficiently substantiated by data?	✓	
		Is there coherence between qualitative data sources, collection, analysis and interpretation?	✓	
Menz et al., 2013[276]	Quantitative descriptive	Is the sampling strategy relevant to address the research question?	✓	5
		Is the sample representative of the target population?	✓	
		Are the measurements appropriate?	✓	
		Is the risk of nonresponse bias low?	✓	
		Is the statistical analysis appropriate to answer the research question?	✓	
Moschny et al., 2011[277]	Quantitative descriptive	Is the sampling strategy relevant to address the research question?	✓	4
		Is the sample representative of the target population?	✓	
		Are the measurements appropriate?	✓	
		Is the risk of nonresponse bias low?		
		Is the statistical analysis appropriate to answer the research question?	✓	
Nyman et al., 2009[278]	Qualitative	Is the qualitative approach appropriate to answer the research question?	✓	3
		Are the qualitative data collection methods adequate to address the research question?		
		Are the findings adequately derived from the data?	✓	
		Is the interpretation of results sufficiently substantiated by data?		
		Is there coherence between qualitative data sources, collection, analysis and interpretation?	✓	
Peach et al.,	Qualitative	Is the qualitative approach appropriate to answer the research question?	✓	5

2017[279]		Are the qualitative data collection methods adequate to address the research question?	✓	
		Are the findings adequately derived from the data?	✓	
		Is the interpretation of results sufficiently substantiated by data?	✓	
		Is there coherence between qualitative data sources, collection, analysis and interpretation?	✓	
Robertson et al., 2014[280]	Qualitative	Is the qualitative approach appropriate to answer the research question?	✓	5
		Are the qualitative data collection methods adequate to address the research question?	✓	
		Are the findings adequately derived from the data?	✓	
		Is the interpretation of results sufficiently substantiated by data?	✓	
		Is there coherence between qualitative data sources, collection, analysis and interpretation?	✓	
Sandlund et al., 2016[281]	Mixed methods	Is there an adequate rationale for using a mixed methods design to address the research question?	✓	3
		Are the different components of the study effectively integrated to answer the research question?	✓	
		Are the outputs of the integration of qualitative and quantitative components adequately interpreted?	✓	
		Are divergences and inconsistencies between quantitative and qualitative results adequately addressed?		
		Do the different components of the study adhere to the quality criteria of each tradition of the methods involved?		
Simek et al., 2015[193]	Qualitative	Is the qualitative approach appropriate to answer the research question?	✓	5
		Are the qualitative data collection methods adequate to address the research question?	✓	
		Are the findings adequately derived from the data?	✓	
		Is the interpretation of results sufficiently substantiated by data?	✓	
		Is there coherence between qualitative data sources, collection, analysis and interpretation?	✓	
Stavric et al., 2017[282]	Quantitative descriptive	Is the sampling strategy relevant to address the research question?	✓	4
		Is the sample representative of the target population?	✓	
		Are the measurements appropriate?	✓	
		Is the risk of nonresponse bias low?		
		Is the statistical analysis appropriate to answer the research question?	✓	
Steltenpohl	Qualitative	Is the qualitative approach appropriate to answer the research question?	✓	5

et al., 2018[283]		Are the qualitative data collection methods adequate to address the research question?	✓	
		Are the findings adequately derived from the data?	✓	
		Is the interpretation of results sufficiently substantiated by data?	✓	
		Is there coherence between qualitative data sources, collection, analysis and interpretation?	✓	
Tiedemann et al., 2013[284]	Quantitative descriptive	Is the sampling strategy relevant to address the research question?	✓	4
		Is the sample representative of the target population?	✓	
		Are the measurements appropriate?	✓	
		Is the risk of nonresponse bias low?		
		Is the statistical analysis appropriate to answer the research question?	✓	
Yardley et al., 2008[285]	Quantitative descriptive	Is the sampling strategy relevant to address the research question?	✓	3
		Is the sample representative of the target population?	✓	
		Are the measurements appropriate?		
		Is the risk of nonresponse bias low?		
		Is the statistical analysis appropriate to answer the research question?	✓	

*Quality assessed using the Mixed Methods Appraisal Tool (MMAT) – Version 2018. The MMAT contains 5 study design categories: qualitative, quantitative randomized controlled, quantitative non-randomized, quantitative descriptive, and mixed methods. Each category contains five quality criteria that are rated as "Yes," indicating a particular criteria was met according to the MMAT's criteria descriptions and the evaluator's assessment of the information presented in the article; "No," indicating a particular criteria was not met according to the MMAT's criteria descriptions and the evaluator's assessment of the information presented in the article; or "Can't tell," indicating that the evaluator could not make a determination on whether that criteria had been met based on the MMAT's criteria descriptions and the information presented in the article. Depending on the number of quality criteria met, each article was assigned a quality score ranging from 0-5, with 0-1 indicating low quality (high risk of bias), 2-3 indicating moderate quality (moderate risk of bias), and 4-5 indicating high quality (low risk of bias).

iii. Aim 1 Qualitative Meta-Synthesis Summary:

There were 158 final codes, and inter-coder reliability was high (Krippendorff's alpha=0.756). Code saturation (the point at which no new codes were added) occurred after 20 articles had been coded. Three overarching analytical themes emerged from the qualitative meta-synthesis. The first theme was that older adults prefer CFP programs with immediate benefits. This included two categories: social support; and physical & mental benefits. The social support category aligned with the social support construct derived from the *CDPM Framework*, while the remaining category emerged from the data. The second theme was that older adults prefer CFP programs that appear trustworthy and legitimate. This included two categories: endorsement by others; and familiarity & learning context. Both categories emerged from the data. The third theme was that older adults prefer CFP programs that are easy to access and that fit into their daily routines. This included two categories: ease of access & service utilization; and self-management & tailoring. These categories aligned with the ease of access, service utilization, and self-management constructs that were derived from the *CDPM Framework*. Article, code, category, and theme frequency counts are reported below, as well as detailed descriptions of each theme and category.

iv. Aim 1 Article, Code, Category, & Theme Frequency:

Article frequencies by code (for select codes), category, and theme are displayed in Table 17. Code frequencies within and across all articles (groundedness, defined as the number of quotations linked to a code)[286-288] are displayed in Figure 5, organized by category and theme. The most commonly grounded codes were related to social

interaction and support; program location and setting; the level of exercise difficulty and ability to tailor or self-pace exercise regimens; flexibility and fit of the programs with older adults' daily routines; transportation; and the instructor's personality and skills. Some general codes related to barriers and motivators for program participation and adherence were also used during the iterative coding process to help build emerging analytical themes, and are not further discussed here.

1) Theme 1: Older Adults Prefer CFP Programs with Immediate Benefits.

The first overarching theme that emerged from the meta-synthesis of coded articles was that older adults prefer CFP programs with immediate benefits. Program benefits should include social, physical, and mental benefits.

1.1) Category 1: Social Support.

Social benefits were seen as fun and immediate benefits by participants that motivated them to "get out of the house" and enjoy camaraderie with other program participants. Older adults viewed CFP programs as places to make long-lasting friendships with other program participants. Programs should provide social interaction with other older adults who are "in the same boat." Some participants wanted to attend programs targeted to their own age group, gender, or culture.

- *"Well, I really would have to say I would enjoy (exercise) more with a group of friends, uh, definitely a more social setting I would enjoy more. So that form of exercise would not only be beneficial to me physically, but that would be beneficial to*

me emotionally and spiritually. Because I really enjoy being around people. (older

adult)" – Steltenpohl

- *"…it allows me to meet people that are doing what I do. (older adult)" – Steltenpohl*

- *"It would be nice to keep in touch, just to chat on the phone. (older adult)" – Hedley*

- *"My husband cheers me on and asks me if I've done my exercises; yes, I think it's*

  good. (older adult)" – Arkkukangas

- *"I think that there's someone who cares about you and can help you, who you*

  connect with so to speak; that's been very positive I think. (older adult)" –

  Arkkukangas

- *"Speaking generally, I think it's relationships. If you had your best friend go with you,*

  then it works. (older adult)" – Clark

- *"What's most important is the social aspect of catching up with people. That it's*

  among friends and so forth. You develop a friendship circle in that group. (older

  adult)" – Clark

- *"I have found, just from my experience that the Aboriginal programs are a lot*

  friendlier, a lot more relaxed, not so rigid, and not so judgmental. And you don't need

  that judgmental stuff. You just need people who have the same or similar problems

  as you that are willing to accept you as you are, and you're going to find some

  common ground with being able to help them, and they help you. And I think that's

  one of the major differences. (older adult)" – Lukaszyk

Interaction with instructors was also beneficial and a source of personal encouragement for participants to continue with the program. This interaction with other participants and instructors also created a sense of accountability and at times competition that motivated participants to attend and adhere to the program.

- *"It's much easier in a group, then it's always someone who pushes. . .and then you don't want to be the one to skip class, so you go. (older adult, 70 years)" – Dohrn*

- *"I'm glad to have physical therapists pushing me saying, "Come on, just a little bit more," because I know you have to push it a little to move forward. (older adult, 68 years)" – Dohrn*

While a preference for group settings may be inferred from older adults' enjoyment of social interactions during group-based CFP programs, not all older adults shared this preference. For example, some participants felt uncomfortable exercising in public or group settings.

- *"The staff there would stop and be watching us exercise. It bothered some of the elders so they wouldn't exercise anymore." – Mathews*

- *"Are you going to embarrass yourself? This can keep a lot of people out of the class. (older adult)" – Clark*

1.2) Category 2: Physical & Mental Benefits.

Participants expected their strength and balance to improve as a result of program

participation, and for specific medical conditions to improve (such as arthritis or

osteoporosis). Participants were motivated to attend and adhere to programs for which

they understood the link between specific exercises/program elements and expected

health benefits. If these links were unclear, older adults were confused about the

purpose of the program and were less likely to adhere and continue attending. On the

other hand, participants who noticed improvements in physical health while participating

in the program felt a sense of accomplishment that motivated them to continue

attending the program.

- *"I couldn't walk up a flight of stairs without feeling out of breath…and that was one of the things that stimulated me that I, I felt I was disintegrating and I had to do something about it. (older adult)" – Costello*

- *"The main reason I started at the fitness center was because I had a knee replacement…, but I have to keep my knee, you know healthy and exercise. (older adult)" – Costello*

- *"That it actually strengthens my muscles. I notice it; it strengthens both my balance and my muscles. (older adult)" – Arkkukangas*

- *"However, now I can stand up without holding on to the edge of the table, and I think I've become more functionally capable. (older adult)" – Arkkukangas*

- *"I went to a falls program that one Wednesday, and all they did was make me stand up and sit down. I refused to do anything. (older adult)" – Lukaszyk*

- *"I don't think I ever did anything that there wasn't a purpose, like my physical therapy…I knew I had to do it [to get better]. (older adult)" – Costello*

- *"I've started going to a gym a little to run on a treadmill. . .because when you pound or put pressure. . .on your bones, it builds new [bone mass], and then I think, even though I'm almost 70, maybe I can build new bone mass, too. (older adult, 69 years)" – Dohrn*

- *"I want to know which joints will benefit from a specific exercise…then it becomes enjoyable, because you know what the benefits are. (older adult)" – Mehra*

Programs should be fun and provide mental stimulation leading to improved mental concentration and positive emotions. Many older adults mentioned they were pleased with programs that generally made them "feel good" or that gave them happiness.

- *"Your own common sense tells you that you need to exercise… as far as I'm concerned I think exercise stimulates your mental capacity too, not only your body. (older adult)" – Costello*

- *"Walking, it clears your mind, I think. It feels good, you get out and. . .and then it feels so good to get back in again. (older adult, 74 years)" – Dohrn*

- *"I start walking and I felt much better, I can see the difference in it. It really helps if you walk. (older adult)" – Mathews*

- *"The fact that you are able to do more things, it allows you to help other people, which is really key to being happy. (older adult)" – Costello*

- *"It has lifted my spirits, I suffer from depression and it really helps. (older adult)" – Hawley-Hague 2017*

2) Theme 2: Older Adults Prefer CFP Programs that Appear Trustworthy and Legitimate.

The second theme that emerged from the meta-synthesis was that older adults prefer CFP programs that appear trustworthy and legitimate. CFP programs should be endorsed by trusted healthcare professionals, and offered in the context of a familiar location, with familiar exercise content delivered by experienced instructors and supplemented by print or media resources.

2.1) Category 1: Endorsement by Others.

Older adults felt reassured when CFP programs were recommended to them by healthcare providers, such as general practitioners, physical therapists, or nurses. Programs should be endorsed by trusted healthcare professionals so that participants can have peace of mind and confidence in the program's legitimacy and effectiveness. When CFP program options and alternatives were not discussed by healthcare providers, older adults who were at risk for falling were unsure about where else to obtain this information.

- *"And she said this project is supported by the HCNs community. So I said, then I will participate. (older adult)" – Amacher*

- *"My doctor told me, "It's icy, don't go out walking now." OK, so what am I supposed to do? Walk indoors? (older adult, 70 years)" – Dohrn*

- *"The doctor said I can give you medicine, but it will not make you any better. That is, my heart would be better, but . . . I had to exercise. And that was . . . almost heavenly! Then I just organised my days. I went for a walk every day if I could, and usually walked my usual round. (older adult)" – de Groot*

2.2) Category 2: Familiarity & Learning Resources.

When programs were offered in familiar community locations, such as senior activity centers, this offered an additional layer of endorsement and legitimacy to the program in the eyes of older adults. Older adults appreciated and felt more comfortable participating in programs if they saw a demonstration of program content ahead of time, participated in a sample classes, or had prior experience with the program elements or exercises. Some older adults expressed a negative perception of the program when exercise content was unfamiliar or unexpected, feeling out-of-place when they could not anticipate and easily follow exercises routines. In this regard, it was important that exercises be demonstrated and explained clearly by instructors prior to older adults' participation in the exercises. This created a sense of familiarity with the exercise regimen, trust in the instructor, and trust in older adults' own abilities. Thus, having some familiarity or personal experience with the exercise content/type (such as Tai Chi,

dancing, or aerobics) ahead of time helped to boost older adults' self-efficacy for performing the exercises and their trust that they would not lose face or be embarrassed in front of others when performing the exercises.

- *"…very very hectic, you know, very, very full on. (older adult)" – Kraft*

- *"I think the most thing is when you get a certain age like we are, if someone says "come tomorrow to do aerobic[s]" and say you've never done it, you might be embarrassed, because for a start you stand there like an ox and then there's music and someone says 1, 2, 3 and off you go and you just don't have the chance… (older adult)" – Kraft*

- *"But if you've done this [balance training],...then you see that you can do it...To me, that was positive. (older adult, 70 years)" – Dohrn*

Further, the instructors or other personnel involved with the program had an important role to play in establishing a trusting relationship with participants. This was done by building rapport with participants, having a positive personality, and demonstrating skill and knowledge. It was important to older adults that they be able to ask questions about program features they did not understand, such as how to perform specific exercises correctly and safely, and the reasons why certain exercises or other features were included in the program. Each program feature and exercise should be linked to specific physical, mental, and/or social benefits. When instructors or other personnel were not available to answer questions (such as in some home-based programs), resources should be provided that clearly explain program features and the rationale for

their inclusion in the program, and that clearly demonstrate how to safely perform specific exercises. This may be accomplished through brochures, booklets, or videos/CDs. The existence of program materials and resources also lent an air of legitimacy to CFP programs.

- *"She [the physiotherapist] knew what she was talking about. You tell her what was wrong and she knew what you were talking about … and she did something about it…. (older adult, 81 years)" – Brooks*

- *"They always explained everything. Yeah, always explained everything, very well explained in simple form y'know, without making people feel like idiots y'know. (older adult, 80 years)" – Brooks*

- *"She goes over things, she insists that you mustn't hurt yourself or that sort of thing, don't overdo it, but we've just enjoyed it. (older adult)" – Hawley-Hague 2017*

- *"She encourages you, she watches everything. (older adult)" – Hawley-Hague 2017*

3) Theme 3: CFP Programs Should be Easy to Access and Fit into Older Adults' Daily Routines.

The third theme that emerged from the meta-synthesis was that older adults prefer programs that are easily accessible and that fit into their daily routines. Programs should be easy to access in terms of affordability, as well as being held at a convenient location close to home, with available and low-cost transportation to the location. Environmental factors should be taken into consideration, such as weather,

road/pavement quality, and neighborhood safety that influence older adults' likelihood to travel or exercise outside. Programs should be tailored to individual needs, be flexible, and allow older adults to self-manage their exercise and fall prevention regimens, while keeping in mind the need to facilitate habit formation of these regimens. All of these things may influence whether an older adult prefers a group- or home-based CFP program, a combination of the two, and/or would benefit from follow-up program sessions to encourage habit formation.

3.1) Category 1: Ease of Access & Service Utilization.

Location, transportation, and cost were important aspects of program access. Proximity of programs to home and familiar locations facilitated program attendance. Familiar community venues, such as senior activity centers, were preferred locations for group programs. Some participants were willing to pay a minimal fee, such as $1-2 per week, or $5 per week. Cost as a barrier to program participation was often linked to transportation, such that some older adults may prefer to participate in fewer group sessions per week due to the financial burden of paying for transportation/fuel to and from a group class. Some older adults were not able to access any transportation to attend group programs, group-based CFP programs were not offered in the area where they lived, or inclement weather discouraged older adults from traveling to group-based classes. Further, programs sometimes lacked easy parking options or were located in cramped facilities that make traveling to group classes difficult or unpleasant. Older adults recognized that home-based programs may be an alternative for those who cannot access CFP programs in the area where they live (such as rural communities or

areas with extreme weather) or who do not have access to transportation. While these home-based programs may afford greater flexibility, they may also lack the social interaction that older adults enjoy in group-based CFP programs. Some participants mentioned that technology, such as video calls, could serve as an alternative means of social interaction for participants in home-based programs. Many older adults also preferred recreational or sports-related exercise that could be performed outside and/or with friends and family, including walking, dancing, biking, fishing, or golfing. However, participation in these types of activities was sometimes influenced by environmental factors, including inclement weather, fear of falling on wet or icy roads, and extreme temperatures; road quality such as uneven pavement; neighborhood safety; and community design.

- *"I'm talking about my mother because I deal with her a lot. If it had anything to do with a hospital, she's not going to want to go. (caregiver)" – Clark*

- *"People don't like to ask other people to take them. (older adult)" – Clark*

- *"Locate the class near where we live, work, worship, in areas we normally travel. (older adult) – Clark*

- *"People would participate more if it's inside their building for the most part. (older adult)" – Costello*

- *"Yeah, I only live over the top of the hill. I can probably see where I come from but I can't get there. . .transport used to pick me up then. . .and it was nice and easy. (older adult)" – Hawley-Hague 2017*

- *"We've got a lot of older people that want to do these exercise classes but just can't get to the place whether it be 'cause they don't have a licence or do have a licence but don't have a car, or can't afford busses. (older adult)" – Lukaszyk*

- *"Many old people in their 50s and 60s have a lot of energy, but they don't know where to go and have recreations...The government can organize classes to teach old people how to dance. Through dance classes, old people can be more physically active. (older adult)" – Mathews*

- *"I don't mean to sound too coarse or anything but everybody wants it to be free. (older adult)" – Costello*

- *"The thing I like about the—the classes…they are free and you don't have to go every single time. (older adult)" – Costello*

- *"Well when you think about it in the long run: you're paying $5 a week for a group as opposed to not being as strong and having falls. When you have a fall you lose so much independence in the way of washing, drying, all that sort of stuff. Five dollars a week in the scheme of things is not a huge amount. (older adult)" – Lukaszyk*

Another important aspect of service utilization included increasing participants' awareness of CFP programs, and disseminating program information through accessible and trusted channels that older adults already use. Examples of preferred information channels given by older adults included messages delivered by healthcare providers (most common), brochures left in community centers, information obtained from other exercise classes, radio or media ads, and internet ads. Content of

recruitment messages and program information should be at an appropriate health literacy level and message content should focus on strength, balance, and independence gained from program participation, rather than potentially stigmatizing messages focused on fall prevention.

- *"Try to tie a package together about strength, independence, maintaining their ability to live like they want to live. (older adult)" – Clark*

3.2) Category 2: Self-Management & Tailoring.

Program flexibility and time commitment were important aspects of falls self-management. Participants stressed the need to self-select the exercise difficulty level, time of day, length of sessions, and number of sessions per week. Programs should be tailored to individuals' needs, functional status, and personal goals and allow participants to manage falls "on their own terms."

- *"There isn't time to do everything you're supposed to be doing. (older adult)" - Costello*

- *"I have a lot of activities...such an exercise program should be 15 min at the most. (older adult)" – Mehra*

- *"I don't want someone telling me, "Now, you should do this and this and this and this." If I want to do a movement, I do it. (older adult)" – Arkkukangas*

- *"It's your own body, you're the only one who knows how much you can manage. (older adult, 70 years)" – Dohrn*

- *"Yes but racquet sports are a bit different. You have to be where the ball is to return it, but with gym you can be up and down on the one spot. Yeah and you can go at your own pace depending on what sort of – the degree of difficulty it's going to be. (older adult)" – Kraft*

- *"I tell the instructors I have issues with my shoulders and they hurt during arm exercises…this worries me and puts me off going. (older adult)" – McPhate*

- *"…the teacher was actually reacting to the feedback she got from the class too and was grading the classes appropriately. (older adult)" – Kraft*

- *"…she said, 'I wouldn't go if I was you'. So I said why? She said 'she'd been to a class. . .and she said it was walking round this room doing these exercises, she said there were no chairs', she said 'I felt as though I just had to sit down now and again, and she said it was just too much for me. (older adult)" – Hawley-Hague 2017*

- *"The instructor will have to sit down with us and figure out what fits with the group that is there. (older adult)" – Clark*

Programs should also incorporate variety to keep older adults engaged and prevent boredom with repetitive exercise regimens.

- *"I kept it [exercise] up for about a year and I found it incredibly boring. (older adult)" – Costello*

On the other hand, participants also expressed a need for program structure and habit formation. Participants recognized that while home-based programs may provide greater options for program flexibility compared to group programs, home-based programs may also lack the structure, reminders, and cues to action needed to motivate regular participation.

- *"...if I would get a list of exercises I should do at home, I would manage for 2 days, but that's about it. (older adult)" – Mehra*
- *"…I don't think I would enjoy going about on my own. (older adult)" – Mehra*
- *"…I don't believe that people that are active, will exercise at home without any guidance. (older adult)" – Mehra*
- *"I'm not very disciplined. (older adult)" – Costello*
- *"[I] just couldn't get myself motivated. (older adult)" – Costello*
- *"I believe you should build up a routine, like it's Monday so let's get started! (older adult)" – Mehra*

Also, some participants expressed that programs should be of longer duration or be continuously offered in order to accommodate older adults' other life commitments and increase program flexibility and the formation of long-term exercise habits. To address this, some studies described programs with "booster" or "follow-on" sessions that were held every few months after the main program ended. Other programs combined group exercise classes and home-based exercise regimens to increase program flexibility and sustainability of exercise habits after group classes had ended. Self-management of

when, where, and how older adults participated in CFP programs reaffirmed older

adults' autonomy and independence and created a sense of empowerment for active,

healthy aging.

- *"This six weeks or this eight weeks thing, it's just no good for the Koori [Aboriginal] community because people get sick. People drop out through winter. People drop out for various reasons but they can come back, pick up where they left off and continue on. You can't offer Koori communities short term fixes because it doesn't fix anything (older adult)." – Lukaszyk*

- *"So I . . . if I was given the offer continuously [to exercise] I would have exercised… (older adult)" – de Groot*

Table 17. Article Frequency by Code, Category, and Theme

Themes, Categories, and Select Codes	Number of articles*
Theme 1: Older adults prefer CFP programs with immediate benefits.	**48 (88.9%)**
Social Support	34 (63.0%)
Social support/interaction	31 (57.4%)
Social norms	2 (3.7%)
Accountability	12 (22.2%)
Competition	5 (9.3%)
Personal encouragement	6 (11.1%)
Physical & Mental Benefits	47 (83.9%)
Perceived benefits of exercise – strength and/or balance	13 (24.1%)
Perceived benefits of exercise – mental & concentration	11 (20.4%)
Perceived benefits of exercise – functional status	13 (24.1%)
Enjoyment, fun, positive emotions	27 (50.0%)
Efficacy	25 (46.3%)
Theme 2: Older adults prefer CFP programs that appear trustworthy and legitimate.	**36 (66.7%)**
Endorsement by Others	24 (44.4%)
Trust, relationship building, endorsement, legitimacy	7 (13.0%)
Recommendation by a healthcare provider	12 (22.2%)
Recommendation by family member/peer	4 (7.4%)
Involvement of a professional person	11 (20.4%)
Familiarity & Learning Resources	34 (63.0%)
Experiential learning – sample class, demonstration, prior experience	8 (14.8%)
Instructor personality, skills, experience, style	17 (31.5%)
Resources – video or cd, tv	5 (9.3%)
Resources – online website or app	2 (3.7%)
Resources – handouts, brochures, booklet	5 (9.3%)
Resources – technology	3 (5.6%)
Resources – phone programming	2 (3.7%)
Resources – diary	1 (1.9%)
Resources – ability to ask questions/see a demonstration	7 (13.0%)
Theme 3: Older adults prefer CFP programs that are easy to access and that fit into their daily routines.	**52 (96.3%)**
Ease of Access & Service Utilization	44 (81.5%)

Transportation	16 (29.6%)
Cost	17 (31.5%)
Session frequency	7 (13.0%))
Session length	5 (9.3%)
Program duration	6 (11.1%)
Environment	19 (35.2%)
Location/setting – group	25 (46.3%)
Location/setting – home	17 (31.5%)
Location/setting – outside	8 (14.8%)
Location/setting – alone	6 (11.1%)
Location/setting – gym/fitness center	5 (9.3%)
Location/setting – church or other community setting	4 (7.4%)
Self-management & Tailoring	51 (94.4%)
Flexibility, fit into daily routine	22 (40.7%)
Exercise difficulty level & tailoring	25 (46.3%)
Self-management	17 (31.5%)
Seen as an individual, on their own terms, empowerment, autonomy	10 (18.5%)
Personally relevant	12 (22.2%)
Program offerings/extras – education	13 (24.1%)
Program offerings/extras – home safety consultation	11 (20.4%)
Program offerings/extras – exercises	12 (22.2%)
Program offerings/extras – vision check	1 (1.9%)
Program offerings/extras – individual counseling or training	4 (7.4%)
Program offerings/extras – physical therapist involvement	3 (5.6%)
Program offerings/extras – add-ons like blood pressure screening	1 (1.9%)
Program offerings/extras – assistive device training	4 (7.4%)
Program offerings/extras – bone strengthening medications	1 (1.9%)
Program offerings/extras – medication review	3 (5.6%)
Program offerings/extras – multi-factor risk assessment	1 (1.9%)
Program offerings/extras – music	4 (7.4%)
Program offerings/extras – prizes, incentives, freebies	1 (1.9%)

*Number of articles for which codes belonging to these categories and themes appear at least once, out of a total of 54 articles. Article frequencies are not mutually exclusive.

Figure 5. Code Frequency Within and Across all Articles (Groundedness), by Category

*Codes in the social support category were grounded 246 times across 209 unique quotes.

Physical & Mental Benefits

Code	Code Frequency (Groundedness)
Perceived benefits of exercise	132
Efficacy	116
Enjoyment, fun, positive emotions	80
Functional status	78
Perceived benefits of exericse - physical/health improvement	68
Efficacy - health improvement	53
Medical condition, hospitalization, poor health	48
Independence and active aging	47
Fear of falling	41
Perceived risk of falling	38
Perceived benefits of exercise - strength and/or balance	34
Perceived benefits of exercise - funtional improvement	29
Perceived benefits of exercise - mental & concentration	29
Efficacy - worsening health, injury, adverse event, not effective	23
perceived benefits of exercise - emotional benefits	21
Perceived benefits of exercise - medical condition specific	16
Sense of accomplishment	14
Future health benefits (future thinking)	10
Personal attitude	10
Reflections on aging	10
Immediate vs. delayed advantages or disadvantages	4
Perceived benefits of exercise - combat the effects of aging	4
Quality of life	4
Quality of life - improved	3

*Codes in the physical and mental benefits category were grounded 912 times across 413 unique quotes.

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Endorsement by Others

Codes	Code Frequency (Groundedness)
Trust, relationship building, endorsement, legitimacy	33
Opinion or support of the healthcare providers or falls clinic staff	23
Recommendation by health provider	23
Involvement of a professional person	20
Recommendation by family member/peer	12
Role model	7
Recommendation, endorsement, testimonial	6
Recommendation by community leader	6
Participant characteristics	5
Physical therapist	2
Peer leader	1

*Codes in the endorsement by others category were grounded 138 times across 102 unique quotes.

Familiarity & Learning Resources

Code	Code Frequency (Groundedness)
Instructor personality, skills, experience, style	65
Experiential learning	52
Resources	50
Safety	28
Experiential learning - sample class, demonstration, prior experience	22
Resources - technology	14
Resources - handouts, brochures, booklet	13
Resources - ability to ask questions/see a demonstration	12
Resources - video or cd, tv	12
Instructor to participant ratio	6
Resources - online website or app	6
Understood the program	6
Realistic expectations	3
Resources - phone programming	3
Resources - diary	2

*Codes in the familiarity & learning resources category were grounded 294 times across 180 unique quotes.

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Ease of Access & Service Utilization

Code	Frequency
Location/setting	144
Location/setting - group	90
Location/setting - home	59
Environment	50
Transportation	43
Cost of program	39
Ease of access	32
Frequency of sessions	19
Proximity to home and familiar places, travel time	18
Environment - weather	15
Location/setting - outside	13
Equipment quality, availability	12
Environment - spacious room, nice facilities	11
Time of day	11
Location/setting - alone	10
Recruitment messages and promotion	9
Location/setting - church or other community setting (non-clinical)	6
Recruitment messages - don't focus on fall prevention	6
Awareness of fall prevention or exercise program	5
Environment - parking	5
Organization of program	5
Location/setting - gym or fitness center	5
Environment - road	4
Environment - safety	4
Message tailoring	4
Class size	3
Information channel	3
Information channel - healthcare provider	3
Location/setting - combination	2
Health literacy	1
Service competition	1
Information channel - community center, brochure	1
Information channel - exercise class	1
Information channel - radio or media	1
Location/setting - hospital	1
Long wait time	1
Recruitment - in-person announcements and word-of-mouth	1
Recruitment messages - internet ads	1

Codes (y-axis) vs. Code Frequency (Groundedness) (x-axis)

*Codes in the ease of access and service utilization category were grounded 596 times across 293 unique quotes.

Self-management & Tailoring

Code	Frequency
Type of exercise	101
Exercise difficulty level & degree of tailoring	88
Program offerings/extras	86
Flexibility & convenience, fit into daily routine	57
Self management	55
Self-concious, stigma, embarrasment, vulnerability, negative emotions	47
Self confidence	40
Type of exercise - Tai Chi	31
Program offerings/extras - education	27
Seen as an individual, on their own terms, empowerment, autonomy	27
Time requirement	27
Type of exercise - walks	26
Type of exercise - sports, dance, swimmig, fishing, golfing, recreational	24
Behavior modification, proactive approach	22
Program offerings/extras - home safety expert	22
Type of exercise - strength and balance	20
Personally relevant	19
Program offerings/extras - exercises	18
Importance of daily routines	17
Duration of program	14
Age appropriate	12
Exercise difficulty level - too hard	11
Follow-on program or follow-up visits	11
Length of sessions	11
Program offerings/extras - individual counseling or training	10
Doable and easy	9
Program offerings/extras - assistive device	9
Program offerings/extras - music	9
Type of exercise - yoga	9
Exercise difficulty level - just right	8
Personal goals	8
Reminder or cue to action	8
Inclusive vs. exclusive	7
Takes skill and effort	7
Variety	7
Hearing and/or vision modifications, visual cues	5
Low pressure	5
Program offerings/extras - physical therapist	6
Program offerings/extras - medication review	4
Program offerings/extras - prizes, incentives, freebies	4
Type of exercise - activities of daily living	4
Type of exercise - gym workout	4
Exercise difficulty level - too easy	3
Program offerings/extras - bone strengthening medications	2
Reflective learning	2
Individual recognition	1
Program offerings/extras - vision check	1
program offerings/extras - multi-factor risk assessment	1
Program offerings/extras - add-ons like blood pressure screening	1

Codes (y-axis), Code Frequency (Groundedness) (x-axis)

*Codes in the self-management & tailoring category were grounded 920 times across 462 unique quotes.

v. Aim 1 Confidence in the Overall Body of Evidence:

1) CERQual.

Our confidence in the overall body of evidence was moderate. Table 18 presents the CERQual evidence summary for each of the four confidence components (methodological limitations, coherence, adequacy of data, and relevance), by theme/category. Table 19 summarizes these CERQual findings into a brief format. Most of the 54 studies that met the inclusion criteria for this review achieved a relatively high-quality rating. However, there was variability across studies in terms of context. For example, some studies reported older adults' preferences for CFP programs designed for people with osteoporosis, Hispanic/Latino(a) participants, or older adults living on limited income. Country, climate, and residential area also varied across studies. Some studies focused mainly on evaluation of CFP program effectiveness and included older adults' level of satisfaction with the program as a secondary measure, while others focused exclusively on older adults' experiences and perspectives with the CFP program. There was also inconsistency in how "older adults' preferences" were operationalized in each study, with some studies focusing on older adults' satisfaction with CFP programs, and others focusing on older adults' perceptions, perspectives, views, beliefs, or opinions about CFP programs. The most common reason for excluding a study from this systematic review was the lack of extractable data on older adults' preferences for features of CFP programs. Also, most studies did not explicitly define older adults' living situations, and the determination of "community-dwelling" was in some cases based on the investigators' interpretation of information presented in the article.

2) Interviews.

Themes that emerged from the interviews were consistent with those that emerged from the meta-synthesis. The two caregiver participants were 41 and 42 years of age and self-identified female, non-Hispanic/Latina ethnicity, and African-American race. The three older adult participants who were patients/clients at the cardiac rehab clinic were 55, 59 and 73 years of age, with the younger two self-identifying as female, non-Hispanic/Latina ethnicity, and African-American race; the oldest participant self-identified as male, non-Hispanic/Latino ethnicity, and White race. Older adults and caregivers emphasized that what they enjoy most about the program is social interaction with other program participants, and the motivation afforded by exercising in a group setting with their peers. Some interviewees indicated that when they have tried to exercise at home in the past, they couldn't "follow-through" or stay motivated. Interviewees were also motivated to continue participating in the program as they saw improvements in their own health that they attributed to the effectiveness of the program, which increased their self-confidence in their ability to self-manage their health and physical fitness.

Speaking with the fall prevention expert confirmed that older adults often do not identify as fallers, and may perceive there to be stigma associated with fall prevention programs. To engage and retain older adults in CFP programs, older adults must believe that they are at risk of falling and have a personal stake in reducing this risk. To improve retention and adherence to CFP programs, expert views recommend

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performing a personal fall risk assessment, including interactive fall prevention education that is visual in nature (such as videos) and incorporates testimonials from other older adults, helping older adults set personal goals that they can achieve as part of the program, and having caring instructors who provide feedback to older adults on their personal progress towards their specific program goal. In addition to older adults' awareness and motivation to reduce personal fall risk, engaging older adults in CFP programs revolves around four program-related factors: "availability;" "accessibility;" "affordability;" and "accountability." Programs must be available in the area where older adults live; older adults must be able to obtain transportation to access the program; there is limited insurance coverage for CFP programs, and programs must be affordable for out-of-pocket payment; and programs must be designed in an evidence-based way that is accountable to the literature.

Interviews also clarified information about specific levels of key CFP program features that mattered most to older adults, such as cost and session frequency. The cardiac rehab program included 1-hour long sessions offered three days per week, and included exercise, educational sessions with dieticians and pharmacists, and monitoring by exercise physiologists. For some clients, the program was fully covered by their health insurance. When asked how much they would be willing to pay for an exercise program similar to the cardiac rehab group program they currently attended, responses from older adults and caregivers included $0, $20, $70, and up to $150 per month. Further, program participants and caregivers verbalized a range of preferred session frequencies, including 1-2 times per week, 3 times per week, and up to 5 times per

week. For these participants, preference for fewer sessions per week was linked to the

financial burden of paying for fuel to travel to the group class. Information from

speaking with a falls expert emphasized that session frequency of exercise-based CFP

programs should be at least 2 times per week in order to be evidence-based in regards

to fall prevention, keeping in mind that 1-hour long sessions 3 times per week may be

needed to meet physical activity guidelines of 150 minutes/week of moderate-intensity

exercise.[289]

To lend evidence to the interpretation of these interview findings, excerpts from written

field notes taken during the interviews are summarized here, and reflect participants'

responses during discussions related to the question: "What would make it easier or

harder to participate in exercise programs?"

- **Caregiver 1:** 42 years, female, African-American, non-Hispanic/Latina.
    - "Equipment" may not be good.
    - "Time" it's offered may be a problem.
    - "Embarrassing" sometimes if too many people.
    - "$15-$20" for a program at a gym or YMCA would be ok. Sometimes it's ok to pay because they have to keep up the program.
    - Area she lives in is "small" and not much there.
    - Wants to do a program with her mom together, but has trouble finding one.
- **Caregiver 2:** 41 years, female, African-American, non-Hispanic/Latina.

- o "Will the exercise trainer be available for each session? How long are the sessions and how many per week?"

- o Would pay $100 for a program at a community center, $150 for a program at home, and $75 for a program online.

- o Location is the most important factor.

- o Session frequency is the second-most important factor.

- o Cost is the least important factor.

- **Client 1:** 55 years, female, African-American, non-Hispanic/Latina.

    - o "Structure" is good.

    - o "Group" format is good, makes her "enjoy" it.

    - o She comes 3-5 times/week.

    - o Would keep going for even a year and "not notice" as long as she enjoyed it.

    - o Sometimes if there are too many people, it could be "embarrassing."

    - o It's motivating because she knows she "needs to do it for health."

    - o Would pay up to $20 for a class at the gym or YMCA.

- **Client 2:** 59 years, female, African-American, non-Hispanic/Latina.

    - o "Structure" and group nature of the program are good.

    - o Program is too "far away."

    - o "Gas" is a problem, she drives from out of town.

    - o No cost to the program would be the only way she could participate. Her insurance covers the cardiac rehab program.

    - o At home, she has "no motivation" to exercise.

- The cardiac rehab program recommends attending 3 times per week, but sometimes she attends 2 times or 1 times per week, depending on what she "can do" and they "always let me in."

- She loves the people and staff at the program, sometimes they "put a smile on your face if you're feeling down."

- She likes that education about "diet" is included in the program.

- **Client 3:** 73 years, male, White, non-Hispanic/Latino ethnicity.

  - Would pay up to $70 for a program at a gym by his home. His insurance may cover some of this.

  - Wants to know the cost for a program at home. Such as for hand weights, materials, a trainer, and consultations.

  - "Flexibility" of time to attend is good.

  - "Structure" with other people is good, in a group.

  - Motivated by group/others.

  - He comes to the cardiac rehab program 3 times per week, and has to drive for 30-40 minutes. The program is free, but he has to pay for gas. He would "not do this regularly."

  - Thinks 1 time per week is too little.

  - He does some things at home, exercises to prevent falls – gives example of catching a wiffle ball to improve hand-eye coordination that a falls specialist told him about.

  - He doesn't "stick with it" at home.

- o He also learns about diabetes and diet in another outpatient program, and

    likes this extra information.

- o Thinks that fall prevention programs may be "up to 60% effective" in

    preventing falls.

Table 18. CERQual Evidence Profile: Confidence in the Findings

Finding (Category)	Studies	Methodological limitations	Coherence	Adequacy of data	Relevance	*CERQual assessment of confidence in the evidence*	Explanation of CERQual assessment
Older adults prefer CFP programs with immediate social benefits.	192,193,234,239-241,248-250,252,254-256,258,260-267,269,271,273-275,277-283	No or minor concerns about methodological limitations. MMAT quality ratings range from 3-5 (moderate-high quality).	Minor concerns about coherence. The social support category was grounded 246 times. Some older adults reported feeling awkward/ stigma when exercising with others.	No or minor concerns. 34 studies contribute to this finding.	No or minor concerns. Articles cover a range in terms of older adults' age range, gender, socioeconomic status, health conditions, functional/ health status, rural/urban status, climate, & country.	High	No or minor concerns about methodological limitations, coherence, adequacy of data, and relevance of the included articles.
Older adults prefer CFP programs with immediate physical and mental benefits.	192,193,233-246,248-252,254-264,266,267,269-271,273-275,277-284	No or minor concerns about methodological limitations. MMAT quality ratings range from 3-5 (moderate-high quality).	No or minor concerns. The physical & mental benefits category was grounded 912 times.	No or minor concerns. 47 studies contribute to this finding. .	No or minor concerns. Articles cover a range in terms of older adults' age range, gender, socioeconomic status, health conditions, functional/ health status, rural/urban status, climate, & country.	High	No or minor concerns about methodological limitations, coherence, adequacy of data, and relevance of the included articles.
Older adults prefer CFP programs that are endorsed by important others.	192,193,233,234,240,241,243,248-250,252,256,258,260,261,263,265-267,269,273,274,279,280	No or minor concerns about methodological limitations. MMAT quality ratings range from 4-5 (high quality).	No or minor concerns. The endorsement by others category was grounded 138 times.	No or minor concerns. 24 studies contribute to this finding.	No or minor concerns. Articles cover a range in terms of older adults' age range, gender, socioeconomic status, health conditions, functional/ health status, rural/urban status, climate, & country.	High	No or minor concerns about methodological limitations, coherence, adequacy of data, and relevance of the included articles.
Older adults prefer CFP programs that include familiar activities and step-by-step learning resources.	192,193,234,236,239-241,243,245,246,248-254,256,258,260-263,265,266,269,270,273-275,279-282	No or minor concerns about methodological limitations. MMAT quality ratings range from 3-5 (moderate-high quality).	No or minor concerns. The familiarity & learning resources category was grounded 294 times.	No or minor concerns. 34 studies contribute to this finding.	No or minor concerns. Articles cover a range in terms of older adults' age range, gender, socioeconomic status, health conditions, functional/ health status, rural/urban status, climate, & country.	High	No or minor concerns about methodological limitations, coherence, adequacy of data, and relevance of the included articles.

Older adults prefer CFP programs that are easy to access and that fit into their daily routine in terms of location, transportation, time of day, session frequency and length, and cost.	192,193,233,234,239-244,248-250,252-256,258-271,273-275,277-285	No or minor concerns about methodological limitations. MMAT quality ratings range from 3-4 (moderate-high quality).	Minor concerns. The ease of access & service utilization category was grounded 596 times. "Ease of access" may mean different things to different older adults. For example, heterogeneity in preference for location and session frequency may be highly dependent on transportation, program cost, participant income, age range, and functional/ health status.	No or minor concerns. 44 studies contribute to this finding.	No or minor concerns. Articles cover a range in terms of older adults' age range, gender, socioeconomic status, health conditions, functional/ health status, rural/urban status, climate, & country.	High	No or minor concerns about methodological limitations, coherence, adequacy of data, and relevance of the included articles.
Older adults prefer CFP programs that allow them to self-manage their fall risk and that are tailored to their individual functional status, fitness level, and needs.	192,193,233-235,237-246,248-252,254-256,258-285	MMAT quality ratings range from 3-5 (moderate-high quality).	Minor concerns. The self-management & tailoring category was grounded 920 times. Some older adults preferred a structured/ fixed program.	No or minor concerns. 51 studies contribute to this finding.	No or minor concerns. Articles cover a range in terms of older adults' age range, gender, socioeconomic status, health conditions, functional/ health status, rural/urban status, climate, & country.	High	No or minor concerns about methodological limitations, coherence, adequacy of data, and relevance of the included articles.

Table 19. CERQual Summary of Findings

Objective: Investigate community-dwelling older adults' (≥65 years) preferences for features of community-based fall prevention programs.

Perspective: Community-dwelling older adults 65+.

Included Programs: Community-based fall prevention programs, which primarily include strength and balance exercises, and which may also include falls education; home safety assessment & modification; vision checks; podiatry interventions; and/or medication management components.

Finding	Studies	CERQual assessment of confidence in the evidence	Explanation of CERQual assessment
Older adults prefer CFP programs with immediate social benefits.	192,193,234,239-241,248-250,252,254-256,258,260-267,269,271,273-275,277-283	High	No or minor concerns about methodological limitations, coherence, adequacy of data, and relevance of the included articles.
Older adults prefer CFP programs with immediate physical and mental benefits.	192,193,233-246,248-252,254-264,266,267,269-271,273-275,277-284	High	No or minor concerns about methodological limitations, coherence, adequacy of data, and relevance of the included articles.
Older adults prefer CFP programs that are endorsed by important others.	192,193,233,234,240,241,243,248-250,252,256,258,260,261,263,265-267,269,273,274,279,280	High	No or minor concerns about methodological limitations, coherence, adequacy of data, and relevance of the included articles.
Older adults prefer CFP programs that include familiar activities and step-by-step learning resources.	192,193,234,236,239-241,243,245,246,248-254,256,258,260-263,265,266,269,270,273-275,279-282	High	No or minor concerns about methodological limitations, coherence, adequacy of data, and relevance of the included articles.
Older adults prefer CFP programs that are easy to access and that fit into their daily routine in terms of location, transportation, time of day, session frequency and length, and cost.	192,193,233,234,239-244,248-250,252-256,258-271,273-275,277-285	High	No or minor concerns about methodological limitations, coherence, adequacy of data, and relevance of the included articles.
Older adults prefer CFP programs that allow them to self-manage their fall risk and that are tailored to their individual functional status, fitness level, and needs.	192,193,233-235,237-246,248-252,254-256,258-285	High	No or minor concerns about methodological limitations, coherence, adequacy of data, and relevance of the included articles.

B. Aim 2: To Quantitatively Determine Older Adults' Preferred CFP Program Design And How This Is Modified By Socioeconomic Status And Physical Functional Status.

i. Aim 2 Participant Characteristics:

A total of 1,703 participants initiated the survey. Of these, 228 did not agree to continue with the survey after reading the information letter, and 788 did not meet the inclusion criteria. Of the 687 eligible participants, 57 abandoned the survey, leaving a total of 630 eligible participants who completed the survey (91.7% completion rate). This represents 15,120 observations (630 participants x 8 choice tasks/participant x 3 alternatives/choice task). The majority of these participants self-reported as White race (86.3%), female (56.3%), non-Hispanic/Latino(a) ethnicity (92.9%), with a mean age of 70.5 years (SD=4.73, range 65-94 years), and taking a mean of 4.2 prescription medications (SD=3.51, range 0-30). A majority (59.2%) reported falling at least once in the past year (range 0-4 times) (Table 20). About one-third (30.8%) of participants self-reported an annual household income below $25,000, and 46.8% were categorized as having "low" physical functional status on the SF-36 (dichotomized based on the median scale score of 65 for the full cohort) (Table 21). Further, 64.8% of participants "somewhat agreed," "agreed," or "strongly agreed" that cost was a barrier to participating in CFP programs (Table 22).

After excluding participants who incorrectly answered the repeated DCE question, the extreme choice DCE question, or straight-lined their DCE responses, a total of 328

participants remained in the sample. This represents 7,872 observations (328 participants x 8 choice tasks/participant x 3 alternatives/choice task). In this final analysis cohort, the majority of participants self-reported as White race (87.5%), female (54.9%), non-Hispanic/Latino(a) ethnicity (93.3%), with a mean age of 70.3 years (SD=4.38, range 65-85), and taking a mean of 4.0 prescription medications (SD=3.29, range 0-28). A majority (61.0%) reported falling at least once in the past year (range 0-4 times) (Table 20). About one-quarter (23.2%) self-reported an annual household income below $25,000, and 47.0% were categorized as having a "low" physical functional status on the SF-36 (dichotomized on the median score of 70 for the final analysis cohort) (Table 21). Further, 59.5% of participants in the final analysis cohort "somewhat agreed," "agreed," or "strongly agreed" that cost was a barrier to participating in CFP programs (Table 22).

Table 20. Participant Characteristics

Characteristic	Full Cohort (n=630) n (%)	Final Analysis Cohort (n=328) n (%)	Removed from the Sample (n=302) n (%)	p-value
Age in years, mean (SD, range)	70.5 (4.73, 65-94)	70.3 (4.38, 65-85)	70.7 (5.06, 65-94)	0.3899
Sex				0.4378
Male	275 (43.65)	148 (45.12)	127 (42.05)	
Female	355 (56.35)	180 (54.88)	175 (57.95)	
Race				0.6566
White	544 (86.35)	287 (87.50)	257 (85.10)	
Black or African American	58 (9.21)	30 (9.15)	28 (9.27)	
Asian	9 (1.43)	3 (0.91)	6 (1.99)	
Hawaiian or Pacific Islander	4 (0.63)	1 (0.30)	3 (0.99)	
American Indian or Alaska Native	6 (0.95)	2 (0.61)	4 (1.32)	
Two or more races	9 (1.43)	5 (1.52)	4 (1.32)	
Ethnicity				0.6582
Hispanic or Latino(a)	45 (7.14)	22 (6.71)	23 (7.62)	
Not Hispanic or Latino(a)	585 (92.86)	306 (93.29)	279 (92.38)	
Educational level				0.0058**
Less than high school diploma	11 (1.75)	3 (0.91)	8 (2.65)	
High school diploma or GED	152 (24.13)	68 (20.73)	84 (27.81)	
Some college	230 (36.51)	113 (34.45)	117 (38.74)	
Bachelor's degree	148 (23.49)	85 (25.91)	63 (20.86)	
Master's degree	75 (11.90)	48 (14.63)	27 (8.94)	
Doctorate degree	14 (2.22)	11 (3.35)	3 (0.99)	
Annual household income level				<0.0001**
Less than $25,000	194 (30.79)	76 (23.17)	118 (39.07)	
$25,000-$49,999	186 (29.52)	107 (32.62)	79 (26.16)	
$50,000-$74,999	143 (22.70)	75 (22.87)	68 (22.52)	
$75,000-$99,999	58 (9.21)	41 (12.50)	17 (5.63)	
$100,000 and above	49 (7.78)	29 (8.84)	20 (6.62)	
Number of prescription medications, mean (SD, range)	4.2 (3.51, 0-30)	4.0 (3.29, 0-28)	4.4 (3.73, 0-30)	0.2417
Health insurance status*				0.5323
Has health insurance	619 (98.41)	323 (98.78)	296 (98.01)	
Does not have health insurance	10 (1.59)	4 (1.22)	6 (1.99)	
Number of falls in the past year				0.6467
None	257 (40.79)	128 (39.02)	129 (42.72)	
One	216 (34.29)	112 (34.15)	104 (34.44)	
Two	116 (18.41)	66 (20.12)	50 (16.56)	
Three or more	41 (6.51)	22 (6.71)	19 (6.29)	
Physical function scale score				
Mean (SD)	61.9 (28.02)	65.6 (26.01)	57.8 (29.52)	0.0005**

	65 (40.0-90.0, 0-100)	70 (45.0-90.0, 0-100)	60 (35.0-85.0, 0-100)	
Median (IQR, range)	65 (40.0-90.0, 0-100)	70 (45.0-90.0, 0-100)	60 (35.0-85.0, 0-100)	
Considers him/herself to be at risk for falling				0.1747
Yes	256 (40.63)	132 (40.24)	124 (41.06)	
No	117 (18.57)	53 (16.16)	64 (21.19)	
Not sure	257 (40.79)	143 (43.60)	114 (37.75)	
Ever participated in an exercise program	208 (33.02)	114 (34.76)	94 (31.13)	0.3331
Ever participated in a strength and balance program	212 (33.65)	112 (34.15)	100 (33.11)	0.7838
Ever participated in a fall prevention program	40 (6.35)	11 (3.35)	29 (9.60)	0.0013**
Preferred exercise scenario				0.0189**
At home by myself	426 (67.62)	205 (62.50)	221 (73.18)	
At home with an exercise trainer	37 (5.87)	19 (5.79)	18 (5.96)	
At a community center in a group	108 (17.14)	69 (21.04)	39 (12.91)	
At a community center by myself	59 (9.37)	35 (10.67)	24 (7.95)	
Preferred type of exercise				0.0005**
Aerobics and using hand-weights	298 (47.30)	167 (50.91)	131 (43.38)	
Tai-Chi	55 (8.73)	38 (11.59)	17 (5.63)	
Yoga	95 (15.08)	49 (14.94)	46 (15.23)	
Other***	182 (28.89)	74 (22.56)	108 (35.76)	
Would use a website or smartphone app to learn about fall prevention and strength/balance training				0.0003**
Yes	247 (39.21)	153 (46.65)	94 (31.13)	
No	169 (26.83)	74 (22.56)	95 (31.46)	
Maybe	214 (33.97)	101 (30.79)	113 (37.42)	
Preferred channel for fall prevention and balance training information				0.1646
From my doctor	369 (58.57)	188 (57.32)	181 (59.93)	
On the television	20 (3.17)	8 (2.44)	12 (3.97)	
On the radio	1 (0.16)	1 (0.30)	0	
In a magazine	7 (1.11)	3 (0.91)	4 (1.32)	
Online website	110 (17.46)	61 (18.60)	49 (16.23)	
Friend, family member, or neighbor	57 (9.05)	33 (10.06)	24 (7.95)	
Newspaper	11 (1.75)	2 (0.61)	9 (2.98)	
Flyer posted in the area where I live	25 (3.97)	17 (5.18)	8 (2.65)	
Other***	30 (4.76)	15 (4.57)	15 (4.97)	

*There was some missing data: final analysis cohort, health insurance status n=327; full cohort, health insurance status n=629.

**p<0.05 for the final analysis cohort vs. participants who were deleted from the sample; t-tests for continuous variables and Chi-square or Fisher's Exact (when cell value <5) tests for categorical variables.

***Examples of "Other" preferred types of exercise included "walking" and "weight-lifting," "biking," and "all of these types." Examples of "Other" preferred information channels included "all of these."

Table 21. Physical Functional Status*

Question	Group	Yes, limited a lot n (%)	Yes, limited a little n (%)	No, not limited at all n (%)
Vigorous activities, such as running, lifting heavy objects, participating in strenuous activities.	Full Cohort	337 (53.49)	210 (33.33)	83 (13.17)
	Final Analysis	166 (50.61)	122 (37.20)	40 (12.20)
Moderate activities, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf.	Full Cohort	87 (13.81)	239 (37.94)	304 (48.25)
	Final Analysis	30 (9.15)	122 (37.20)	176 (53.66)
Lifting or carrying groceries.	Full Cohort	64 (10.16)	193 (30.63)	373 (59.21)
	Final Analysis	25 (7.62)	85 (25.91)	218 (66.46)
Climbing several flights of stairs.	Full Cohort	191 (30.32)	243 (38.57)	196 (31.11)
	Final Analysis	89 (27.13)	131 (39.94)	108 (32.93)
Climbing one flight of stairs.	Full Cohort	94 (14.92)	174 (27.62)	362 (57.46)
	Final Analysis	40 (12.20)	84 (25.61)	204 (62.20)
Bending, kneeling, or stooping.	Full Cohort	124 (19.68)	296 (46.98)	210 (33.33)
	Final Analysis	54 (16.46)	157 (47.87)	117 (35.67)
Walking more than a mile.	Full Cohort	251 (39.84)	176 (27.94)	203 (32.22)
	Final Analysis	112 (34.15)	102 (31.10)	114 (34.76)
Walking several blocks.	Full Cohort	185 (29.37)	167 (26.51)	278 (44.13)
	Final Analysis	79 (24.09)	85 (25.91)	164 (50.00)
Walking one block.	Full Cohort	85 (13.49)	136 (21.59)	409 (64.92)
	Final Analysis	29 (8.84)	66 (20.12)	233 (71.04)
Bathing or dressing yourself.	Full Cohort	23 (3.65)	88 (13.97)	519 (82.38)
	Final Analysis	6 (1.83)	40 (12.20)	282 (85.98)

*Physical functional status was measured via the physical functional status domain of the SF-36.[228]

Table 22. Barriers to Participating in CFP Programs

Question	Group	Strongly Disagree n (%)	Disagree n (%)	Somewhat Disagree n (%)	Somewhat Agree n (%)	Agree n (%)	Strongly Agree n (%)
My doctor always leaves times during visits for me to ask questions.	Full Cohort	12 (1.90)	21 (3.33)	34 (5.40)	115 (18.25)	195 (30.95)	253 (40.16)
	Final Analysis	7 (2.13)	6 (1.83)	17 (5.18)	59 (17.99)	118 (35.98)	121 (36.89)
I feel comfortable talking about my risk of falling.	Full Cohort	11 (1.75)	16 (2.54)	43 (6.83)	106 (16.83)	227 (36.03)	227 (36.03)
	Final Analysis	4 (1.22)	5 (1.52)	22 (6.71)	60 (18.29)	126 (38.41)	111 (33.84)
I have resources to help me learn about how to prevent falls.	Full Cohort	37 (5.87)	48 (7.62)	123 (19.52)	179 (28.41)	154 (24.44)	89 (14.13)
	Final Analysis	13 (3.96)	31 (9.45)	72 (21.95)	93 (28.35)	77 (23.48)	42 (12.80)
I have people around me who care about my health.	Full Cohort	14 (2.22)	20 (3.17)	41 (6.51)	96 (15.24)	171 (27.14)	288 (45.71)
	Final Analysis	6 (1.83)	11 (3.35)	14 (4.27)	46 (14.02)	89 (27.13)	162 (49.39)
I have reliable transportation when I need it.	Full Cohort	18 (2.86)	17 (2.70)	30 (4.76)	75 (11.90)	183 (29.05)	307 (48.73)
	Final Analysis	8 (2.44)	7 (2.13)	11 (3.35)	38 (11.59)	90 (27.44)	174 (53.05)
It's easy to fit new things into my schedule.	Full Cohort	14 (2.22)	40 (6.35)	79 (12.54)	185 (29.37)	182 (28.89)	130 (20.63)
	Final Analysis	4 (1.22)	22 (6.71)	34 (10.37)	82 (25.00)	110 (33.54)	76 (23.17)
Learning about how to prevent falls could cost me too much money.	Full Cohort	48 (7.62)	67 (10.63)	107 (16.98)	155 (24.60)	119 (18.89)	134 (21.27)
	Final Analysis	30 (9.15)	44 (13.41)	59 (17.99)	95 (28.96)	53 (16.16)	47 (14.33)
I enjoy socializing with other people.	Full Cohort	25 (3.97)	37 (5.87)	88 (13.97)	183 (29.05)	154 (24.44)	143 (22.70)
	Final Analysis	6 (1.83)	14 (4.27)	39 (11.89)	96 (29.27)	90 (27.44)	83 (25.30)
Exercise is easy for me to do.	Full Cohort	76 (12.06)	80 (12.70)	125 (19.84)	174 (27.62)	122 (19.37)	53 (8.41)
	Final Analysis	26 (7.93)	34 (10.37)	65 (19.82)	101 (30.79)	76 (23.17)	26 (7.93)
There are many community activities for older adults in the area that I live.	Full Cohort	59 (9.37)	60 (9.52)	139 (22.06)	186 (29.52)	121 (19.21)	65 (10.32)
	Final Analysis	23 (7.01)	40 (12.20)	74 (22.56)	93 (28.35)	65 (19.82)	33 (10.06)

ii. Aim 2 Preference Weights of Attribute Levels:

Increasing the cost of a CFP program contributed negatively to the program's utility (Table 23). For every $1 increase in cost of a program, utility of the program decreased by 0.0450 units among the final analysis cohort ($p<0.0001$), indicating that utility of the program decreased as its cost increased. All levels of program cost included in this DCE ($25, $50, $75, and $100 per month) would thus contribute negatively to a program's utility when compared to the status quo of choosing not to spend any money on a CFP program. On the other hand, increasing the efficacy of a program contributed positively to the program's utility. For every 1% increase in falls-reduction, utility of the program increased by 0.0070 units ($p<0.0001$), indicating that utility of the program increased as its efficacy increased. All efficacy levels included in this DCE (10%, 30%, 50%, and 70% reduction in falls rate) would thus contribute positively to a program's utility when compared to the status quo falls rate of 30/100 older adults who choose not to participate in any CFP program.

The frequency of program sessions affected the program's utility. Programs offered 2 or 5 times per week negatively contributed to the program's utility (with 2 times per week contributing most negatively), while programs offered 3 or 4 times per week positively contributed to the program's utility (with 3 times per week contributing most positively), when compared to the status quo of not participating in any CFP program sessions per week ($p<0.05$ for 3 times per week).

Group location contributed positively to the program's utility (p<0.0001), while a home-based location contributed negatively. Similarly, inclusion of a home safety consultation as a feature of a CFP program contributed negatively to the program's utility (p>0.05), while not including a home safety consultation as part of the program contributed positively.

For all attributes except session frequency, these sign and magnitude patterns were consistent across both the lower and higher income groups, and the lower and higher physical functional status groups. For session frequency, this sign and magnitude pattern was maintained for the lower physical function group, and was also maintained for the higher physical function and higher income groups with the exception of a session frequency of 4 times per week (rather than 3 times per week) contributing most positively to the program's utility. However, this sign and magnitude pattern for session frequency was not maintained by the lower income group, for whom programs offered 4 or 5 times per week contributed negatively to the program's utility, while programs offered 2 or 3 times per week contributed positively to the program's utility. While differences in utility between these session frequencies were not proportional, there was a general trend in the lower income group showing that as session frequency increased from 2 to 5 times per week, the preference weight for that attribute became progressively less positive. These results are consistent with results of the final interaction model, which showed that interaction terms between session frequency and income level were statistically significant, while interaction terms between session frequency and physical function level were not statistically significant (Table 24). This is also consistent with the Aim 1

interviews, in which participants or caregivers in an outpatient cardiac rehab program who expressed a lower willingness or ability to pay for an exercise program also expressed a preference for attending fewer exercise sessions per week compared to interviewees who expressed a higher willingness or ability to pay for program sessions. Results of alternate specification models and results from the full cohort are shown in Tables 25-30 for comparison. Table 31 shows results from a reduced cohort (n=539) with only respondents who incorrectly answered the repeat and extreme choice DCE questions removed from the sample (respondents who answered "No Program" to all DCE questions were retained).

Table 23. Preference Weights: Conditional Logit Main Effects Final Models, Final Analysis Cohort by Income and Physical Functional Status

Attributes and Levels	Final Analysis Cohort (n=328) Preference Weights (Standard Error), p-value	Relative Importance Score (%) [c]	Lower Income (n=76) Preference Weights (Standard Error), p-value	Relative Importance Score (%)	Higher Income (n=252) Preference Weights (Standard Error), p-value	Relative Importance Score (%)	Lower Physical Function (n=154) Preference Weights (Standard Error), p-value	Relative Importance Score (%)	Higher Physical Function (n=174) Preference Weights (Standard Error), p-value	Relative Importance Score (%)
Cost										
Cost (continuous)	-0.0450 (0.00148), <0.0001*	**78.24**	-0.05097 (0.00336), <0.0001*	**77.05**	-0.04378 (0.00165), <0.0001*	**73.79**	-0.04383 (0.00214), <0.0001*	**78.23**	-0.04608 (0.00205), <0.0001*	**73.36**
Efficacy										
Efficacy (continuous)	0.00700 (0.00161), <0.0001*	**6.49**	0.00167 (0.00344), 0.6276	**2.02**	0.00858 (0.00182), <0.0001*	**11.57**	0.00643 (0.00233), 0.0058*	**9.18**	0.00750 (0.00222), 0.0007*	**9.55**
Session Frequency										
Two times per week (effects coded)	-0.05546 (0.05858), 0.3438		0.25395 (0.12700), 0.0455*		-0.14173 (0.06647), 0.0330*		-0.00368 (0.08485), 0.9654		-0.09431 (0.08122), 0.2456	
Three times per week (effects coded)	0.11732 (0.05887), 0.0463*	**6.51**	0.09471 (0.12780), 0.4586	**8.70**	0.12572 (0.06663), 0.0592	**7.61**	0.14157 (0.08465), 0.0945	**7.60**	0.09595 (0.08204), 0.2422	**6.31**
Four times per week (effects coded)	0.10183 (0.0575), 0.0768		-0.17119 (0.12845), 0.1826		0.17731 (0.06462), 0.0061*		0.03989 (0.08473), 0.6378		0.14783 (0.07890), 0.0610	
Five times per week (effects coded) [a]	-0.16369		-0.17747		-0.1613		-0.17778		-0.14947	
Location										
Group location (effects coded)	0.13745 (0.03456), <0.0001*	**6.37**	0.16012 (0.07747), 0.0388*	**6.45**	0.13099 (0.03869), 0.0007*	**5.89**	0.06481 (0.05087), 0.2027	**3.08**	0.19396 (0.04730), <0.0001*	**8.23**
Home location (effects coded) [a]	-0.13745		-0.16012		-0.13099		-0.06481		-0.19396	
Home Safety Consultation										
Home Safety Consult Included (effects coded)	-0.05149 (0.0349), 0.1404	**2.39**	-0.14332 (0.07733), 0.0638	**5.78**	-0.02546 (0.03929), 0.5170	**1.14**	-0.04001 (0.05167), 0.4387	**1.90**	-0.05975 (0.04750), 0.2085	**2.54**
Home Safety Consult not Included (effects coded) [a]	0.05149		0.14332		0.02546		0.04001		0.05975	
Constant										
Constant [b]	2.29628 (0.11337), <0.0001*	---	2.60558 (0.24732), <0.0001*	---	2.23381 (0.12836), <0.0001*	---	2.23535 (0.16405), <0.0001*	---	2.35391 (0.15750), <0.0001*	---

[a] The preference weights for reference levels of effects coded variables were recovered manually.
[b] The constant is positive and statistically significant, indicating that participants as a whole were more likely to choose to participate in any CFP program vs. not to participate in any program at all.
[c] When older adults choose a CFP program to participate in, how important are these five program features in influencing their choice? Importance scores are shown as percentages on a 0-100 scale, where 0 is least important and 100 is most important.
*p<0.05

Table 24. Preference Weights: Conditional Logit Interaction Effects Final Model, Final Analysis Cohort (n=328)

Attributes and Levels	Preference Weights	Standard Error	p-value
Cost			
Cost*Income (continuous)	-0.02279	0.00184	<0.0001*
Efficacy			
Efficacy (continuous)	0.00496	0.00136	0.0003*
Session Frequency			
Two times per week*Income (effects coded)	0.34324	0.10980	0.0018*
Three times per week*Income (effects coded)	0.06935	0.11884	0.5595
Four times per week*Income (effects coded)	-0.2152	0.12126	0.0759
Five times per week*Income (effects coded) [a]	-0.19739		
Location			
Group location*Income (effects coded)	0.31560	0.06859	<0.0001*
Home location*Income (effects coded) [a]	-0.31560		
Home Safety Consultation			
Home safety consult included (effects coded)	-0.06871	0.02885	0.0172*
Home safety consult not included (effects coded) [a]	0.06871		
Constant			
Constant [b]	0.21734	0.07879	0.0058*

[a] The preference weights for reference levels of effects coded variables were recovered manually.
[b] The constant is positive and statistically significant, indicating that participants as a whole were more likely to choose to participate in any CFP program vs. not to participate in any program at all.
*p<0.05

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Table 25. Preference Weights: Conditional Logit Models with Session Frequency Coded as Minutes of Exercise per Week, Final Analysis Cohort (n=328)

Attributes and Levels	Preference Weights	Standard Error	p-value
Cost			
Cost (continuous)	-0.04480	0.00147	<0.0001*
Efficacy			
Efficacy (continuous)	0.00686	0.00159	<0.0001*
Minutes of Exercise per Week			
Minutes of exercise per week (continuous)	-0.0004281	0.0005261	0.4158
Location			
Group location (effects coded)	0.14392	0.03430	<0.0001*
Home location (effects coded) [a]	-0.14392		
Home Safety Consultation			
Home safety consult included (effects coded)	-0.06471	0.03449	0.0606
Home safety consult not included (effects coded) [a]	0.06471		
Constant			
Constant [b]	2.38244	0.15424	<0.0001*

[a] The preference weights for reference levels of effects coded variables were recovered manually.
[b] The constant is positive and statistically significant, indicating that participants as a whole were more likely to choose to participate in any CFP program vs. not to participate in any program at all.
*p<0.05

Table 26. Preference Weights: Conditional Logit Interaction Effects Model, with Session Frequency Coded as Minutes of Exercise per Week, Final Analysis Cohort (n=328)

Attributes and Levels	Preference Weights	Standard Error	p-value
Cost			
Cost*Income (continuous)	-0.02241	0.00181	<0.0001*
Efficacy			
Efficacy (continuous)	0.00491	0.00136	0.0003*
Minutes of Exercise per Week			
Minutes of exercise per week (continuous)	-0.00123	0.0004275	0.0039*
Location			
Group location*Income (effects coded)	0.30050	0.06736	<0.0001*
Home location*Income (effects coded) [a]	-0.30050		
Home Safety Consultation			
Home safety consult included (effects coded)	-0.07054	0.02880	0.0143*
Home safety consult not included (effects coded) [a]	0.07054		
Constant			
Constant [b]	0.48240	0.12033	<0.0001*

[a] The preference weights for reference levels of effects coded variables were recovered manually.
[b] The constant is positive and statistically significant, indicating that participants as a whole were more likely to choose to participate in any CFP program vs. not to participate in any program at all.
*$p<0.05$

Table 27. Preference Weights: Conditional Logit Main Effects Final Model, Full Cohort

Attributes and Levels	Full Cohort (n=630) Preference Weights (Standard Error), p-value	Relative Importance Score (%) [c]	Lower Income (n=194) Preference Weights (Standard Error), p-value	Higher Income (n=436) Preference Weights (Standard Error), p-value	Lower Physical Function (n=295) Preference Weights (Standard Error), p-value	Higher Physical Function (n=335) Preference Weights (Standard Error), p-value
Cost						
Cost (continuous)	-0.0306 (0.0009586), <0.0001*	**83.71**	-0.03144 (0.00194), <0.0001*	-0.03082 (0.00112), <0.0001*	-0.02955 (0.00141), <0.0001*	-0.03144 (0.00131), <0.0001*
Efficacy						
Efficacy (continuous)	0.00350 (0.00111), 0.0016*	**1.25**	0.0003548 (0.00217), 0.8702	0.00472 (0.00131), 0.0003*	0.00295 (0.00164), 0.0724	0.00392 (0.00151), 0.0092*
Session Frequency						
Two times per week (effects coded)	0.00167 (0.04114), 0.9677		0.11062 (0.07952), 0.1642	-0.03493 (0.04845), 0.4709	0.01329 (0.06047), 0.8261	-0.01064 (0.05628), 0.8500
Three times per week (effects coded)	0.10167 (0.04126), 0.0137*	**9.27**	0.08062 (0.08118), 0.3207	0.11433 (0.04840), 0.0182*	0.12650 (0.06059), 0.0368*	0.08060 (0.05644), 0.1533
Four times per week (effects coded)	0.04916 (0.04114), 0.2321		-0.07886 (0.08411), 0.3485	0.09453 (0.04784), 0.0482*	0.00277 (0.06139), 0.9640	0.09234 (0.05563), 0.0969
Five times per week (effects coded) [a]	-0.1525		-0.11238	-0.17393	-0.14256	-0.1623
Location						
Group location (effects coded)	-0.05377 (0.02403), 0.0253*	**3.92**	-0.06200 (0.04771), 0.1938	-0.05251 (0.02808), 0.0615	-0.12178 (0.03552), 0.0006*	0.00314 (0.03278), 0.9238
Home location (effects coded) [a]	0.05377		0.06200	0.05251	0.12178	-0.00314
Home Safety Consultation						
Home Safety Consult Included (effects coded)	-0.02538 (0.02440), 0.2982	**1.85**	-0.070300 (0.04805), 0.1434	-0.00852 (0.02861), 0.7657	-0.04032 (0.03582), 0.2604	-0.01297 (0.03345), 0.6982
Home Safety Consult not Included (effects coded) [a]	0.02538		0.070300	0.00852	0.04032	0.01297
Constant						
Constant [b]	1.01858 (0.07792), <0.0001*	---	0.68772 (0.14963), <0.0001*	1.20514 (0.09245), <0.0001*	0.97843 (0.11382), <0.0001*	1.05179 (0.10712), <0.0001*

[a] The preference weights for reference levels of effects coded variables were recovered manually.

[b] The constant is positive and statistically significant, indicating that participants as a whole were more likely to choose to participate in any CFP program vs. not to participate in any program at all.

[c] When older adults choose a CFP program to participate in, how important are these five program features in influencing their choice? Importance scores are shown as percentages on a 0-100 scale, where 0 is least important and 100 is most important.

*p<0.05

Table 28. Preference Weights: Conditional Logit Model with Session Frequency Coded as Minutes of Exercise per Week, Full Cohort (n=630)

Attributes and Levels	Preference Weights	Standard Error	p-value
Cost			
Cost (continuous)	-0.03047	0.0009568	<0.0001*
Efficacy			
Efficacy (continuous)	0.00367	0.00110	0.0009*
Minutes of Exercise per Week			
Minutes of exercise per week (continuous)	-0.0007786	0.0003626	0.0318*
Location			
Group location (effects coded)	-0.04811	0.02394	0.0444*
Home location (effects coded) [a]	0.04811		
Home Safety Consultation			
Home safety consult included (effects coded)	-0.03160	0.02429	0.1933
Home safety consult not included (effects coded) [a]	0.03160		
Constant			
Constant [b]	1.16667	0.10801	<0.0001*

[a] The preference weights for reference levels of effects coded variables were recovered manually.
[b] The constant is positive and statistically significant, indicating that participants as a whole were more likely to choose to participate in any CFP program vs. not to participate in any program at all.
*p<0.05

Table 29. Preference Weights: Conditional Logit Interaction Effects Final Model, Full Cohort (n=630)

Attributes and Levels	Preference Weights	Standard Error	p-value
Cost			
Cost*Income (continuous)	-0.0192	0.00120	<0.0001*
Efficacy			
Efficacy (continuous)	0.00352	0.00104	0.0007*
Session Frequency			
Two times per week*Income (effects coded)	0.17265	0.07885	0.0286*
Three times per week*Income (effects coded)	0.08158	0.08210	0.3204
Four times per week*Income (effects coded)	-0.1390	0.08599	0.1059
Five times per week*Income (effects coded) [a]	-0.11523		
Location			
Group location*Income (effects coded)	0.08090	0.04490	0.0716
Home location*Income (effects coded) [a]	-0.08090		
Home Safety Consultation			
Home safety consult included (effects coded)	-0.04446	0.02269	0.0500*
Home safety consult not included (effects coded) [a]	0.04446		
Constant			
Constant [b]	-0.42690	0.05790	<0.0001*

[a] The preference weights for reference levels of effects coded variables were recovered manually.
[b] The constant is positive and statistically significant, indicating that participants as a whole were more likely to choose to participate in any CFP program vs. not to participate in any program at all.
*p<0.05

Table 30. Preference Weights: Conditional Logit Interaction Effects Model, with Session Frequency Coded as Minutes of Exercise per Week, Full Cohort (n=630)

Attributes and Levels	Preference Weights	Standard Error	p-value
Cost			
Cost*Income (continuous)	-0.01912	0.00119	<0.0001*
Efficacy			
Efficacy (continuous)	0.00348	0.00104	0.0008*
Minutes of Exercise per Week			
Minutes of exercise per week (continuous)	-0.00110	0.0003352	0.0010*
Location			
Group location*Income (effects coded)	0.07951	0.04467	0.0751
Home location*Income (effects coded) [a]	-0.07951		
Home Safety Consultation			
Home safety consult included (effects coded)	-0.04652	0.02268	0.0402*
Home safety consult not included (effects coded) [a]	0.04652		
Constant			
Constant [b]	-0.19149	0.09147	0.0363*

[a] The preference weights for reference levels of effects coded variables were recovered manually.
[b] The constant is positive and statistically significant, indicating that participants as a whole were more likely to choose to participate in any CFP program vs. not to participate in any program at all.
*p<0.05

Table 31. Preference Weights: Conditional Logit Model, Reduced Cohort (n=539)

Attributes and Levels	Preference Weights	Standard Error	p-value	Relative Importance Score (%) [c]
Cost				
Cost (continuous)	-0.03365	0.00110	<0.0001*	**77.23**
Efficacy				
Efficacy (continuous)	0.00353	0.00124	0.0044*	**6.48**
Minutes of Exercise per Week				
Two times per week (effects coded)	0.01868	0.04605	0.6850	
Three times per week (effects coded)	0.07807	0.04620	0.0911	
Four times per week (effects coded)	0.05804	0.04611	0.2081	**7.13**
Five times per week (effects coded)	-0.15479			
Location				
Group location (effects coded)	-0.07601	0.02703	0.0049*	
Home location (effects coded) [a]	0.07601			**7.06**
Home Safety Consultation				
Home safety consult included (effects coded)	-0.03424	0.02736	0.2108	
Home safety consult not included (effects coded) [a]	0.03424			**2.10**
Constant				
Constant [b]	1.03091	0.08633	<0.0001*	---

[a] The preference weights for reference levels of effects coded variables were recovered manually.

[b] The constant is positive and statistically significant, indicating that participants as a whole were more likely to choose to participate in any CFP program vs. not to participate in any program at all.

[c] When older adults choose a CFP program to participate in, how important are these five program features in influencing their choice? Importance scores are shown as percentages on a 0-100 scale, where 0 is least important and 100 is most important.

*p<0.05

iii. Aim 2 Trade-offs Between Incentive Attributes:

In choosing between CFP program designs, participants made trade-offs between the program attributes described in the DCE. These trade-offs were quantified by comparing the utility difference between the most and least preferred levels of each attribute. In the final analysis cohort (n=328), program cost was the most important factor in determining program choice, followed by session frequency, efficacy of the program, location, and inclusion of a home safety consultation. Specifically, decreasing the cost of the program from $100/month to $25/month gave participants 12.0 times as much utility as changing the session frequency from 5 times per week to 3 times per week would have; 12.1 times as much utility as an improvement in the program's efficacy from a 10% reduction in falls rate to a 70% reduction in falls rate would have; 12.3 times as much utility as changing the program from a home-based setting to a group setting would have; and 32.7 times as much utility as eliminating the home safety consultation from the program would have. In terms of program components that may be readily modified, changing the frequency of the program sessions from 5 times per week to 3 times per week gave participants 2.7 times as much utility as eliminating the home safety consultation would have, and changing the location of the program from a home-based to a group setting also gave participants about 2.7 times as much utility as eliminating the home safety component would have. Relative importance scores are used to compare these trade-offs between attributes in Figure 6, by income and physical function level.

This general pattern of trade-offs between attributes differed based on older adults' physical functional status and income level. For those with a higher physical function

level, cost was the most important factor in determining CFP program choice, followed by program efficacy, location, session frequency, and inclusion of a home safety consultation. For those with lower physical function level, cost remained the most important factor in determining CFP program choice, followed by program efficacy, session frequency, location, and inclusion of a home safety consultation. Similarly, for those with higher income level, cost was the most important factor in determining CFP program choice, followed by program efficacy, session frequency, location, and inclusion of a home safety consultation. For those with lower income level, cost remained the most important factor in determining CFP program choice, followed by session frequency, location, inclusion of a home safety consultation, and program efficacy. In other words, cost was the most important factor in older adults' choice between CFP programs, regardless of income (relative importance score of 77.05% in the lower income group, and 73.79% in the higher income group). For participants with lower income, program efficacy was the least important factor (relative importance score of 2.02%), while inclusion of a home safety consultation was least important for those with higher income (relative importance score of 1.14%). For comparison, results of the ranking task question are shown in Table 32.

Figure 6. Relative Importance Scores for Five CFP Program Features.

Panel A. Income
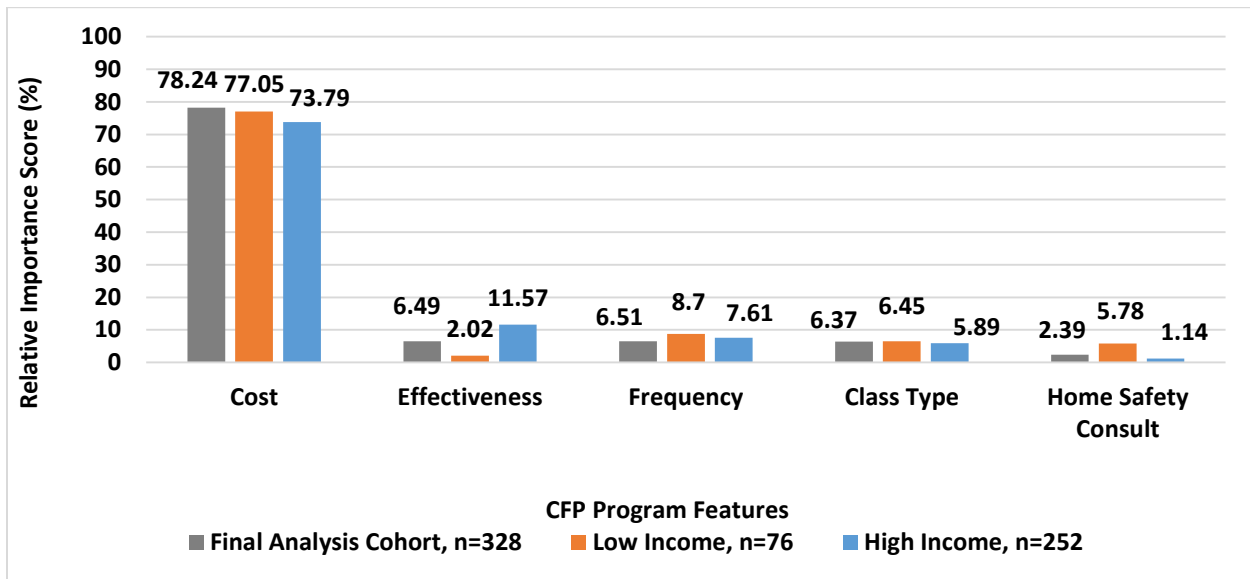
*When older adults choose a CFP program to participate in, how important are these five program features in influencing their choice? Importance scores are shown as percentages on a 0-100 scale, where 0 is least important and 100 is most important.

Panel B. Physical Function
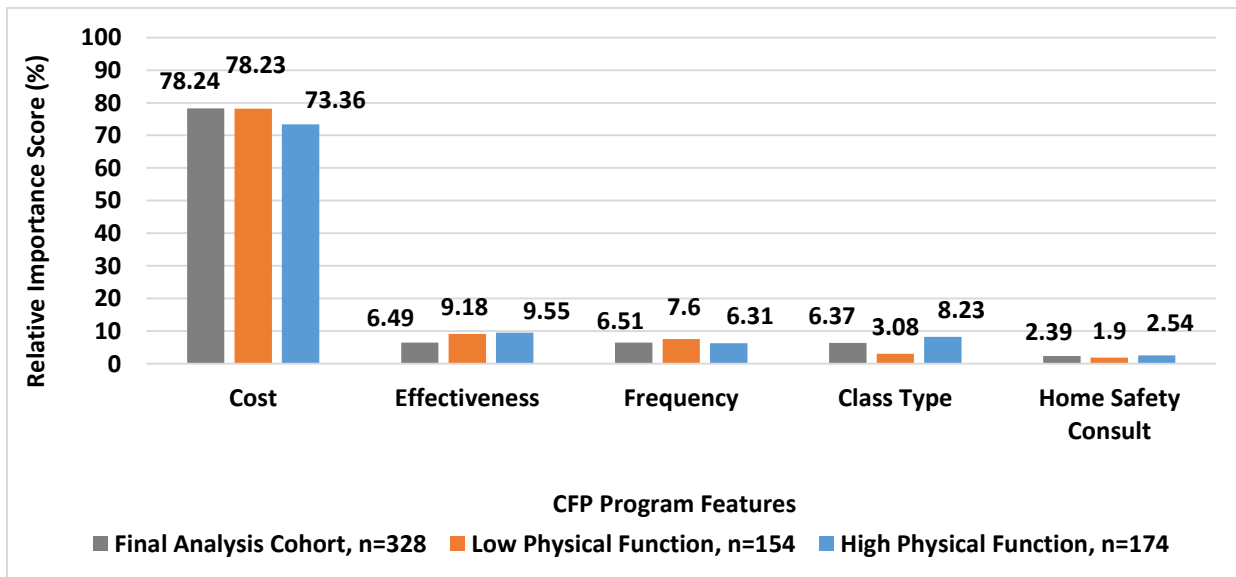
*When older adults choose a CFP program to participate in, how important are these five program features in influencing their choice? Importance scores are shown as percentages on a 0-100 scale, where 0 is least important and 100 is most important.

Table 32. Preferences for Features of CFP Programs, Ranking Task Results*

Attribute	Group	Ranking 1	Ranking 2	Ranking 3	Ranking 4	Ranking 5
Cost	Full Cohort	361 (57.30)	117 (18.57)	59 (9.37)	45 (7.14)	48 (7.62)
	Final Analysis	179 (54.57)	60 (18.29)	40 (12.20)	24 (7.32)	25 (7.62)
Efficacy	Full Cohort	124 (19.68)	120 (19.05)	136 (21.59)	164 (26.03)	86 (13.65)
	Final Analysis	84 (25.61)	60 (18.29)	60 (18.29)	81 (24.70)	43 (13.11)
Location	Full Cohort	96 (15.24)	215 (34.13)	160 (25.40)	98 (15.56)	61 (9.68)
	Final Analysis	45 (13.72)	106 (32.32)	89 (27.13)	52 (15.85)	36 (10.98)
Session Frequency	Full Cohort	31 (4.92)	129 (20.48)	218 (34.60)	191 (30.32)	61 (9.68)
	Final Analysis	16 (4.88)	75 (22.87)	116 (35.37)	100 (30.49)	21 (6.40)
Home Safety Consultation	Full Cohort	18 (2.86)	49 (7.78)	57 (9.05)	132 (20.95)	374 (59.37)
	Final Analysis	4 (1.22)	27 (8.23)	23 (7.01)	71 (21.65)	203 (61.89)

*Rankings are from 1-5, with 1 being most preferred and 5 being least preferred.

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C. Aim 3: To Assess Older Adults' Willingness To Pay (WTP) For CFP Programs, Net Benefit Of Participating In CFP Programs, And Predicted Program Uptake, And How These Are Modified By Socioeconomic Status.

i. Aim 3 Willingness to Pay (WTP):

Extracted CFP program costs are listed in Table 33. Results of the DCE data for the final analysis cohort showed that participants' mean marginal WTP for the five examples of hypothetical CFP programs (Table 34) ranged from $56.10/month (95% CI=$49.21-$62.58) to $62.45/month (95% CI=$56.35-$68.23).   For the lower income group, participants' mean marginal WTP for these example programs ranged from $53.95 (95% CI=$40.40-$66.93) to $64.81 (95% CI=$53.08-$76.82), and in the higher income group ranged from $56.20 ($51.52-$61.03) to $63.12 (95% CI=$56.19-$69.82).   Also, magnitude patterns for WTP values varied according to participants' income level (Table 34). The bootstrap distributions for the mean marginal WTP values are shown in Figure 7 by income group.

Table 33. Extracted CFP Program Costs in 2018 USD

Program	Source	Total Program Cost	Total Training, Software, and Licensing Costs*	Implementation Cost (per program)	Total Patient Cost (per program)[b]	Total Patient Cost (per month)
A Matter of Balance (MOB)	NCOA[9,98,99]	$2,485.76/ group of 14	$1,500	$985.76	$70.41	$35.21
CAPABLE	NCOA[100-103]	U[a]	U	$2,825/ person	$0[c]	$0
Enhance Fitness	NCOA[9,104-108]	$6,350 for group of 24	$5,450	$900	$37.50	$3.13
FallsTalk	NCOA[109-113]	U	$645	U	$645	$107.50
FallScape	NCOA[109-113]	U	$1,090	U	$1,090	$181.67
Fit and Strong!	NCOA[96,114-116]	$4,696.40	$1,000	$3,696.40	$184.32	$92.16
Healthy Steps for Older Adults (HSOA)	NCOA)[117-121]	U	U	U	$0[c]	$0
YMCA Moving for Better Balance	NCOA[45,67,122-125]	U	U	$386	$70	$23.33
The Otago Exercise Program (OEP)	NCOA[67,96,126-129] Medicare Interactive[290]	$2,065	$25	$2,040	$339.15	$28.26
Stay Active and Independent for Life (SAIL)	NCOA[96,131-135]	U	$185	U	$0[c]	$0
Stepping On	NCOA[96,136-138]	U	$1,200 ($250 in Wisconsin)	U	$211.38	$105.69
Tai Chi for Arthritis	NCOA[96,125,139-142]	U	$275	U	$27.5	$13.75
Tai Ji Quan: Moving for Better Balance (TJQMBB)	NCOA[45,67,96,143-145]	$479.02	$375	$104.02	$104.02	$17.37
Average Cost		$3,215.24	$1,174.50	$1562.45	$213.80	**$46.77 (range= $0-$181.67)**

*Training, software, and licensing costs are either one-time or annual fees.
[a]U=unknown
[b]Costs to participants are based on implementation costs, unless otherwise indicated by the program. If implementation cost is unknown, costs to participants are based on total program costs, unless otherwise indicated by the program. Total costs are based on first-year program implementation plus training, software, and licensing costs. Over time, total program costs may decrease after one-time training, software, and licensing costs have been paid.
[c]Some programs indicate that participants pay no cost to attend.

Table 34. Older Adults' Mean Marginal Willingness to Pay (WTP) and Net Benefit

for Participating in Select CFP Programs, by Income Level*[a]

Program Description	Final Analysis Cohort (n=328)		Lower Income (n=76)		Higher Income (n=252)	
Strength and balance exercise program offered for 1 hour, 3 times per week in a community center group setting, does not include a home safety consultation, and reduces falls rate by 30% (similar to SAIL).	WTP/month (95% CI)	$62.45 ($56.35-$68.23)	WTP/month (95% CI)	$60.91 ($50.04-$73.21)	WTP/month (95% CI)	$63.12 ($56.19-$69.82)
	Net Benefit (95% CI): Base Case	$62.45 ($56.35-$68.23)	Net Benefit (95% CI): Base Case	$60.91 ($50.04-$73.21)	Net Benefit (95% CI): Base Case	$63.12 ($56.19-$69.82)
	Net Benefit (95% CI): $0 participant cost	$62.45 ($56.35-$68.23)	Net Benefit (95% CI): $0 participant cost	$60.91 ($50.04-$73.21)	Net Benefit (95% CI): $0 participant cost	$63.12 ($56.19-$69.82)
	Net Benefit (95% CI): $100/month participant cost	$-37.55 ($-43.65-$-31.77)	Net Benefit (95% CI): $100/month participant cost	$-39.09 ($-49.96-$-26.79)	Net Benefit (95% CI): $100/month participant cost	$-36.88 ($-43.81-$-30.18)
Strength and balance exercise program offered for 1 hour, 2 times per week in a community center group setting, includes a home safety consultation, and reduces falls rate by 30% (similar to Stepping On).	WTP/month (95% CI)	$56.59 ($52.44-$60.38)	WTP/month (95% CI)	$58.24 ($49.92-$66.38)	WTP/month (95% CI)	$56.20 ($51.52-$61.03)
	Net Benefit (95% CI): Base Case	$-49.10 ($-53.25-$-45.31)	Net Benefit (95% CI): Base Case	$-47.45 ($-55.77-$-39.31)	Net Benefit (95% CI): Base Case	$-49.49 ($-54.17-$-44.66)
	Net Benefit (95% CI): $0 participant cost	$56.59 ($52.44-$60.38)	Net Benefit (95% CI): $0 participant cost	$58.24 ($49.92-$66.38)	Net Benefit (95% CI): $0 participant cost	$56.20 ($51.52-$61.03)
	Net Benefit (95% CI): $100/month participant cost	$-43.41 ($-47.56-$-39.62)	Net Benefit (95% CI): $100/month participant cost	$-41.76 ($-50.08-$-33.62)	Net Benefit (95% CI): $100/month participant cost	$-43.80 ($-48.48-$-38.97)
Strength and balance exercise program offered for 1 hour, 2 times per week in a community center group setting, does not include a home safety consultation, and reduces falls rate by 50% (similar to TJQMBB).	WTP/month (95% CI)	$62.11 ($56.21-$67.91)	WTP/month (95% CI)	$64.81 ($53.08-$76.82)	WTP/month (95% CI)	$61.45 ($54.54-$68.33)
	Net Benefit (95% CI): Base Case	$44.74 ($38.84-$50.54)	Net Benefit (95% CI): Base Case	$47.44 ($35.71-$59.45)	Net Benefit (95% CI): Base Case	$44.08 ($37.17-$50.96)
	Net Benefit (95% CI): $0 participant cost	$62.11 ($56.21-$67.91)	Net Benefit (95% CI): $0 participant cost	$64.81 ($53.08-$76.82)	Net Benefit (95% CI): $0 participant cost	$61.45 ($54.54-$68.33)
	Net Benefit (95% CI): $100/month participant cost	$-37.89 ($-43.79-$-32.09)	Net Benefit (95% CI): $100/month participant cost	$-35.19 ($-46.92-$-23.18)	Net Benefit (95% CI): $100/month participant cost	$-38.55 ($-45.46-$-31.67)
Strength and balance exercise program offered for 1 hour, 2 times per week in a community center group setting, does not include a home safety consultation, and reduces falls rate by 30% (similar to MOB).	WTP/month (95% CI)	$58.82 ($52.79-$64.62)	WTP/month (95% CI)	$64.30 ($53.14-$76.71)	WTP/month (95% CI)	$57.27 ($50.27-$64.20)
	Net Benefit (95% CI): Base Case	$23.61 ($17.58-$29.41)	Net Benefit (95% CI): Base Case	$29.09 ($17.93-$41.50)	Net Benefit (95% CI): Base Case	$22.06 ($15.06-$28.99)
	Net Benefit (95% CI): $0 participant cost	$58.82 ($52.79-$64.62)	Net Benefit (95% CI): $0 participant cost	$64.30 ($53.14-$76.71)	Net Benefit (95% CI): $0 participant cost	$57.27 ($50.27-$64.20)
	Net Benefit (95% CI): $100/month participant cost	$-41.18 ($-47.21-$-35.38)	Net Benefit (95% CI): $100/month participant cost	$-35.70 ($-46.86-$-23.29)	Net Benefit (95% CI): $100/month participant cost	$-42.73 ($-49.73-$-35.80)

Strength and balance exercise program offered for 1 hour, 3 times per week in a home-based setting, does not include a home safety consultation, and reduces falls rate by 30% (similar to OTAGO).	**WTP/month (95% CI)**	$56.10 ($49.21-$62.58)	**WTP/month (95% CI)**	$53.95 ($40.40-$66.93)	**WTP/month (95% CI)**	$56.91 ($49.30-$64.39)
	Net Benefit (95% CI): Base Case	$27.84 ($20.95-$34.32)	**Net Benefit (95% CI): Base Case**	$25.69 ($12.14-$38.67)	**Net Benefit (95% CI): Base Case**	$28.65 ($21.04-$36.13)
	Net Benefit (95% CI): $0 participant cost	$56.10 ($49.21-$62.58)	**Net Benefit (95% CI): $0 participant cost**	$53.95 ($40.40-$66.93)	**Net Benefit (95% CI): $0 participant cost**	$56.91 ($49.30-$64.39)
	Net Benefit (95% CI): $100/month participant cost	$-43.90 ($-50.78-$-37.42)	**Net Benefit (95% CI): $100/month participant cost**	$-46.05 ($-59.60-$-33.07)	**Net Benefit (95% CI): $100/month participant cost**	$-43.09 ($-50.70-$-35.61)

*Income was dichotomized into "low" (<$25,000 annual household income) and "high" ($\geq$$25,000 household income) categories based on the median annual household income for U.S. older adults (age 65+) of $25,000.

[a]Mean marginal WTP for each hypothetical CFP program was calculated using utility ratios obtained from the Aim 2 DCE, with 95% CI's calculated via 1,000 bootstrapped samples with replacement. For the base case analysis, net benefit of participating in each of these hypothetical CFP programs (from older adults' perspective) was calculated as the mean marginal WTP/month for that program minus the average monthly cost per participant for that program, as extracted from NCOA data and presented in Table 33. Given the broad range in program costs and uncertainty in costs paid directly by participants (due to geographic, service provider, or health system differences in cost), participant costs were varied from $0 to $100/month in sensitivity analyses to examine how net benefit may change.

Figure 7. Mean Marginal Willingness to Pay (WTP) Bootstrap Distributions, Based on 1,000 Bootstrapped Samples with Replacement

Panel A. Final Analysis Cohort, n=328

Bootstrap Distribution

*Strength and balance exercise program offered for 1 hour, 3 times per week in a community center group setting, does not include a home safety consultation, and reduces falls rate by 30%. Mean marginal WTP data is expressed in 2018 USD.

Bootstrap Distribution

*Strength and balance exercise program offered for 1 hour, 2 times per week in a community center group setting, does include a home safety consultation, and reduces falls rate by 30%. Mean marginal WTP data is expressed in 2018 USD.

Bootstrap Distribution

*Strength and balance exercise program offered for 1 hour, 2 times per week in a community center group setting, does not include a home safety consultation, and reduces falls rate by 50%. Mean marginal WTP data is expressed in 2018 USD.

Bootstrap Distribution

*Strength and balance exercise program offered for 1 hour, 3 times per week in a home-based setting, does not include a home safety consultation, and reduces falls rate by 30%. Mean marginal WTP data is expressed in 2018 USD.

Bootstrap Distribution

*Strength and balance exercise program offered for 1 hour, 2 times per week in a community center group setting, does not include a home safety consultation, and reduces falls rate by 30%. Mean marginal WTP data is expressed in 2018 USD.

Panel B. Final Analysis Cohort, Lower Income Group, n=76

*Strength and balance exercise program offered for 1 hour, 3 times per week in a community center group setting, does not include a home safety consultation, and reduces falls rate by 30%. Mean marginal WTP data is expressed in 2018 USD.

Bootstrap Distribution

*Strength and balance exercise program offered for 1 hour, 2 times per week in a community center group setting, does include a home safety consultation, and reduces falls rate by 30%. Mean marginal WTP data is expressed in 2018 USD.

Bootstrap Distribution

*Strength and balance exercise program offered for 1 hour, 2 times per week in a community center group setting, does not include a home safety consultation, and reduces falls rate by 50%. Mean marginal WTP data is expressed in 2018 USD.

Bootstrap Distribution

*Strength and balance exercise program offered for 1 hour, 3 times per week in a home-based setting, does not include a home safety consultation, and reduces falls rate by 30%. Mean marginal WTP data is expressed in 2018 USD.

Bootstrap Distribution

*Strength and balance exercise program offered for 1 hour, 2 times per week in a community center group setting, does not include a home safety consultation, and reduces falls rate by 30%. Mean marginal WTP data is expressed in 2018 USD.

Panel C. Final Analysis Cohort, Higher Income Group, n=252

*Strength and balance exercise program offered for 1 hour, 3 times per week in a community center group setting, does not include a home safety consultation, and reduces falls rate by 30%. Mean marginal WTP data is expressed in 2018 USD.

Bootstrap Distribution

*Strength and balance exercise program offered for 1 hour, 2 times per week in a community center group setting, does include a home safety consultation, and reduces falls rate by 30%. Mean marginal WTP data is expressed in 2018 USD.

Bootstrap Distribution

*Strength and balance exercise program offered for 1 hour, 2 times per week in a community center group setting, does not include a home safety consultation, and reduces falls rate by 50%. Mean marginal WTP data is expressed in 2018 USD.

Bootstrap Distribution

*Strength and balance exercise program offered for 1 hour, 3 times per week in a home-based setting, does not include a home safety consultation, and reduces falls rate by 30%. Mean marginal WTP data is expressed in 2018 USD.

Bootstrap Distribution

*Strength and balance exercise program offered for 1 hour, 2 times per week in a community center group setting, does not include a home safety consultation, and reduces falls rate by 30%. Mean marginal WTP data is expressed in 2018 USD.

ii. Aim 3 Net Benefit:

The average participant cost to participate in a CFP program was $46.77/month (range=$0-$181.67/month) based on 2018 cost data extracted from NCOA's website for 13 existing evidence-based CFP programs (Table 33). In the base case, net benefit of participating in five different hypothetical CFP programs (from older adults' perspective) was calculated as the mean marginal WTP/month for that program minus the average monthly cost/participant for a similar program in Table 33 (SAIL, average monthly participant cost=$0; Stepping On, average monthly participant cost=$105.69; TJQMBB, average monthly participant cost=$17.37; MOB, average monthly participant cost=$35.21; and OTAGO, average monthly participant cost=$28.26 based on 2018 data on the NCOA website). In the final analysis cohort, the base case net benefit/month ranged from $62.45 (95% CI=$56.35-$68.23) to $-49.10 (95% CI=$-53.25-$-45.31) for older adults who participated in the five hypothetical CFP programs. In one-way sensitivity analyses, participant costs were changed from program-specific costs to $0 or $100/month to examine how net benefit may change based on uncertainty in costs paid directly by participants. A participant cost of $0 results in net benefit values equal to the WTP values, while a participant cost of $100/month results in negative net benefit across all five example programs. Also, magnitude patterns for net benefit values varied according to participants' income level (Table 34).

iii. Aim 3 Predicted Program Uptake:

Program cost was varied between $25/month and $50/month to examine how uptake among the five example programs may change based on cost. For the final analysis

cohort, predicted uptake (Table 35) among the five examples of hypothetical CFP programs was lowest for the program offered for 1 hour, 2 times per week in a community center group setting, which included a home safety consultation, reduced falls rate by 30%, and cost participants $50/month (9.01% of older adults surveyed would choose this program out of the five example CFP programs). Predicted uptake among these five programs was highest for the program offered for 1 hour, 2 times per week in a community center group setting, which did not include a home safety consultation, reduced falls rate by 30%, and cost participants $25/month (47.61% of older adults surveyed would choose this program out of the five example CFP programs). This uptake pattern was consistent with the uptake pattern in the high income group, but differed from the uptake pattern seen in the low income group. Among those in the lower income group, the predicted uptake was lowest for the program offered for 1 hour, 3 times per week in a home-based setting, which did not include a home safety consultation, reduced falls rate by 30%, and cost participants $50 (5.00% of older adults in the lower income group would choose this program out of the five example CFP programs).

Table 35. Predicted Uptake of Select CFP Programs

Program Description	Probability of Choice		
	Final Analysis Cohort (n=328)	Lower Income (n=76)	Higher Income (n=252)
Strength and balance exercise program offered for 1 hour, 3 times per week in a community center group setting, does not include a home safety consultation, reduces falls rate by 30% (similar to SAIL), and costs participants $50/month.	17.68%	13.64%	19.02%
Strength and balance exercise program offered for 1 hour, 2 times per week in a community center group setting, includes a home safety consultation, reduces falls rate by 30% (similar to Stepping On), and costs participants $50/month.	9.01%	10.20%	8.66%
Strength and balance exercise program offered for 1 hour, 2 times per week in a community center group setting, does not include a home safety consultation, reduces falls rate by 50% (similar to TJQMBB), and costs participants $50/month.	16.65%	18.84%	15.90%
Strength and balance exercise program offered for 1 hour, 2 times per week in a community center group setting, does not include a home safety consultation, reduces falls rate by 30% (similar to MOB), and costs participants $25/month.	47.61%	52.33%	45.93%
Strength and balance exercise program offered for 1 hour, 3 times per week in a home-based setting, does not include a home safety consultation, reduces falls rate by 30% (similar to OTAGO), and costs participants $50/month.	9.04%	5.00%	10.49%

iv. Aim 3 Contingent Valuation:

In one open-ended contingent valuation question (Figure 8), participants in the final analysis cohort were willing to pay an average of $26.23 USD per month to participate in a CFP program (SD=$26.537, range $0-$256.00). Among these participants, those with low income were willing to pay an average of $18.63 USD per month (SD=$18.18, range $0-$100.00), while those with high income were willing to pay an average of $28.53 USD per month (SD=$28.18, range=$0-$256.00).

Figure 8. Contingent Valuation Question

Imagine your doctor recommends you participate in a program to strengthen your muscles and improve balance.

- The program includes aerobics and using hand-weights.
- The level of difficulty of the exercise is medium (not light, but not heavy).
- Imagine it is held at a community center near your home for 1 hour, twice per week for 3 months.
- A group of people participate together.
- An exercise trainer teaches you how to do each exercise. The trainer is experienced and friendly.
- The program includes visits with a home safety expert who will help you find and fix hazards in your home that could cause you to fall (for example, loose rugs).
- Every year, 30 out of 100 people fall at least once. This program reduces that to 15 out of 100 people. This means the program reduces falls by fifty percent (50%).

How much would you be willing to pay per month to participate in this program, in dollars? **Please type a number.**

$ [_____] / month

Chapter 5
Discussion

I. Study Overview

This study used a mixed methods approach to address the question, "What are community-dwelling older adults' (65+) preferences for features of community-based fall prevention programs?" This was accomplished through three aims.

A. Aim 1: To Characterize Key Features Of A CFP Program From The Perspective Of Older Adults.

Key features were identified through qualitative meta-synthesis of patients' preferences for CFP program features, and interviews with older adults, caregivers, and a falls expert.

B. Aim 2: To Quantitatively Determine Older Adults' Preferred CFP Program Design And How This Is Modified By Socioeconomic Status And Physical Functional Status.

A national online survey was used to quantitatively prioritize CFP program features that are preferred by older adults, using a discrete choice experiment (DCE) and conditional logit models. Analyses were repeated in different sub-groups to determine differences in preferences between older adults who self-reported low vs. high annual household income level and physical functional status.

C. Aim 3: To Assess Older Adults' Willingness To Pay (WTP) For CFP Programs, Net Benefit Of Participating In CFP Programs, And Predicted Uptake Of CFP Program Designs, And How These Are Modified By Socioeconomic Status.

Willingness to pay for a CFP program and net benefit of CFP program participation were assessed from the perspective of older adults, using the results of the Aim 2 DCE. Analyses were repeated in different sub-groups to determine differences in WTP and net benefit of CFP program participation between older adults who self-reported low vs. high annual household income level.

II. Review of Previous Literature and What this Study Adds

Despite the existence of real-world effectiveness data, cost and ROI data, federal funding mechanisms, and provider- and Medicare plan-level incentives for utilization of evidence-based CFP programs for older adults, these programs remain severely under-utilized,[10,150-157] even as falls in community-dwelling older adults continue to rise.[11] One reason for this may be that older adults are not engaged by current CFP program designs. Results of the current mixed methods study begin to address this by examining older adults' preferences for features of CFP programs, and how these preferences may change based on older adults' physical functional status and income level.

Results of the Aim 1 meta-synthesis build on the results from previous systematic reviews of older adults' experiences with CFP and exercise programs (Table 36).[161,195,291] The meta-synthesis results include articles published after the Title III-D evidence-based requirement for CFP programs was implemented, qualitative coding in Atlas.ti, code frequency counts (groundedness), and an overall assessment of the quality of evidence using the CERQual approach. Meta-synthesis results pool the findings of multiple qualitative, mixed methods, and quantitative descriptive studies, in order to draw overarching themes that emerge from a synthesis of quantitative "big data" and qualitative "thick data." Also, population heterogeneity may be better captured by pooling the results of multiple existing studies in different populations, rather than conducting smaller-scale primary data collection. Unlike quantitative meta-

analysis, qualitative meta-analysis is well-suited to incorporating heterogeneity in study methods and populations through within-case and cross-case qualitative analysis.[215] Further, qualitative results from Aim 1 were supplemented with quantitative results from Aims 2 and 3. This builds on results of a previous best-worst-scaling survey that quantified older adults' preferences for features of exercise programs,[255] by incorporating features unique to fall prevention programs (such as home safety consultations) and investigating heterogeneity in preferences based on physical functional status and income level. The current study also began to explore older adults' willingness to pay for participating in CFP programs, net benefit of participating in CFP programs from the perspective of older adults, and older adults' likelihood to choose a particular CFP program from among competing options. Results may help to guide program evaluation, program design, and quality improvement efforts for health systems and other community providers of CFP programs.

Table 36. Comparison of Aim 1 Qualitative Meta-synthesis to Previous

Systematic Reviews on Older Adults' Experiences with CFP Programs

Comparison Criteria	Previous Reviews[161,195,291]	Aim 1 Qualitative Meta-synthesis
Includes older adults' preferred CFP program features	x	x
Includes interview, focus group, and survey studies	x	x
Includes qualitative synthesis of studies	x	x
Includes studies published after the Title III-D evidence-based requirement for CFP programs was implemented		x
Includes qualitative coding		x
Includes code frequency counts		x
Includes assessment of overall quality-of-evidence		x

III. Synthesis of Findings Across Aims

To begin investigating older adults' preferences for features of CFP programs, Aim 1 included a systematic literature review and meta-synthesis of qualitative, mixed methods, and quantitative descriptive studies. A total of 54 articles were retained in the review, representing the perspectives of 20,540 older adults. There were 158 final codes in the meta-synthesis, and inter-coder reliability was high (Krippendorff's alpha=0.756). The most commonly grounded codes were related to social interaction and support; program location and setting; the level of exercise difficulty and ability to tailor or self-pace exercise regimens; flexibility and fit of the programs with older adults' daily routines; transportation; and the instructor's personality and skills.

Three overarching analytical themes emerged from the qualitative meta-synthesis. The first theme was that older adults prefer CFP programs with immediate benefits. This included two categories: social support; and physical & mental benefits. The social support category aligned with the social support construct derived from the *CDPM Framework*, while the remaining category emerged from the data. The second theme was that older adults prefer CFP programs that appear trustworthy and legitimate. This included two categories: endorsement by others; and familiarity & learning resources. Both of these categories emerged from the data. The third theme was that CFP programs should be easy to access and fit into older adults' daily routines. This included two categories: ease of access & service utilization; and self-management &

tailoring. These categories aligned with the ease of access, service utilization, and self-management constructs derived from the *CDPM Framework*.

The first overarching theme that emerged from the meta-synthesis of coded articles was that older adults prefer CFP programs with immediate benefits. Program benefits should include social, physical, and mental benefits. While a preference for group settings may be inferred from older adults' enjoyment of social interactions during group-based CFP programs, not all older adults shared this preference. For example, some participants felt uncomfortable exercising in public or group settings. This theme was consistent with findings from the interviews with older adults, caregivers, and a falls expert. In these interviews, participants expressed that social interaction is a strong motivator for program participation, as is noticing improvement in one's own physical and mental health as a result of program participation.

The second theme that emerged from the meta-synthesis was that older adults prefer CFP programs that appear trustworthy and legitimate. Programs should be endorsed by trusted healthcare professionals so that participants can have peace of mind and confidence in the program's legitimacy and effectiveness. When CFP program options and alternatives were not discussed by healthcare providers, older adults who were at risk for falling were unsure about where else to obtain this information. Further, when programs were offered in familiar community locations, such as senior activity centers, this offered an additional layer of endorsement and legitimacy to the program in the eyes of older adults. Also, older adults appreciated and felt more comfortable

participating in programs if they saw a demonstration of program content ahead of time,

participated in a sample classes, or had prior experience with the program elements or

exercises. It was important that exercises be demonstrated and explained clearly by

instructors prior to older adults' participation. This created a sense of familiarity with the

exercise regimen, trust in the instructor, and trust in older adults' own abilities. Trust in

the instructor was also established by building rapport with participants, having a

positive personality, and demonstrating skill and knowledge. Additionally, it was

important to older adults that they be able to ask questions about program features they

did not understand, such as how to perform specific exercises correctly and safely, and

the reasons why certain exercises or other features were included in the program.

When instructors or other personnel were not available to answer questions (such as in

some home-based programs), print or media resources should be provided that clearly

explain program features and the rationale for their inclusion in the program, and that

clearly demonstrate how to safely perform specific exercises.

The third theme that emerged from the meta-synthesis was that older adults prefer

programs that are easily accessible and that fit into their daily routines. Programs

should be easy to access in terms of affordability, as well as being held at a convenient

location close to home, with available and low-cost transportation to the location. Some

participants were willing to pay a minimal fee, such as $1-2 per week, or $5 per week.

Environmental factors should be taken into consideration, such as weather,

road/pavement quality, and neighborhood safety that influence older adults' likelihood to

travel or exercise outside. Programs should be tailored to individual needs, be flexible,

and allow older adults to self-manage their exercise and fall prevention regimens, while keeping in mind the need to facilitate habit formation of these regimens. All of these things may influence whether an older adult prefers a group- or home-based CFP program, a combination of the two, and/or would benefit from follow-up program sessions to encourage habit formation. This theme was also consistent with findings from the interviews with older adults, caregivers, and a falls expert. In these interviews, participants expressed a willingness to pay for exercise programs ranging from $0 to $150 per month.

While there was high confidence in the findings that emerged from the Aim 1 meta-synthesis, heterogeneity in older adults' preferences for CFP program features was noticed. In particular, while older adults in the meta-synthesis overwhelmingly expressed a preference for social interaction to be part of CFP or exercise programs, some older adults expressed that exercising or participating in CFP programs could be awkward, embarrassing, or stigmatizing in the presence of others. This was especially mentioned by older adults when programs were composed of people who were "not like" the participant in terms of age, sex, culture, and/or functional status. This might imply that there is heterogeneity in older adults' preferences for 1) social setting of CFP programs (alone or in a group), and 2) location of CFP programs (at home, outside, or at a community center/group class location). Indeed, while results of the meta-synthesis suggest that group locations may be preferred by older adults due to the social benefits, some previous studies have noted that older adults have a preference for home-based exercise or CFP programs, or programs that do not require transportation.[292,293] Further,

older adults with lower income, lower functional status, and/or who lack low-cost transportation options may be less willing to travel to program locations not in close proximity to home. This is further supported by results of the Aim 1 interviews, in which some participants mentioned traveling for 30-40 minutes to reach the cardiac rehab program, which they stated was not feasible for them long-term due to the cost of gas. Of note, older adults/caregivers in the Aim 1 interviews were current participants of a group exercise and education program (the cardiac rehab program) that was offered three times per week and was fully covered by some clients' health insurance. Thus, these participants may have been predisposed towards group programs of a similar design.

Aim 1 findings revealed a knowledge gap in terms of specific combinations of features that older adults prefer in CFP programs, including combinations of session frequency and cost. To help inform this knowledge gap and quantify older adults' preferences for CFP program features and WTP, the Aim 2 DCE survey was developed and launched in the US using a national online Qualtrics Panel. A total of 630 participants completed the survey, and 328 were included as part of the final analysis cohort after removing potentially low-quality responses and respondents who did not make trade-offs between CFP program features.

Consistent with expectations, DCE results showed that increasing the cost of a CFP program contributed negatively to the program's utility. On the other hand, increasing the efficacy of a program contributed positively to the program's utility, which is also consistent with expectations. Group location contributed positively to the program's utility,

while a home-based location contributed negatively in the final analysis cohort. This is consistent with findings from the meta-synthesis indicating that older adults prefer CFP or exercise programs that allow for social interaction, which may be facilitated by programs in a group location/setting compared to a home-based setting.

The frequency of program sessions also affected a CFP program's utility. Programs offered 2 or 5 times per week negatively contributed to the program's utility (with 2 times per week contributing most negatively), while programs offered 3 or 4 times per week positively contributed to the program's utility (with 3 times per week contributing most positively), when compared to the status quo of not participating in any CFP program sessions per week. These results are consistent with interview findings from Aim 1, and with a previous best-worst scaling study of older adults' preferences for features of exercise programs, in which extreme frequencies of 1 or 5 times per week were less favored than programs held 2, 3, or 4 times per week.[294] This could imply that programs offering 1-2 sessions per week do not provide sufficient benefits to participants to justify their time and effort spent, and that programs offering sessions 5 times per week may be too inconvenient to fit into older adults' daily routines and life circumstances. On the other hand, programs offered 3 times per week may offer older adults an optimal combination of physical, social, and mental benefits, while minimizing issues of program access and fit into daily or weekly routines. Another possibility is that older adults may prefer to "pick and choose" which days of the week they attend a CFP program, and programs offered 3-4 times per week may allow more flexibility in this regard compared to programs offered 1-2 times per week. This is consistent with findings from the meta-synthesis showing that

older adults prefer CFP programs that are flexible and fit into their daily routines, so they can self-manage their fall risk. In other words, preferences for more flexible session frequencies may not translate into an intention to attend all sessions offered. In support of this, Jenkyn et al. found that over 60% of participants had only low or moderate adherence to a CFP program.[82] Thus, future studies should further investigate the "why" behind this finding and the link between preferences for the number of sessions offered and intentions to actually attend those sessions.

However, the pattern of preferred session frequency was different for participants with lower income (<$25,000 annual household income). There was a general trend in the lower income group showing that as session frequency increased from 2 to 5 times per week, the preference weight for that attribute became progressively less positive. These results are consistent with results of the interaction models, which showed that interaction terms between session frequency and income level were statistically significant. This is also consistent with the Aim 1 interviews, in which participants or caregivers in an outpatient cardiac rehab program who expressed a lower willingness or ability to pay for an exercise program also expressed a preference for attending fewer exercise sessions per week compared to interviewees who expressed a higher willingness or ability to pay for program sessions. All of this indicates that there is heterogeneity in older adults' preferences for the frequency of CFP program sessions offered, based on older adults' income level.

Unexpectedly, inclusion of a home safety consultation as a feature of a CFP program contributed negatively to the program's utility, while not including a home safety consultation as part of the program contributed positively. This may be a result of older adults in the survey sample finding home safety consultations to be invasive, which is consistent with some previous studies. Older adults in the survey's final analysis cohort also scored an average of 70 on the physical function domain of the SF-36 (on a scale of 0-100, where 100 indicates higher physical function); it is possible that older adults with relatively high physical function may be less likely to accept a home safety consultation. However, it should be kept in mind that inclusion of a home safety consultation was the least important factor in determining older adults' program choice in this survey. In the final analysis cohort, program cost was the most important factor in determining program choice, followed by session frequency, efficacy of the program, location, and inclusion of a home safety consultation. Specifically, decreasing the cost of the program from $100/month to $25/month gave participants 12.0 times as much utility as changing the session frequency from 5 times per week to 3 times per week would have; 12.1 times as much utility as an improvement in the program's efficacy from a 10% reduction in falls rate to a 70% reduction in falls rate would have; 12.3 times as much utility as changing the program from a home-based setting to a group setting would have; and 32.7 times as much utility as eliminating the home safety consultation from the program would have. In terms of program components that may be readily modified, changing the frequency of the program sessions from 5 times per week to 3 times per week gave participants 2.7 times as much utility as eliminating the home safety consultation would have, and changing the location of the program from a home-based to a group setting also gave

participants about 2.7 times as much utility as eliminating the home safety component would have. Thus, although inclusion of a home safety consultation decreased a CFP program's utility in this sample, its potential influence on the ultimate choice between CFP programs was small in comparison to other features such as cost or frequency of sessions offered.

It is interesting to note that for those with lower income level, while cost remained the most important feature, program location and inclusion of a home safety consultation became more important and program efficacy became less important in choosing between CFP programs when compared to participants with higher income (based on relative importance scores). Specifically, cost remained the most important factor in determining CFP program choice for those with lower income (relative importance score of 77.05%), followed by session frequency, location, inclusion of a home safety consultation, and program efficacy (relative importance score of 2.02%). This suggests that there is heterogeneity in how older adults make trade-offs between the features of CFP programs, and which features matter more than others in their decision-making process when choosing a CFP program to enroll in. However, cost remained the most important feature for these programs in DCE results, regardless of participants' income level or physical function level. This is consistent with results of the meta-synthesis, which suggest that high program cost can be a barrier to older adults' participation in CFP or exercise programs, as expected.

Given the importance of cost in older adults' choice between CFP programs, as well as the lack of insurance reimbursement for any full, evidence-based CFP program, Aim 3 investigated older adults' WTP for five hypothetical examples of CFP programs. Results of the DCE data for the final analysis cohort showed that participants' mean marginal WTP for these hypothetical CFP programs ranged from \$56.10/month (95% CI=\$49.21-\$62.58) to \$62.45/month (95% CI=\$56.35-\$68.23). For the lower income group, participants' mean marginal WTP for these hypothetical programs ranged from \$53.95 (95% CI=\$40.40-\$66.93) to \$64.81 (95% CI=\$53.08-\$76.82), and in the higher income group ranged from \$56.20 (\$51.52-\$61.03) to \$63.12 (95% CI=\$56.19-\$69.82).

However, in the open-ended contingent valuation question, participants in the final analysis cohort were only willing to pay an average of \$26.23 USD per month to participate in one hypothetical CFP program (range \$0-\$256.00/month). Among these participants, those with low income were willing to pay an average of \$18.63 USD per month (range \$0-\$100.00/month), while those with high income were willing to pay an average of \$28.53 USD per month (range=\$0-\$256.00/month). Mean WTP values obtained via the contingent valuation question were smaller than those obtained from the DCE, although the range of WTP values was larger in the contingent valuation question compared to the DCE. This may be due to the different methodology used to obtain the WTP estimates. Indeed, previous studies have shown than open-ended contingent valuation questions, such as used in the current study, may be substantially lower than WTP estimates obtained via DCE.[295] It is also possible that ordering effects or reference dependence influenced the WTP estimates from the DCE towards higher values, given

that participants answered the DCE questions after answering the contingent valuation question and after seeing example and practice DCE questions that valued a CFP program at $25/month. While there is literature surrounding the differences between WTP estimates obtained using different methods and different question designs,[295-300] future research should investigate how this applies specifically to older adults. Despite this, the WTP estimates obtained from this DCE were within the range of WTP estimates obtained from the contingent valuation question, regardless of participants' income level, which lends validity to the WTP estimates. After validation in larger samples, these results may be used to inform a scoring algorithm (affordability threshold) in future value tools and directly inform payers' and health systems' formulary and reimbursement decisions for individual CFP programs.

WTP values obtained via the DCE were also somewhat higher than the actual cost that a participant might be charged to participate in a CFP program. Average program costs to participate in a CFP program (from the perspective of a program participant) were $46.77/month based on 2018 cost data extracted from NCOA's website for 13 existing evidence-based CFP programs. In the base case, average program costs per participant for five CFP programs that were similar to the five examples of hypothetical programs from the DCE were $0, $105.69, $17.37, $35.21, and $28.26/month. Using these values, average net benefit/month in the final analysis cohort ranged from $62.45 (95% CI=$56.35-$68.23) to $-49.10 (95% CI=$-53.25-$-45.31) for older adults who might participate in the five hypothetical CFP programs examined in Aim 3. In one-way sensitivity analyses, participant costs were changed from program-specific costs to $0 or

$100/month to examine how net benefit may change based on uncertainty in program costs paid directly by participants. As expected, a program cost of $0 results in net benefit values equal to the WTP values, while a program cost of $100/month results in negative net benefit across all five hypothetical programs. This method may be used in future studies to examine relative benefits of CFP programs from participants' perspectives, and may help payers to incorporate older adults' values and perspectives into reimbursement decisions for specific CFP programs offered to different groups of older adults.

CFP program developers and service providers may also benefit from a method to predict uptake of CFP programs, and older adults' likelihood to choose a specific program from among a group of competing CFP or exercise programs. To examine how cost may influence program uptake, program costs were varied between $25 and $50/month in Aim 3. For the final analysis cohort, predicted uptake among five hypothetical CFP programs was lowest for the program offered for 1 hour, 2 times per week in a community center group setting, which included a home safety consultation, reduced falls rate by 30%, and cost participants $50/month (9.01% of older adults surveyed would choose this program out of five hypothetical CFP programs). Predicted uptake among these five programs was highest for the program offered for 1 hour, 2 times per week in a community center group setting, which did not include a home safety consultation, reduced falls rate by 30%, and cost participants $25/month (47.61% of older adults surveyed would choose this program out of five hypothetical CFP programs). This uptake pattern was consistent with the uptake pattern in the higher income group, but differed from the uptake pattern seen in the lower income group, which suggests that CFP program service providers may

consider tailoring which programs to offer based on the socioeconomic level in their area. This may help to best meet the needs and preferences of their clients, while optimizing service providers' use of resources.

IV. Limitations and Solutions

A. Aim 1: To Characterize Key Features Of A CFP Program From The Perspective Of Older Adults.

Our confidence in the overall body of evidence for each category that emerged from the meta-synthesis was high. Most of the 54 studies that met the inclusion criteria for this review achieved a relatively high-quality rating (a quality score of 3-5 on the MMAT). However, there was variability across studies in terms of context. For example, some studies reported older adults' preferences for CFP programs designed for people with osteoporosis, Hispanic/Latino(a) participants, or older adults living on limited income. Older adults were heterogeneous in age range, physical functional status, socioeconomic status, residential area (rural vs. urban), climate, and country. Further, some studies recruited older adults $\geq$65 years, $\geq$60 years, $\geq$55 years, or $\geq$45 years, which introduced the need to assume that studies reporting participant eligibility in this manner included a portion of participants who were 65+. In most cases, opinions or findings relating directly to participants 65+ could be extracted from individual studies, but opinions and findings were not always separated by older adults' age range. Also, most older adults in the included studies were women and reported White race, although participant demographics were not always comprehensively reported in the included articles. Also, most studies did not explicitly define older adults' living situations, and the determination of "community-dwelling" was in some cases based on the investigators' interpretation of information presented in the article.

Further, some studies focused mainly on evaluation of CFP program effectiveness and included older adults' level of satisfaction with the program as a secondary measure, while others focused exclusively on older adults' experiences and perspectives with the CFP program. There was also inconsistency in how "older adults' preferences" were operationalized in each study, with some studies focusing on older adults' satisfaction with CFP programs, and others focusing on older adults' perceptions, perspectives, views, beliefs, or opinions about CFP programs. While most studies had a qualitative or mixed methods design, some were quantitative surveys or best-worst-scaling experiments from which older adults' preferences and opinions regarding specific logistic, format, or existential features of CFP programs could be inferred. An individual study's contribution towards the meta-synthesis findings may be reflected in the number of quotations that were coded in the article. The number of coded quotations ranged from 1 to 76 for the articles retained in this study, which may be one indication of the relative richness of data obtained from each article. For example, an article with 1 coded quotation may provide less rich data compared to articles with more coded quotations. The number of codes that were linked to each quotation may also contribute to this relative "thinness" or "thickness" of data provided by individual articles.[301-304]

Publication bias may also be a concern. Many studies included in the meta-synthesis recruited participants from existing group- or home-based CFP or exercise programs. Thus, participants in these studies may have been predisposed towards particular program settings, locations, and designs. To help address this, future studies may

recruit community-dwelling older adults from general community settings and compare

study results between those with and without a prior history of participating in CFP or

exercise programs.

B. Aim 2: To Quantitatively Determine Older Adults' Preferred CFP Program Design And How This Is Modified By Socioeconomic Status And Physical Functional Status.

To increase validity and reliability of the DCE results, participants who "incorrectly" answered the repeated DCE question, the extreme choice DCE question, or straight-lined their responses to the DCE questions were removed from the sample. In the full cohort of 630 respondents, 74 (11.7%) "incorrectly" answered the repeated DCE question, 8 (1.3%) straight-lined a CFP program DCE response, and 130 (20.6%) straight-lined the "No program" response in DCE questions. After removing these participants from the sample, 90 (14.3%) of the respondents "incorrectly" answered the extreme DCE question and were also removed from the sample, leaving a total of 328 participants in the final analysis cohort. This is similar to a DCE study investigating patients' preferences for features of a community-based diabetes education program, in which 21.4% of respondents straight-lined the "No program" response in DCE questions.[305] Some participants in the current study may have tried to avoid making a decision between CFP programs in each DCE question by choosing the opt-out option, which gives the research team no information about how these participants make trade-offs between different features of CFP programs. Also, participants may not have understood the DCE choice tasks. However, participants in the survey readability workshop seemed to comprehend the DCE choice tasks. Also, in three multiple-choice questions (response options: Agree, Disagree, or Not sure) asking survey participants' opinions on the ease of answering the DCE questions, 98.8% of respondents in the final

analysis cohort stated that the DCE questions were easy to read and understand, 99.7% stated that the DCE questions loaded easily on their device, and 91.2% responded "No" to a statement that it was tiring to answer all the DCE questions. Future studies should further investigate how opt-out options and question design affect responses to DCE choice tasks among older adults, who may have different decision-making processes compared to younger or middle-aged adults. As many published DCE studies in healthcare are related to drugs or medical devices, construction and design of DCE choice tasks should also be further investigated for topics related to community-based education or public health programs.

It is possible that some participants who straight-lined "No program" may have actually preferred not to participate in any CFP program at all. However, the constant in the final model for the full cohort (n=630) was positive and statistically significant, indicating that on average the respondents preferred to participate in any CFP program vs. not participate in a program at all. In DCE results for the full cohort, preference weights for the five attributes follow a similar pattern as in the final analysis cohort, with the exception of a home-based setting compared to a group setting contributing more positively to program utility in the full cohort (the opposite result of the final analysis cohort). In the full cohort, preference weights for program location also differed based on older adults' physical function level, with a home-based setting compared to a group setting contributing more positively to program utility in the lower physical function group (p<0.05), while in the higher physical function group a group setting contributed more positively compared to a home-based setting (p>0.05). This makes sense considering

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that older adults with a lower physical functional status may have mobility limitations that make traveling outside the home difficult. However, preference weights for the location attribute were not statistically significant in the full cohort's higher physical function group, and this difference in preference weights based on physical function level was not seen in the final analysis cohort. Future studies should further explore how physical functional status influences older adults' preferences for features of CFP programs, including features that were not examined in the current study.

Participants were also shown a ranking task and asked to rank from 1 to 5 which features of CFP programs were most important to them, with 1 being most important and 5 being least important. The five CFP program features included in this ranking task were the same as those presented in the DCE (cost, efficacy, session frequency, location, and inclusion of a home safety consultation), and were presented to participants in a random order. In this ranking task, 54.6% of participants in the final analysis cohort indicated that cost was their most preferred CFP program feature and 61.9% that inclusion of a home safety consultation was their least preferred feature, among the features included in the ranking task. This is broadly consistent with the attribute trade-offs seen in the DCE results from the final analysis cohort, and lends validity to the DCE results.

Further, to explore features of CFP programs not included in the DCE, a multiple choice question was included to ask participants which of two CFP program features mattered most to them when choosing a CFP program to participate in: socializing with other

people in the program, or how close to home the program is located. This also helped

to clarify preferences for location vs. preferences for social interaction that were not

separated in the DCE. For example, it is possible that participants may have interpreted

the Class Type attribute in the DCE differently, in that a group vs. home-based class

may have two interwoven attributes: proximity to home, and degree of social interaction.

Future studies should consider this limitation when designing DCEs to investigate

preferences for community programs and health services. In the final analysis cohort,

82.0% of participants indicated that proximity to home mattered most to them. However,

18.0% of participants did indicate that they perceived social interaction to be a more

important feature of CFP programs compared to program proximity. In addition to

optimizing the combination of program features included in the current DCE, future

studies may further investigate ways to tailor CFP programs for older adults without

easy access to low-cost transportation or without a CFP program located in the area

where they live, while maintaining social interaction as a component of the program in

order to improve participant engagement.

Another potential limitation is the sample size of the lower income group (n=76) in the

final analysis cohort. The preliminary power calculation estimated a sample size of

approximately n=200 per sub-sample in order to reach 80% power. While this was

achieved in the sub-samples from the full cohort, the reduced sample size of the final

analysis cohort may not be sufficient to reach the desired power. On the other hand,

responses from participants in the final analysis cohort may be of higher quality than

those who were removed from the sample, and there is considerable debate

surrounding sample size estimation for DCEs (Table 37).[18,24,306-311] Further, the

Qualtrics Panel is an online sampling frame. Thus, the sample may not reflect

preferences of older adults with low internet access, internet use, or internet literacy.

Also, response rate and non-response bias are difficult to assess due to Qualtrics'

recruitment algorithm using multiple Panels, recruitment waves, and a recruitment cap.

However, Qualtrics recruitment quotas based on US Census demographics for older

adults 65+ were used to recruit a nationally representative sample of older adults, with a

range of income levels to facilitate sub-sample analyses. Future studies should attempt

to replicate results of the current study in larger samples with multiple recruitment

methods, especially community-based recruitment that captures the preferences of

older adults with low internet access.

Table 37. Examples of Sample Sizes and Designs Used for Discrete Choice Experiments in Healthcare Research Studies in 2012*

Characteristic	Number of DCE Healthcare Studies in 2012
Number of Attributes	
2-3	5 (7%)
4-5	24 (35%)
6	25 (36%)
7-9	17 (25%)
>9	3 (4%)
Number of Choice Tasks	
≤ 8	14 (20%)
9-16	47 (68%)
>16	5 (7%)
Unclear	3 (4%)
Sample Size[a]	
<100	22 (32%)
100-300	28 (41%)
300-600	17 (25%)
600-1,000	10 (14%)
>1,000	6 (9%)
Sample Size Method	
Rule of thumb	9 (13%)
Referencing other studies	8 (12%)
Unclear	49 (71%)

*Categories, percentages based on de Bekker-Grob et al.'s 2015 systematic review.[24]

[a] Percentages add to more than 100% due to multiple sub-samples or multiple DCEs in some studies.

C. Aim 3: To Assess Older Adults' Willingness To Pay (WTP) For CFP Programs, Net Benefit Of Participating In CFP Programs, And Predicted Uptake Of CFP Program Designs, And How These Are Modified By Socioeconomic Status.

As mentioned above, there may be concerns with the sample size of the final analysis cohort's lower income group, and the WTP and net benefit estimates in Aim 3 may be influenced by the methodology used. Further, there is some uncertainty in existing evidence-based CFP program costs that were used to calculate net benefit values. For each of the 13 evidence-based CFP programs listed on NCOA's website at the end of 2018, estimates of program costs were extracted from documents posted on NCOA's website. Costs related to initial program start-up; instructor training, software, and licensing fees; program implementation; and costs paid directly by program participants were not always clear. Also, discounting was not used, since costs posted on NCOA's website at the end of 2018 were assumed to be 2018 values and data analysis took place less than one year after cost information was obtained. It is important to note that costs vary over time, and could also vary depending on geographic region, institution, or the program service provider. This may affect net benefit estimates. Future research may include conducting interviews and surveys with CFP program service providers, instructors, and administrators in different US regions to create a more comprehensive understanding of CFP program costs and usual implementation practices in real-world community settings. Similarly, willingness to pay for a program may vary depending on cost of living in particular geographic locations, and weather patterns may influence seasonal willingness to pay. Future research should also investigate differences in

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older adults' willingness to pay for CFP programs in specific geographic locations in the

US, and how weather patterns may affect both program preferences and willingness to

pay. Further, stated preferences may not match revealed preferences, spending

patterns, or program uptake patterns.[312] Future studies may investigate the

concordance between stated preference methods (like DCE) and older adults' actual

enrollment, retention, and adherence patterns in CFP programs.

V. Implications, Conclusions, and Future Directions

Quantitative results showed that cost was the most important factor in older adults' choice between CFP programs, regardless of participants' income. For participants with lower income, program efficacy was the least important factor, while inclusion of a home safety consultation was the least important factor for those with higher income. Three themes emerged from the qualitative meta-synthesis that emphasized several facets of older adults' preferences for CFP program features. The first theme was that older adults prefer CFP programs with immediate benefits. This included two categories: social support; and physical & mental benefits. The second theme was that older adults prefer CFP programs that appear trustworthy and legitimate. This included two categories: endorsement by others; and familiarity & learning resources. The third theme was that CFP programs should be easy to access and fit into older adults' daily routines. This included two categories: ease of access & service utilization; and self-management & tailoring. Self-management of when, where, and how older adults participated in CFP programs reaffirmed older adults' autonomy and independence and created a sense of empowerment for active, healthy aging.

Results may be used to develop, modify, or evaluate CFP programs in order to design programs that incorporate older adults' preferences. This may help to improve older adults' enrollment, retention, and adherence to CFP programs, which may ultimately reduce falls and improve older adults' quality of life and health outcomes. In addition to future research related to older adults' preferences and engagement with CFP

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programs, studies should investigate older adults' awareness of CFP programs, dissemination and availability of CFP programs, and patterns of CFP program use among diverse groups of older adults. Results may also inform development of a prototype patient-centered value tool for CFP programs for future usability testing by health system providers and payers. Future randomized studies may test the effectiveness of patient-centered CFP programs designed from this tool in improving program reach, utilization, and reducing falls in different types of older adults.

Future studies should also examine best practices for designing DCE surveys for older adults. The DCE results, analyzed via conditional logit models here, may be re-examined using different analysis methods that account for preference heterogeneity, including mixed logit. Results from the final analysis cohort may also be further compared to results of the reduced cohort that includes participants who responded to all DCE questions with "No Program." This may help to clarify practices for DCE methodology and design for older adult populations, especially for older adult participants recruited through online market research Panels.

Additionally, future studies should examine how the preference, WTP, net benefit, and predicted program uptake results obtained here may vary based on recruitment methods for older adult participants. For example, responses from older adults recruited directly from community settings may differ from those recruited via online market research Panels. Studies should investigate older adults' willingness to use online methods for preference-based research. Specific to CFP programs, studies

should also investigate older adults' willingness to use online classes as a CFP program option, and their preferences surrounding the design of these classes. As internet use continues to rise among older adults, online CFP program options may be especially helpful for older adults who live in areas where CFP programs are not easily accessible (such as rural areas), or for those who do not like the CFP programs offered in their area. Online CFP programs may also facilitate offering multiple CFP program designs, as well as the individual-level program tailoring that older adults in this study wanted to see in a CFP program. Online and telehealth options may also facilitate reaching older adults in home-based settings, while allowing for social interaction with a healthcare provider or CFP program instructor.

Further study should also be given to how older adults interpret "home" vs. "group" class types. This could include concepts of proximity to home, general setting (with strangers, with friends/family, with an instructor, or alone), degree of social interaction, and type of location (inside the home, outside in the neighborhood, outside in a park, inside a community center, senior center, church, gym, or outpatient clinic). The current study may be expanded to parse out older adults' preferences for these different facets of "class type." Similarly, preferences for including home safety consultations in a CFP program may be examined specifically among older adults who prefer home-based locations.

Preferences for features of CFP programs, WTP, net benefit, and predicted program uptake may also vary depending on older adults' individual risk of falling and perceived

risk of falling. In the current study, only about 41% of survey participants in Aim 2 perceived themselves to be at risk for falling, despite 59% of participants reporting at least one fall in the past year, and all participants meeting the STEADI screening criteria for fall risk. Older adults who perceive themselves to be at high risk for falling, or those who have experienced a fall may be willing to pay more to participate in CFP programs, and may have specific preferences for CFP program features. Future studies should examine how these factors may vary based on older adults' fall history and perceptions of fall risk.

Work should also be done to examine healthcare providers', CFP program service providers', and community leaders' views and preferences for features of CFP programs, to optimize feasibility of CFP program delivery in specific regions of the US. This includes examining how interprofessional teams can contribute to fall prevention for older adults. For example, community pharmacies offer an easily accessible point of healthcare contact for older adults. Pharmacists working in community settings may benefit from training and tools to identify older adults who are at high risk for falling, such as through medication reviews to identify fall-risk medications, and STEADI's fall-risk screening questions. Community pharmacists may then refer older adults at high risk for falling to physician, nurse, physical therapist, occupational therapist, and other allied health colleagues for further evaluation and referral to community-based fall prevention services. Developing a Falls Referral Network may help older adults and healthcare providers become more aware of CFP program options in the area where they live, and facilitate the referral and enrollment process for CFP programs. Mapping

the location of fall prevention resources, programs, and providers may be especially

helpful for older adults living in rural areas where health services are relatively scarce.

This may facilitate the creation of an online tool to help older adults, caregivers, and

providers find and select CFP programs that meet selected preference criteria and

individual needs. Presenting older adults with more options for CFP programs, and

helping them select the program that best fits their needs, may help to optimize program

reach, referral, enrollment, retention, and adherence.

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Appendix 1. Aim 1 Systematic Review Search Strings

Google Scholar

Older adult and fall prevention and preference | preferences | perception | perceptions

Take the top 200 results.

PubMed

("Frail Elderly"[Mesh] OR "Aged"[Mesh] OR "older adult" OR senior [tiab] OR elder* [tiab] OR aged [tiab]) AND ("Accidental Falls"[Mesh] OR fall [tiab] OR falls [tiab]) AND ("Patient Preference"[Mesh] OR "Patient Satisfaction"[Mesh] OR prefer* [tiab] OR satisf* [tiab])

Limits: English, 2008-2018, all are peer-reviewed in PubMed

CINAHL

("Frail Elderly" OR Aged OR "older adult" OR senior OR elder) AND ("Accidental Falls" OR fall OR falls) AND (patient satisfaction OR prefer* OR satisf*)

Limits: English, 2008 to 2018, limiting to peer reviewed leaves

PsycINFO

("Frail Elderly" OR Aged OR "older adult" OR senior OR elder) AND ("Accidental Falls" OR fall OR falls) AND (client satisfaction OR prefer* OR satisf*)

Limits: English, 2008 to 2018, limiting to peer reviewed

ERIC

("Frail Elderly" OR Aged OR "older adult" OR senior OR elder) AND ("Accidental Falls" OR fall OR falls) AND (prefer* OR satisf*)

Limits: English, 2008-2018, peer-reviewed

ClinicalTrials.gov

Condition: fall prevention; Other terms: older adult

Appendix 2. Aim 2 Survey Instrument

Thank you for agreeing to participate in this survey, your thoughtful responses are important to us! First, please tell us a bit about yourself. Please press "NEXT."

Page Break

Only people who are at least 65 years old are eligible for this survey. Are you 65 years old or older?

○ Yes

○ No

Where do you live?

○ Alone in my own home or apartment

○ With family, friend, or spouse in my own home or apartment

○ In an assisted living facility

○ Other

Page Break

Have you fallen in the past year? **A "fall" is a sudden change in position causing someone to land at a lower level, on an object, the floor, or the ground.**

○ Yes

○ No

Do you feel unsteady when standing or walking?

○ Yes

○ No

Do you worry about falling?

○ Yes

○ No

Page Break ——————————————————————————

Please indicate your sex.

○ Male

○ Female

Please indicate your race.

○ White

○ Black or African American

○ Asian

○ Native Hawaiian or Pacific Islander

○ American Indian or Alaska Native

○ Two or more races

Please indicate your ethnicity.

○ Hispanic or Latino(a)

○ Not Hispanic or Latino(a)

Page Break

Please indicate your level of household income during the past year (this includes things like wages, pension, and social security for yourself and your spouse or partner).

○ Less than $25,000

○ $25,000 - $49,999

○ $50,000 - $74,999

○ $75,000 - $99,999

○ $100,000 and above

How many adults live in your household, including yourself? For example, if you live alone, please type "1" without quotes.

_____

Please indicate your highest level of education completed.

○ Less than high school diploma

○ High school diploma or GED

○ Some college

○ Bachelor's degree

○ Master's degree

○ Doctorate degree

Page Break

Please indicate your age in years. For example, if you are 65 years old, please type "65" without quotes.

_____

Do you have health insurance?

○ Yes

○ No

Page Break ──

Please indicate which chronic condition(s) you have. **Please mark all that apply.**

☐ High blood pressure

☐ High cholesterol

☐ Heart disease

☐ Asthma/COPD

☐ Diabetes

☐ Other, please specify: _____

☐ None of the above

Please indicate how many prescription medications you currently take on a regular basis. **Please type a number.**

_____

Page Break

Do you think you personally are at risk for falling?

○ Yes

○ No

○ Maybe

How many times have you fallen in the past 12 months? **A "fall" is a sudden change in position causing someone to land at a lower level, on an object, the floor, or the ground.**

○ Never

○ Once

○ Twice

○ Three times or more

Page Break ───────────────────────────────

Have you ever participated in a program to help keep you from falling?

   ○ Yes

   ○ No

Have you ever participated in an exercise program in the area where you live?

   ○ Yes

   ○ No

Have you ever participated in a program to help strengthen your muscles or improve your balance?

   ○ Yes

   ○ No

How did you hear about the program(s) you participated in? **Please mark all that apply.**

☐ From my doctor

☐ On the television

☐ On the radio

☐ In a magazine

☐ Online website

☐ From a friend, family member, or neighbor

☐ Newspaper

☐ Flyer posted in the area where I live

☐ Other, please specify: _____

How would you **most like** to get information about programs to help you improve your balance and avoid falls? **Please choose one answer.**

○ From my doctor

○ On the television

○ On the radio

○ In a magazine

○ Online website

○ From a friend, family member, or neighbor

○ Newspaper

○ Flyer posted in the area where I live

○ Other, please specify: _____

Page Break

I would most like to exercise...

    ○ At home by myself

    ○ At home with an exercise trainer

    ○ At a community center in a group

    ○ At a community center by myself

What type of exercise would you **most** like to do? **Please choose one answer.**

    ○ Aerobics and using hand-weights

    ○ Tai-Chi

    ○ Yoga

    ○ Other, please specify _____

Would you like to use an online website or smartphone app to help learn about ways to improve your strength and balance and keep from falling?

    ○ Yes

    ○ No

    ○ Maybe

Page Break

The following questions are about activities you might do during a typical day. Does your health now limit you in these activities? If so, how much? 1=No, not limited at all; 2=Yes, limited a little; 3=Yes, limited a lot.

	No, not limited at all 1	Yes, limited a little 2	Yes, limited a lot 3
Vigorous activities, such as running, lifting heavy objects, participating in strenuous activities.	○	○	○
Moderate activities, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf.	○	○	○
Lifting or carrying groceries.	○	○	○
Climbing several flights of stairs.	○	○	○
Climbing one flight of stairs.	○	○	○
Bending, kneeling, or stooping.	○	○	○
Walking more than a mile.	○	○	○
Walking several blocks.	○	○	○
Walking one block.	○	○	○
Bathing or dressing yourself.	○	○	○

The next section of this survey asks your opinion about some features of community programs that help people learn how to improve their balance and prevent falls.

Definition: A "fall" is a sudden change in position causing someone to land at a lower level, on an object, the floor, or the ground.

Please press "Next" to continue.

Imagine your doctor recommends you participate in a program to strengthen your muscles and improve balance.

The program includes aerobics and using hand-weights.

The level of difficulty of the exercise is medium (not light, but not heavy).

Imagine it is held at a community center near your home for 1 hour, twice per week for 3 months.

A group of people participate together.

An exercise trainer teaches you how to do each exercise. The trainer is experienced and friendly.

The program includes visits with a home safety expert who will help you find and fix hazards in your home that could cause you to fall (for example, loose rugs).

Every year, 30 out of 100 people fall at least once. This program reduces that to 15 out of 100 people. This means the program reduces falls by fifty percent (50%).

How much would you be willing to pay per month to participate in this program, in dollars? **Please type a number.**

$_____ / month

Page Break

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The next part of the survey asks about which type of community program you would like to participate in to help improve your balance.

For each question, you will be asked to choose between different programs that help people improve their balance. For example, programs might look like this:

Example.

<u>Program A:</u> An exercise program to help strengthen muscles and improve balance. This program is held at the local community center for 1 hour, twice per week for 3 months. A group of people participate together. An exercise trainer teaches you how to do each exercise. Every year, 30 out of 100 people fall at least once. This program reduces that to 20 out of 100 people. This means the program reduces falls by thirty percent (30%). The program would cost you $25 per month.

<u>Program B:</u> An exercise program to help strengthen muscles and improve balance. An exercise trainer will visit you at your home for 1 hour, three times per week for 3 months to help teach you the best exercise techniques. The program includes visits with a home safety expert who will help you find and fix hazards in your home that could cause you to fall (for example, loose rugs). Every year, 30 out of 100 people fall at least once. This program reduces that to 15 out of 100 people. This means the program reduces falls by fifty percent (50%). The program would cost you $50 per month.
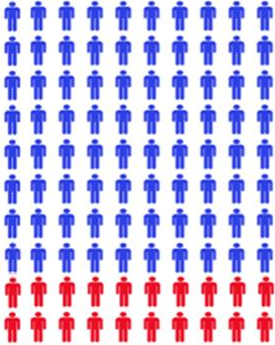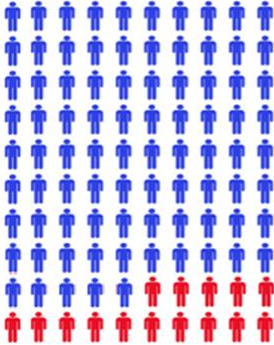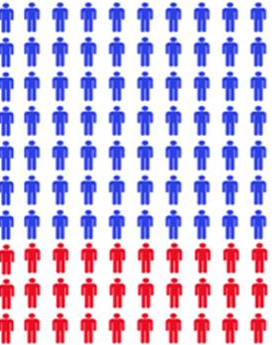
  Let's try a practice question on the next screen.

Page Break ———————————————

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Practice Question.

Imagine you're choosing an exercise program to help improve your strength and balance. Exercises include aerobics and using hand-weights. The level of difficulty of the exercise is medium (not light, but not heavy). An exercise trainer teaches you how to do the exercises at each session. Programs last for 3 months. Assume that programs have been tested and some are more effective than others at helping people avoid falls.

Which of these options would you choose, if these were the only options in the area that you live? Select one.

Mark your choice by clicking the circle for that option. If you don't like either of these programs, you can choose not to participate in any program by marking "No Program."

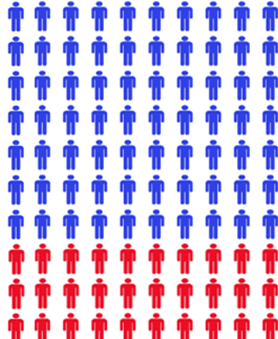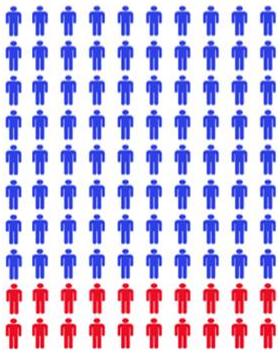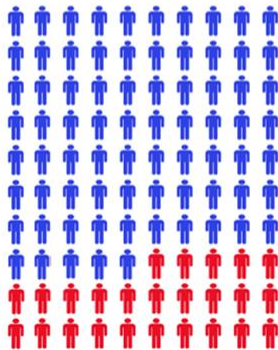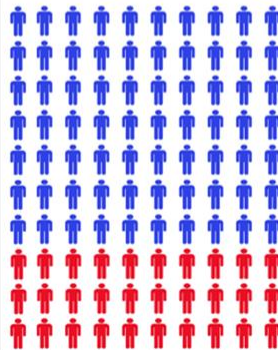| Program Description	Program A	Program B	No Program
Class type	Group class	At home with an exercise trainer	
Timing	Two times per week (2/week) for 1 hour	Three times per week (3/week) for 1 hour	Do not participate in a program.
Extras	No extras	One consultation with a home safety expert	
Cost	Twenty-five dollars per month ($25/month)	Fifty dollars per month ($50/month)	
Effectiveness	20 out of 100 people fall at least once each year	15 out of 100 people fall at least once each year	30 out of 100 people fall at least once each year

Only 20 out of 100 people who do this program **fall** each year. This means this program reduces falls by **30%**.

Only 15 out of 100 people who do this program **fall** each year. This means this program reduces falls by **50%**.

30 out of 100 people who don't do a program **fall** each year

70 out of 100 people who don't do a program **don't** fall anyway

○ **Program A**   ○ **Program B**   ○ No Program

Page Break

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Let's Start!

Situation:
Imagine that your doctor says you could be at risk for having a fall and fracturing a hip. Your doctor recommends that you participate in a 3-month long exercise program to improve or maintain your strength and balance. The level of difficulty of the exercise is medium (not light, but not heavy). Exercises include aerobics and using hand-weights. At each session, an exercise trainer teaches you how to do the exercises.

Assume that programs have been tested and some are more effective than others at helping people avoid falls.

Page Break

For each of the 10 questions on the next screens, imagine that you have to choose between the options described.

If you don't like either of the programs, you can choose not to participate in any program by marking "No Program." But, 30 out of 100 people who choose "No Program" fall at least once each year.
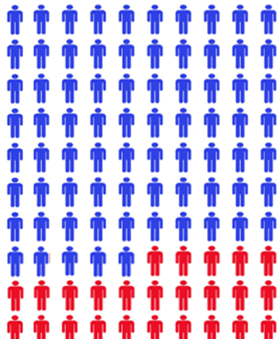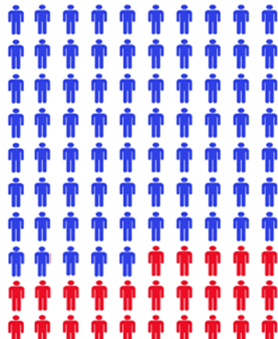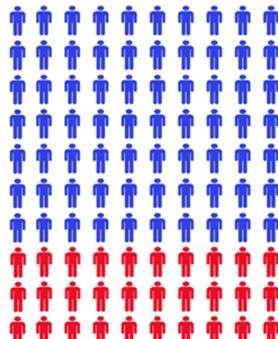
Programs will change slightly for each question and may seem similar. Please press "NEXT" to begin.
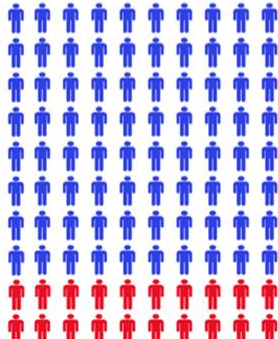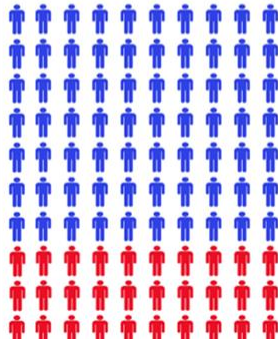
Page Break

Which of these options would you choose, if these were the only options? **Select one**.

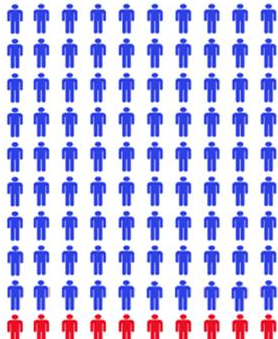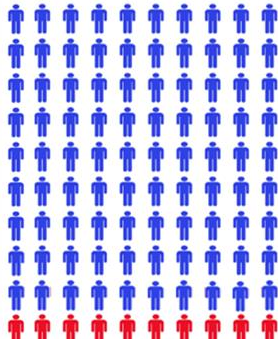| Program Description	Program A	Program B	No Program
Class type	At home with an exercise trainer	Group class	
Timing	Two times per week (2/week) for 1 hour	Four times per week (4/week) for 1 hour	Do not participate in a program.
Extras	No extras	One consultation with a home safety expert	
Cost	Twenty-five dollars per month ($25/month)	Fifty dollars per month ($50/month)	
Effectiveness	25 out of 100 people fall at least once each year	25 out of 100 people fall at least once each year	30 out of 100 people fall at least once each year

○ **Program A**   ○ **Program B**   ○ No Program

Page Break

284

Which of these options would you choose, if these were the only options? **Select one**.

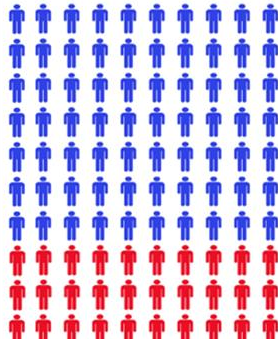| Program Description	Program A	Program B	No Program
Class type	At home with an exercise trainer	Group class	
Timing	Three times per week (3/week) for 1 hour	Three times per week (3/week) for 1 hour	Do not participate in a program.
Extras	No extras	One consultation with a home safety expert	
Cost	One hundred dollars per month ($100/month)	One hundred dollars per month ($100/month)	
Effectiveness	15 out of 100 people fall at least once each year	20 out of 100 people fall at least once each year	30 out of 100 people fall at least once each year

○ **Program A**   ○ **Program B**   ○ No Program

Page Break

Which of these options would you choose, if these were the only options? **Select one**.

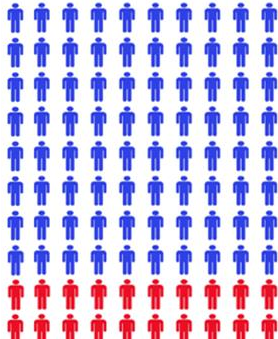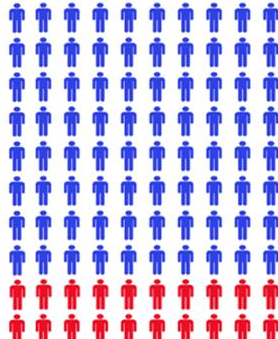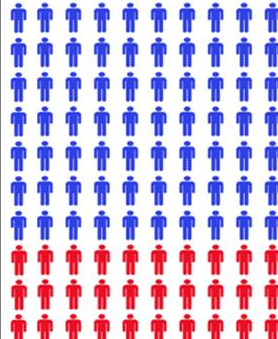| Program Description	Program A	Program B	No Program
Class type	At home with an exercise trainer	Group class	Do not participate in a program.
Timing	Three times per week (3/week) for 1 hour	Four times per week (4/week) for 1 hour	
Extras	One consultation with a home safety expert	No extras	
Cost	Fifty dollars per month ($50/month)	Twenty-five dollars per month ($25/month)	
Effectiveness	10 out of 100 people fall at least once each year	15 out of 100 people fall at least once each year	30 out of 100 people fall at least once each year

○ **Program A**   ○ **Program B**   ○ No Program

Page Break

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Which of these options would you choose, if these were the only options? **Select one**.

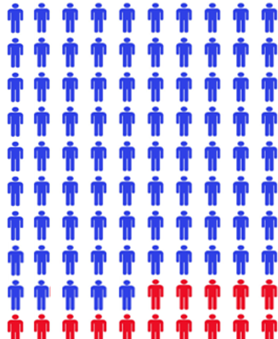| Program Description	Program A	Program B	No Program
Class type	Group class	At home with an exercise trainer	Do not participate in a program.
Timing	Four times per week (4/week) for 1 hour	Five times per week (5/week) for 1 hour	
Extras	One consultation with a home safety expert	No extras	
Cost	Twenty-five dollars per month ($25/month)	Fifty dollars per month ($50/month)	
Effectiveness	20 out of 100 people fall at least once each year	15 out of 100 people fall at least once each year	30 out of 100 people fall at least once each year

○ **Program A**   ○ **Program B**   ○ No Program

Page Break

Which of these options would you choose, if these were the only options? **Select one**.

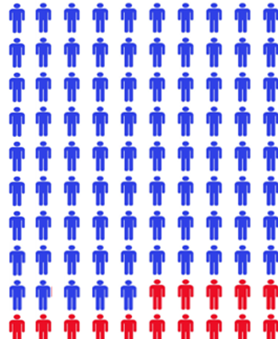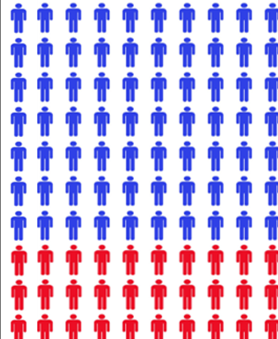| Program Description	Program A	Program B	No Program
Class type	Group class	At home with an exercise trainer	Do not participate in a program.
Timing	Five times per week (5/week) for 1 hour	Five times per week (5/week) for 1 hour	
Extras	No extras	One consultation with a home safety expert	
Cost	Fifty dollars per month ($50/month)	Twenty-five dollars per month ($25/month)	
Effectiveness	15 out of 100 people fall at least once each year	25 out of 100 people fall at least once each year	30 out of 100 people fall at least once each year

○ **Program A**   ○ **Program B**   ○ No Program

Page Break

Which of these options would you choose, if these were the only options? **Select one**.

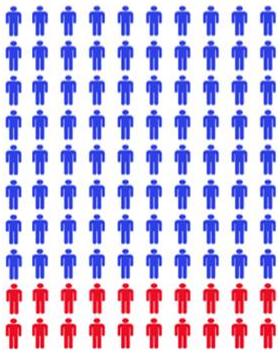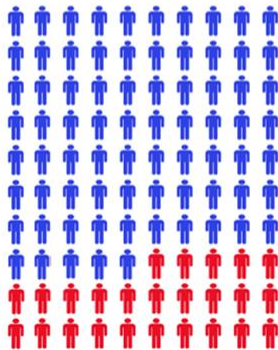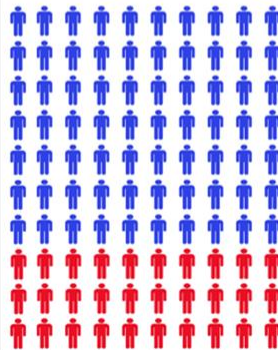| Program Description	Program A	Program B	No Program
Class type	At home with an exercise trainer	Group class	Do not participate in a program.
Timing	Two times per week (2/week) for 1 hour	Three times per week (3/week) for 1 hour	
Extras	One consultation with a home safety expert	No extras	
Cost	Seventy-five dollars per month ($75/month)	Seventy-five dollars per month ($75/month)	
Effectiveness	20 out of 100 people fall at least once each year	10 out of 100 people fall at least once each year	30 out of 100 people fall at least once each year

○ **Program A**   ○ **Program B**   ○ No Program

Page Break

Which of these options would you choose, if these were the only options? **Select one**.

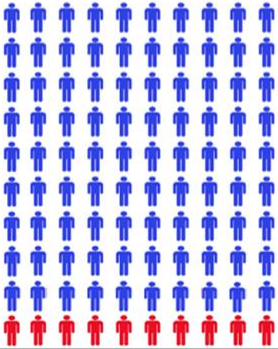| Program Description	Program A	Program B	No Program
Class type	Group class	At home with an exercise trainer	
Timing	Four times per week (4/week) for 1 hour	Two times per week (2/week) for 1 hour	Do not participate in a program.
Extras	No extras	One consultation with a home safety expert	
Cost	Seventy-five dollars per month ($75/month)	Seventy-five dollars per month ($75/month)	
Effectiveness	25 out of 100 people fall at least once each year	20 out of 100 people fall at least once each year	30 out of 100 people fall at least once each year

○ **Program A**   ○ **Program B**   ○ No Program

Page Break ———————————————————————————

Which of these options would you choose, if these were the only options? **Select one**.

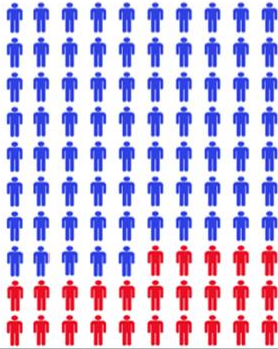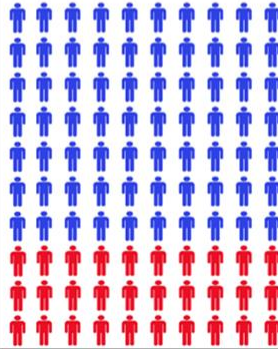| Program Description	Program A	Program B	No Program
Class type	Group class	At home with an exercise trainer	
Timing	Five times per week (5/week) for 1 hour	Two times per week (2/week) for 1 hour	Do not participate in a program.
Extras	One consultation with a home safety expert	No extras	
Cost	One hundred dollars per month ($100/month)	One hundred dollars per month ($100/month)	
Effectiveness	10 out of 100 people fall at least once each year	10 out of 100 people fall at least once each year	30 out of 100 people fall at least once each year

○ **Program A**   ○ **Program B**   ○ No Program

Page Break

291

Which of these options would you choose, if these were the only options? **Select one**.

Program Description	Program A	Program B	No Program
Class type	Group class	At home with an exercise trainer	Do not participate in a program.
Timing	Four times per week (4/week) for 1 hour	Five times per week (5/week) for 1 hour	
Extras	One consultation with a home safety expert	No extras	
Cost	Twenty-five dollars per month ($25/month)	Fifty dollars per month ($50/month)	
Effectiveness	20 out of 100 people fall at least once each year	15 out of 100 people fall at least once each year	30 out of 100 people fall at least once each year

○ **Program A**   ○ **Program B**   ○ No Program

Page Break

Note: This is the repeated DCE question for block 1.

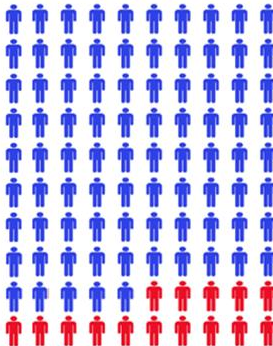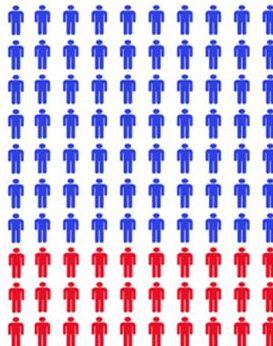Which of these options would you choose, if these were the only options? **Select one**.

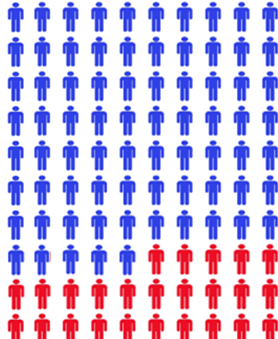| Program Description	Program A	Program B	No Program
Class type	At home with an exercise trainer	Group class	Do not participate in a program.
Timing	Two times per week (2/week) for 1 hour	Four times per week (4/week) for 1 hour	
Extras	No extras	No extras	
Cost	Twenty-five dollars per month ($25/month)	One hundred dollars per month ($100/month)	
Effectiveness	10 out of 100 people fall at least once each year	15 out of 100 people fall at least once each year	30 out of 100 people fall at least once each year

○ **Program A**   ○ **Program B**   ○ No Program

Page Break

293

Which of these options would you choose, if these were the only options? **Select one**.

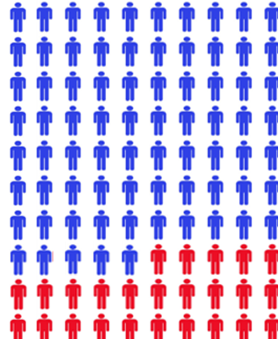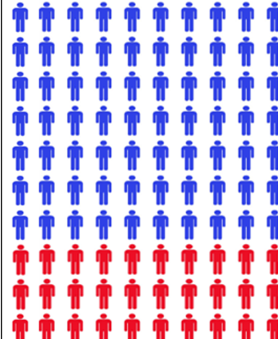| Program Description	Program A	Program B	No Program
Class type	Group class	At home with an exercise trainer	Do not participate in a program.
Timing	Three times per week (3/week) for 1 hour	Three times per week (3/week) for 1 hour	
Extras	One consultation with a home safety expert	No extras	
Cost	Seventy-five dollars per month ($75/month)	Twenty-five dollars per month ($25/month)	
Effectiveness	25 out of 100 people fall at least once each year	25 out of 100 people fall at least once each year	30 out of 100 people fall at least once each year

○ **Program A**   ○ **Program B**   ○ No Program

Page Break

294

Which of these options would you choose, if these were the only options? **Select one**.

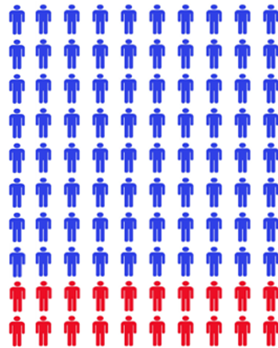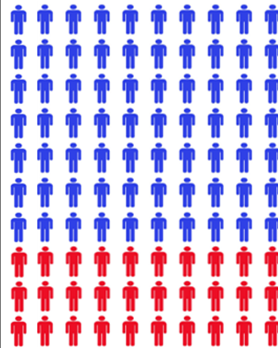| Program Description	Program A	Program B	No Program
Class type	Group class	At home with an exercise trainer	Do not participate in a program.
Timing	Two times per week (2/week) for 1 hour	Three times per week (3/week) for 1 hour	
Extras	No extras	One consultation with a home safety expert	
Cost	One hundred dollars per month ($100/month)	Fifty dollars per month ($50/month)	
Effectiveness	10 out of 100 people fall at least once each year	15 out of 100 people fall at least once each year	30 out of 100 people fall at least once each year

○ **Program A**   ○ **Program B**   ○ No Program

Page Break

295

Which of these options would you choose, if these were the only options? **Select one**.

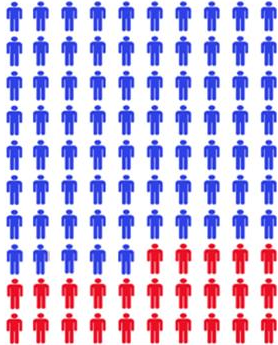| Program Description	Program A	Program B	No Program
Class type	Group class	Group class	
Timing	Five times per week (5/week) for 1 hour	Four times per week (4/week) for 1 hour	Do not participate in a program.
Extras	One consultation with a home safety expert	One consultation with a home safety expert	
Cost	One hundred dollars per month ($100/month)	Seventy-five dollars per month ($75/month)	
Effectiveness	20 out of 100 people fall at least once each year	25 out of 100 people fall at least once each year	30 out of 100 people fall at least once each year

◯ **Program A**   ◯ **Program B**   ◯ No Program

Page Break

Which of these options would you choose, if these were the only options? **Select one**.

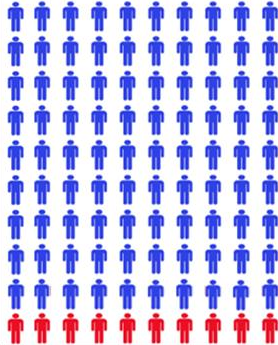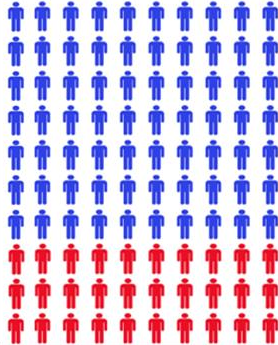| Program Description	Program A	Program B	No Program
Class type	At home with an exercise trainer	Group class	
Timing	Five times per week (5/week) for 1 hour	Five times per week (5/week) for 1 hour	Do not participate in a program.
Extras	One consultation with a home safety expert	No extras	
Cost	Twenty-five dollars per month ($25/month)	One hundred dollars per month ($100/month)	
Effectiveness	25 out of 100 people fall at least once each year	20 out of 100 people fall at least once each year	30 out of 100 people fall at least once each year

○ **Program A**   ○ **Program B**   ○ No Program

Page Break

297

Which of these options would you choose, if these were the only options? **Select one**.

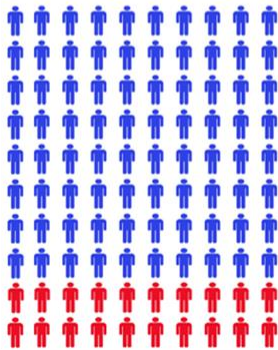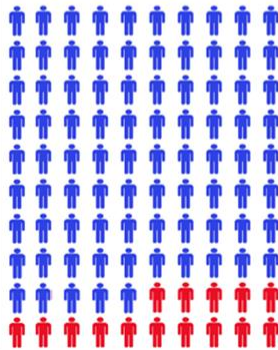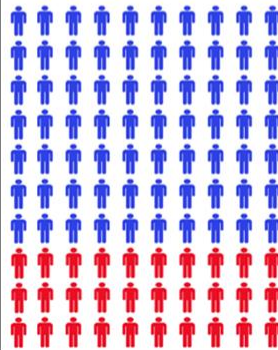| Program Description	Program A	Program B	No Program
Class type	At home with an exercise trainer	Group class	
Timing	Four times per week (4/week) for 1 hour	Five times per week (5/week) for 1 hour	Do not participate in a program.
Extras	No extras	One consultation with a home safety expert	
Cost	Fifty dollars per month ($50/month)	Seventy-five dollars per month ($75/month)	
Effectiveness	10 out of 100 people fall at least once each year	10 out of 100 people fall at least once each year	30 out of 100 people fall at least once each year

○ **Program A**   ○ **Program B**   ○ No Program

Page Break

298

Which of these options would you choose, if these were the only options? **Select one**.

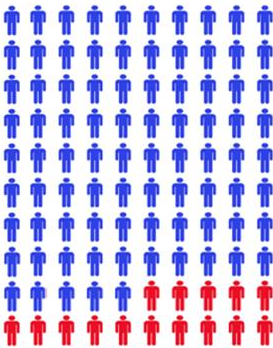| Program Description	Program A	Program B	No Program
Class type	At home with an exercise trainer	At home with an exercise trainer	
Timing	Three times per week (3/week) for 1 hour	Two times per week (2/week) for 1 hour	Do not participate in a program.
Extras	One consultation with a home safety expert	One consultation with a home safety expert	
Cost	Fifty dollars per month ($50/month)	Fifty dollars per month ($50/month)	
Effectiveness	20 out of 100 people fall at least once each year	20 out of 100 people fall at least once each year	30 out of 100 people fall at least once each year

○ **Program A**   ○ **Program B**   ○ No Program

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Page Break ——

299

Which of these options would you choose, if these were the only options? **Select one**.

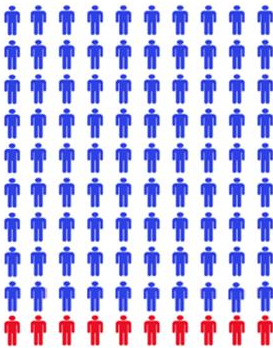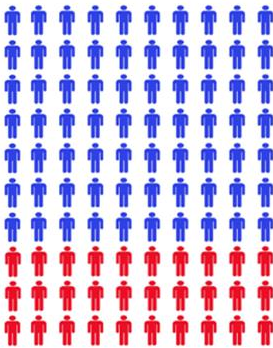| Program Description	Program A	Program B	No Program
Class type	At home with an exercise trainer	Group class	
Timing	Two times per week (2/week) for 1 hour	Four times per week (4/week) for 1 hour	Do not participate in a program.
Extras	No extras	No extras	
Cost	Twenty-five dollars per month ($25/month)	Seventy-five dollars per month ($75/month)	
Effectiveness	15 out of 100 people fall at least once each year	15 out of 100 people fall at least once each year	30 out of 100 people fall at least once each year

○ **Program A**   ○ **Program B**   ○ No Program

Which of these options would you choose, if these were the only options? **Select one**.

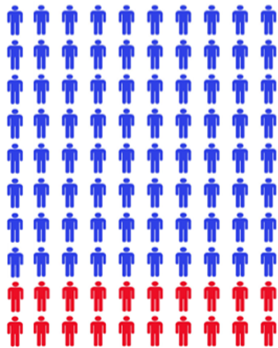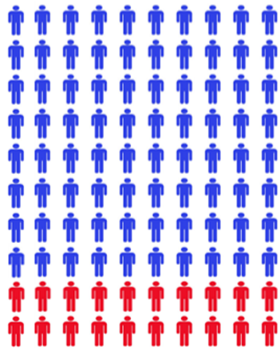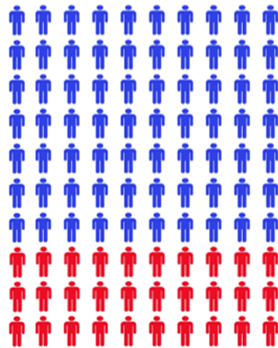| Program Description	Program A	Program B	No Program
Class type	Group class	Group class	Do not participate in a program.
Timing	Five times per week (5/week) for 1 hour	Four times per week (4/week) for 1 hour	
Extras	One consultation with a home safety expert	One consultation with a home safety expert	
Cost	One hundred dollars per month ($100/month)	Seventy-five dollars per month ($75/month)	
Effectiveness	20 out of 100 people fall at least once each year	25 out of 100 people fall at least once each year	30 out of 100 people fall at least once each year

⚬ **Program A**   ⚬ **Program B**   ⚬ No Program

Page Break

Note: This is the repeated DCE question for block 2.

301

Which of these options would you choose, if these were the only options? **Select one**.

Program Description	Program A	Program B	No Program
Class type	Group class	Group class	Do not participate in a program.
Timing	Three times per week (3/week) for 1 hour	Two times per week (2/week) for 1 hour	
Extras	No extras	No extras	
Cost	Twenty-five dollars per month ($25/month)	Seventy-five dollars per month ($75/month)	
Effectiveness	10 out of 100 people fall at least once each year	25 out of 100 people fall at least once each year	30 out of 100 people fall at least once each year

◯ **Program A**   ◯ **Program B**   ◯ No Program

Page Break

Which of these options would you choose, if these were the only options? **Select one**.

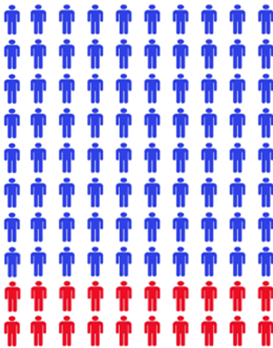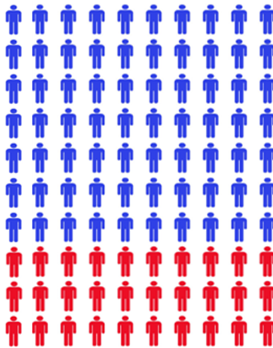| Program Description	Program A	Program B	No Program
Class type	At home with an exercise trainer	At home with an exercise trainer	Do not participate in a program.
Timing	Five times per week (5/week) for 1 hour	Three times per week (3/week) for 1 hour	
Extras	One consultation with a home safety expert	One consultation with a home safety expert	
Cost	Twenty-five dollars per month ($25/month)	Seventy-five dollars per month ($75/month)	
Effectiveness	15 out of 100 people fall at least once each year	15 out of 100 people fall at least once each year	30 out of 100 people fall at least once each year

○ **Program A**   ○ **Program B**   ○ No Program

Page Break

303

Which of these options would you choose, if these were the only options? **Select one**.

Program Description	Program A	Program B	No Program
Class type	Group class	At home with an exercise trainer	
Timing	Two times per week (2/week) for 1 hour	Three times per week (3/week) for 1 hour	Do not participate in a program.
Extras	One consultation with a home safety expert	No extras	
Cost	Fifty dollars per month ($50/month)	One hundred dollars per month ($100/month)	
Effectiveness	25 out of 100 people fall at least once each year	25 out of 100 people fall at least once each year	30 out of 100 people fall at least once each year

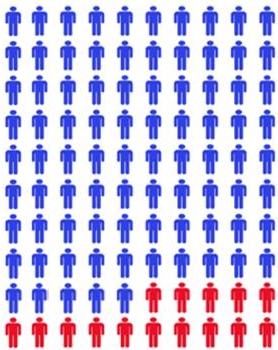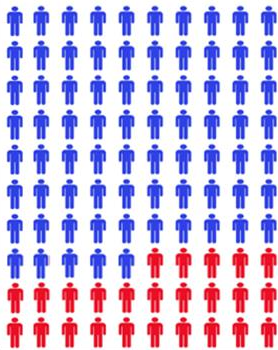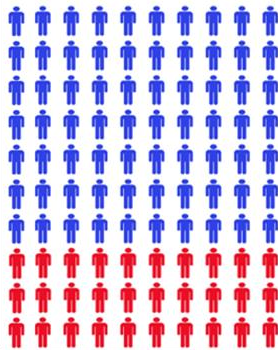○ **Program A**   ○ **Program B**   ○ No Program

304

Which of these options would you choose, if these were the only options? **Select one**.

Program Description	Program A	Program B	No Program
Class type	At home with an exercise trainer	At home with an exercise trainer	
Timing	Five times per week (5/week) for 1 hour	Four times per week (4/week) for 1 hour	Do not participate in a program.
Extras	No extras	No extras	
Cost	Seventy-five dollars per month ($75/month)	Fifty dollars per month ($50/month)	
Effectiveness	10 out of 100 people fall at least once each year	20 out of 100 people fall at least once each year	30 out of 100 people fall at least once each year

○ **Program A**   ○ **Program B**   ○ No Program

Page Break

Which of these options would you choose, if these were the only options? **Select one**.

Program Description	Program A	Program B	No Program
Class type	At home with an exercise trainer	At home with an exercise trainer	
Timing	Four times per week (4/week) for 1 hour	Four times per week (4/week) for 1 hour	Do not participate in a program.
Extras	One consultation with a home safety expert	One consultation with a home safety expert	
Cost	One hundred dollars per month ($100/month)	Twenty-five dollars per month ($25/month)	
Effectiveness	25 out of 100 people fall at least once each year	10 out of 100 people fall at least once each year	30 out of 100 people fall at least once each year

○ **Program A**   ○ **Program B**   ○ No Program

Page Break ─────────────────────────────

Which of these options would you choose, if these were the only options? **Select one**.

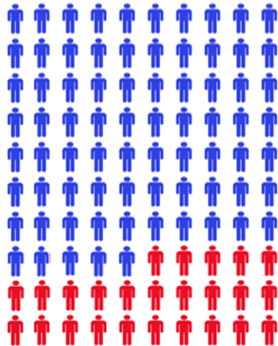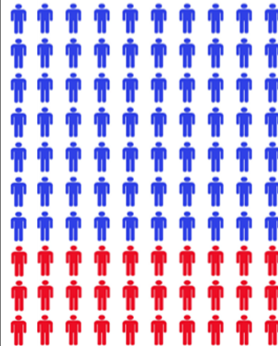| Program Description	Program A	Program B	No Program
Class type	At home with an exercise trainer	Group class	Do not participate in a program.
Timing	Four times per week (4/week) for 1 hour	Two times per week (2/week) for 1 hour	
Extras	No extras	One consultation with a home safety expert	
Cost	Fifty dollars per month ($50/month)	One hundred dollars per month ($100/month)	
Effectiveness	20 out of 100 people fall at least once each year	15 out of 100 people fall at least once each year	30 out of 100 people fall at least once each year

○ **Program A**   ○ **Program B**   ○ No Program

Which of these options would you choose, if these were the only options? **Select one**.

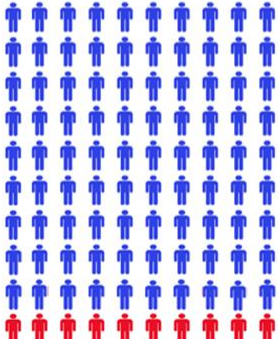| Program Description	Program A	Program B	No Program
Class type	Group class	Group class	Do not participate in a program.
Timing	Three times per week (3/week) for 1 hour	Five times per week (5/week) for 1 hour	
Extras	One consultation with a home safety expert	One consultation with a home safety expert	
Cost	Seventy-five dollars per month ($75/month)	Fifty dollars per month ($50/month)	
Effectiveness	15 out of 100 people fall at least once each year	10 out of 100 people fall at least once each year	30 out of 100 people fall at least once each year

○ **Program A**   ○ **Program B**   ○ No Program

Page Break

Which of these options would you choose, if these were the only options? **Select one**.

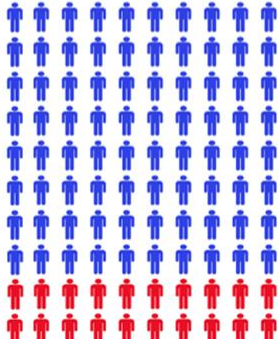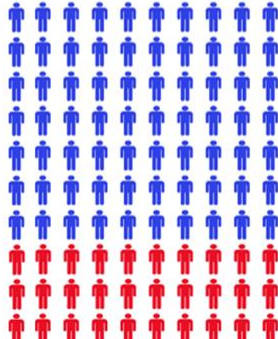| Program Description	Program A	Program B	No Program
Class type	Group class	Group class	
Timing	Two times per week (2/week) for 1 hour	Five times per week (5/week) for 1 hour	Do not participate in a program.
Extras	No extras	No extras	
Cost	One hundred dollars per month ($100/month)	Twenty-five dollars per month ($25/month)	
Effectiveness	20 out of 100 people fall at least once each year	20 out of 100 people fall at least once each year	30 out of 100 people fall at least once each year

○ **Program A**   ○ **Program B**   ○ No Program

Page Break

Which of these options would you choose, if these were the only options? **Select one**.

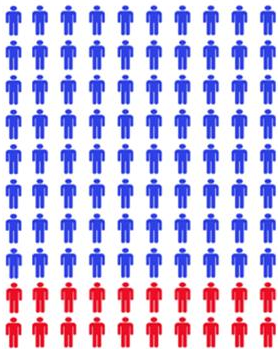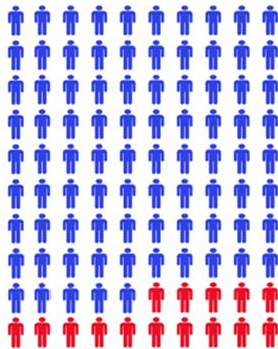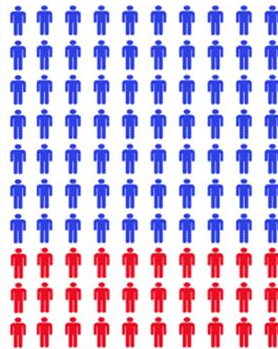| Program Description	Program A	Program B	No Program
Class type	At home with an exercise trainer	At home with an exercise trainer	
Timing	Five times per week (5/week) for 1 hour	Four times per week (4/week) for 1 hour	Do not participate in a program.
Extras	No extras	No extras	
Cost	Seventy-five dollars per month ($75/month)	Fifty dollars per month ($50/month)	
Effectiveness	10 out of 100 people fall at least once each year	20 out of 100 people fall at least once each year	30 out of 100 people fall at least once each year

○ **Program A**   ○ **Program B**   ○ No Program

Note: This is the repeated DCE question for Block 3.

Which of these options would you choose, if these were the only options? **Select one**.

Program Description	Program A	Program B	No Program
Class type	At home with an exercise trainer	Group class	
Timing	Four times per week (4/week) for 1 hour	Two times per week (2/week) for 1 hour	Do not participate in a program.
Extras	One consultation with a home safety expert	No extras	
Cost	One hundred dollars per month ($100/month)	Fifty dollars per month ($50/month)	
Effectiveness	15 out of 100 people fall at least once each year	25 out of 100 people fall at least once each year	30 out of 100 people fall at least once each year

○ **Program A**   ○ **Program B**   ○ No Program

Page Break

Which of these options would you choose, if these were the only options? **Select one**.

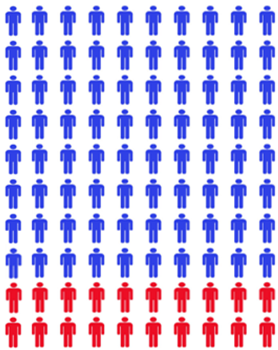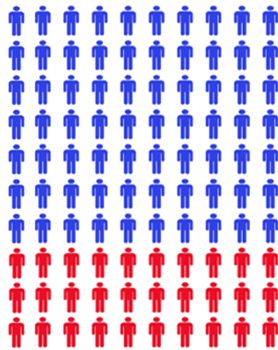| Program Description	Program A	Program B	No Program
Class type	At home with an exercise trainer	At home with an exercise trainer	Do not participate in a program.
Timing	Three times per week (3/week) for 1 hour	Five times per week (5/week) for 1 hour	
Extras	No extras	No extras	
Cost	One hundred dollars per month ($100/month)	Seventy-five dollars per month ($75/month)	
Effectiveness	25 out of 100 people fall at least once each year	15 out of 100 people fall at least once each year	30 out of 100 people fall at least once each year

○ **Program A**   ○ **Program B**   ○ No Program

Which of these options would you choose, if these were the only options? **Select one**.

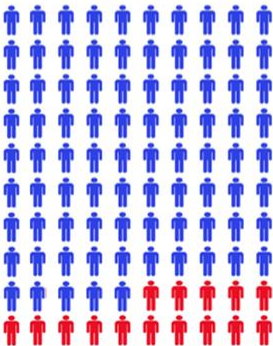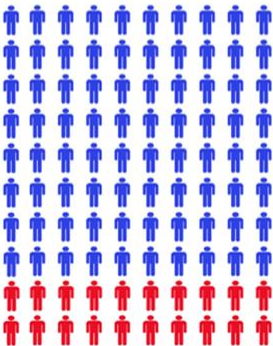| Program Description	Program A	Program B	No Program
Class type	Group class	Group class	
Timing	Five times per week (5/week) for 1 hour	Three times per week (3/week) for 1 hour	Do not participate in a program.
Extras	No extras	No extras	
Cost	Fifty dollars per month ($50/month)	Fifty dollars per month ($50/month)	
Effectiveness	25 out of 100 people fall at least once each year	10 out of 100 people fall at least once each year	30 out of 100 people fall at least once each year

○ **Program A**   ○ **Program B**   ○ No Program

Page Break

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Which of these options would you choose, if these were the only options? **Select one**.

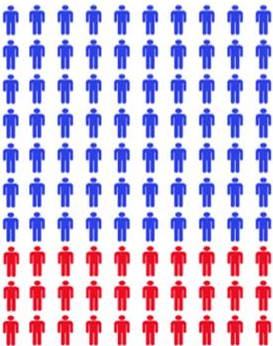| Program Description	Program A	Program B	No Program
Class type	Group class	Group class	Do not participate in a program.
Timing	Four times per week (4/week) for 1 hour	Three times per week (3/week) for 1 hour	
Extras	One consultation with a home safety expert	One consultation with a home safety expert	
Cost	Twenty-five dollars per month ($25/month)	Twenty-five dollars per month ($25/month)	
Effectiveness	10 out of 100 people fall at least once each year	20 out of 100 people fall at least once each year	30 out of 100 people fall at least once each year

○ **Program A**   ○ **Program B**   ○ No Program

Which of these options would you choose, if these were the only options? **Select one**.

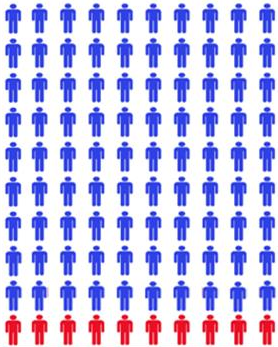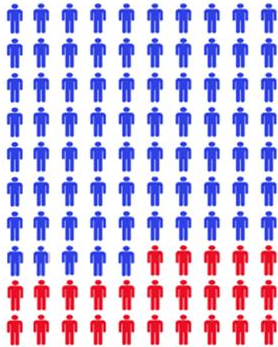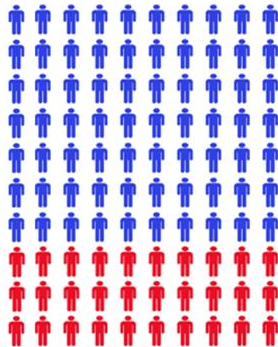| Program Description	Program A	Program B	No Program
Class type	At home with an exercise trainer	Group class	
Timing	Five times per week (5/week) for 1 hour	Two times per week (2/week) for 1 hour	Do not participate in a program.
Extras	No extras	One consultation with a home safety expert	
Cost	Seventy-five dollars per month ($75/month)	Twenty-five dollars per month ($25/month)	
Effectiveness	20 out of 100 people fall at least once each year	15 out of 100 people fall at least once each year	30 out of 100 people fall at least once each year

○ **Program A**   ○ **Program B**   ○ No Program

Page Break

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Which of these options would you choose, if these were the only options? **Select one**.

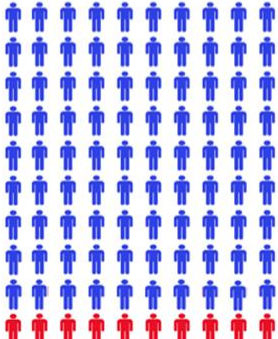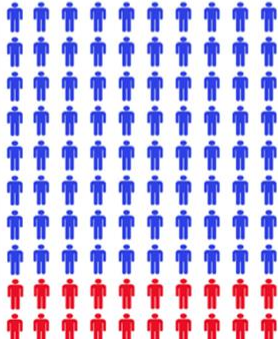| Program Description	Program A	Program B	No Program
Class type	Group class	At home with an exercise trainer	Do not participate in a program.
Timing	Three times per week (3/week) for 1 hour	Four times per week (4/week) for 1 hour	
Extras	No extras	One consultation with a home safety expert	
Cost	Twenty-five dollars per month ($25/month)	One hundred dollars per month ($100/month)	
Effectiveness	20 out of 100 people fall at least once each year	10 out of 100 people fall at least once each year	30 out of 100 people fall at least once each year

○ **Program A**   ○ **Program B**   ○ No Program

Page Break

Which of these options would you choose, if these were the only options? **Select one**.

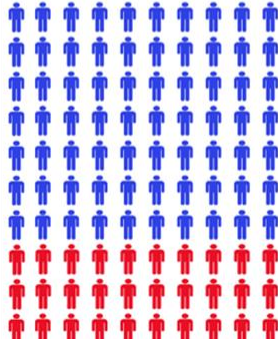| Program Description	Program A	Program B	No Program
Class type	Group class	At home with an exercise trainer	Do not participate in a program.
Timing	Two times per week (2/week) for 1 hour	Four times per week (4/week) for 1 hour	
Extras	One consultation with a home safety expert	No extras	
Cost	Fifty dollars per month ($50/month)	Seventy-five dollars per month ($75/month)	
Effectiveness	15 out of 100 people fall at least once each year	20 out of 100 people fall at least once each year	30 out of 100 people fall at least once each year

◯ **Program A**   ◯ **Program B**   ◯ No Program

Page Break

Which of these options would you choose, if these were the only options? **Select one**.

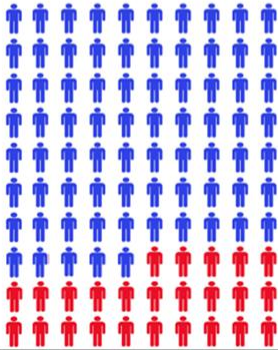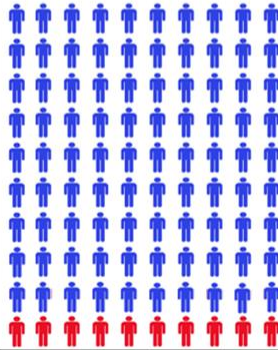| Program Description	Program A	Program B	No Program
Class type	At home with an exercise trainer	At home with an exercise trainer	Do not participate in a program.
Timing	Two times per week (2/week) for 1 hour	Five times per week (5/week) for 1 hour	
Extras	One consultation with a home safety expert	One consultation with a home safety expert	
Cost	Seventy-five dollars per month ($75/month)	One hundred dollars per month ($100/month)	
Effectiveness	10 out of 100 people fall at least once each year	25 out of 100 people fall at least once each year	30 out of 100 people fall at least once each year

○ **Program A**   ○ **Program B**   ○ No Program

Page Break

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Which of these options would you choose, if these were the only options? **Select one**.

Program Description	Program A	Program B	No Program
Class type	Group class	Group class	Do not participate in a program.
Timing	Four times per week (4/week) for 1 hour	Three times per week (3/week) for 1 hour	
Extras	One consultation with a home safety expert	One consultation with a home safety expert	
Cost	Twenty-five dollars per month ($25/month)	Twenty-five dollars per month ($25/month)	
Effectiveness	10 out of 100 people fall at least once each year	20 out of 100 people fall at least once each year	30 out of 100 people fall at least once each year

○ **Program A**　　　○ **Program B**　　　○ No Program

Page Break

Note: This is the repeated DCE questions for Block 4.

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Which of these options would you choose, if these were the only options? **Select one**.

Program Description	Program A	Program B	No Program
Class type	Group class	Group class	
Timing	Two times per week (2/week) for 1 hour	Two times per week (2/week) for 1 hour	Do not participate in a program.
Extras	No extras	No extras	
Cost	One hundred dollars per month ($100/month)	Twenty-five dollars per month ($25/month)	
Effectiveness	25 out of 100 people fall at least once each year	10 out of 100 people fall at least once each year	30 out of 100 people fall at least once each year

○ **Program A**   ○ **Program B**   ○ No Program

Page Break

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You're almost done! The next section asks about your experience filling out the survey questions that you just answered. Please press "Next" to continue.

Page Break

Questions were easy to read and understand.

○ Agree

○ Disagree

○ Not sure

Questions loaded easily on my computer, phone, or tablet.

○ Agree

○ Disagree

○ Not sure

It was tiring to answer all the questions.

○ Agree

○ Disagree

○ Not sure

Page Break ─────────────────────────────

Please provide any comments about your experience filling out these survey questions so far.

_____

_____

_____

_____

_____

Page Break

The next section is the last one. This section asks about your opinion on some things that might make it easier or harder to participate in programs that help people improve their balance and avoid falls. Please press "Next" to continue.

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If you were choosing a program to help you improve your balance and avoid falls, what would be most important to you? Please click, drag, and drop the items below to order them from most to least important, so the most important item is at the top of the list and the least important is at the bottom.

_____ Cost of the program

_____ How effective the program is at helping people avoid falls

_____ Location (for example, in a community center or in your own home)

_____ Whether or not it includes consultations with a home safety expert

_____ How often the sessions are (for example, two or three times per week)

Page Break

If you were choosing a program to help you improve your balance and avoid falls, which of these two things would be more important to you? **Please choose one answer.**

○ Socializing with other people in the program

○ How close to home the program is located

Page Break

Please provide any comments about what you would like to see in a program to help improve your balance and avoid falls.

_____

_____

_____

_____

_____

Page Break

On a scale of 1 to 6, where 1=strongly disagree and 6=strongly agree, please indicate how much you agree or disagree with each statement.

	Strongly Disagree 1	Disagree 2	Somewhat Disagree 3	Somewhat Agree 4	Agree 5	Strongly Agree 6
My doctor always leaves time during visits for me to ask questions.	○	○	○	○	○	○
I feel comfortable talking about my risk of falling.	○	○	○	○	○	○
I have resources to help me learn about how to prevent falls.	○	○	○	○	○	○
I have people around me who care about my health.	○	○	○	○	○	○
I have reliable transportation when I need it.	○	○	○	○	○	○
It's easy to fit new things into my schedule.	○	○	○	○	○	○
Learning about how to prevent falls could cost me too much money.	○	○	○	○	○	○
I enjoy socializing with other people.	○	○	○	○	○	○
Exercise is easy for me to do.	○	○	○	○	○	○
There are many community activities for older adults in the area that I live.	○	○	○	○	○	○

Page Break

End of Block: Barriers and Facilitators