Exercise and Fall Prevention: Narrowing the Research-to-Practice Gap and Enhancing Integration of Clinical and Community Practice

Fuzhong Li, PhD,* Elizabeth Eckstrom, MD, MPH,† Peter Harmer, PhD, MPH,‡ Kathleen Fitzgerald, MD,§ Jan Voit, PT,¶ and Kathleen A. Cameron, MPH**

Falls in older adults are a global public health crisis, but mounting evidence from randomized controlled trials shows that falls can be reduced through exercise. Public health authorities and healthcare professionals endorse the use of evidence-based, exercise-focused fall interventions, but there are major obstacles to translating and disseminating research findings into healthcare practice, including lack of evidence of the transferability of efficacy trial results to clinical and community settings, insufficient local expertise to roll out community exercise programs, and inadequate infrastructure to integrate evidence-based programs into clinical and community practice. The practical solutions highlighted in this article can be used to address these evidence-to-practice challenges. Falls and their associated healthcare costs can be reduced by better integrating research on exercise intervention into clinical practice and community programs.


Key words: falls; older adults; evidence-based; exercise

Every year, one in three community-dwelling adults aged 65 and older falls. Many of these falls lead to moderate to severe injuries, resulting in emergency department visits and hospital admissions, and the death rate from falls has risen sharply over the past decade.1 Falls present a considerable financial challenge to the nation’s healthcare services. In 2013, the direct medical costs for fall-related incidents, adjusted for inflation, was $34 billion, mostly covered by Medicare.1,2 These medical costs will rise as baby boomers age and fall-related injuries increase.2

Falls are preventable with risk assessment and exercise. Exercise has been shown to reduce the incidence of falls by 13%3 to 40%,4,5 which has led to a broad consensus among experts that community-dwelling older adults, especially those at risk of falling, should be offered exercises that incorporate elements of balance, gait, and strength training.5,7 Organizations including the American Geriatrics Society and British Geriatrics Society,6 Academy of Geriatric Physical Therapy of the American Physical Therapy Association,7 National Institute for Health and Care Excellence,8 U.S. Preventive Services Task Force,9 and National Council on Aging have issued guidelines, recommendations, and action plans to assist practitioners working with those at risk for falls.

The Centers for Disease Control and Prevention (CDC) Injury Center has created the CDC Compendium of Effective Fall Interventions: What Works for Community-Dwelling Older Adults,10 which identifies 14 exercise-based interventions supported by randomized controlled trials (RCTs). Table 1 provides summary information of these interventions, their outcomes in reducing falls, and on-line resources.

However, few of these evidence-based interventions have been adopted in clinical or community practice25,26 because of a lack of research-to-practice data and gaps in the current guidelines regarding how to prescribe appropriate interventions or implement and integrate them into routine clinical and community practice. In this article we highlight current challenges to delivering these CDC-complied interventions and offer solutions to enhance their potential to serve clients through community programs and medical practice.

CHALLENGES

Efficacy Versus Effectiveness Research

Most of the CDC Compendium exercise interventions are efficacy (explanatory) trials conducted under controlled...
## Table 1. Summary Information on Exercise-Focused Evidence-Based Fall Prevention Interventions Compiled by the Centers for Disease Control and Prevention

<table>
<thead>
<tr>
<th>Program</th>
<th>Reduction in Fall Rates or Risk</th>
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<tr>
<td>Stay Safe, Stay Active&lt;sup&gt;11&lt;/sup&gt;</td>
<td>40%</td>
<td>Community setting, delivered by accredited exercise instructors</td>
<td>1-hour class session (37 sessions total) once per week over 1-year period</td>
<td><a href="http://www.cdc.gov/HomeandRecreationalSafety/Falls/compendium.html">www.cdc.gov/HomeandRecreationalSafety/Falls/compendium.html</a></td>
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<tr>
<td>The Otago Exercise Programme&lt;sup&gt;12&lt;/sup&gt;</td>
<td>35%</td>
<td>Home setting, delivered by physical therapists or nurses</td>
<td>30-minute individual session 3 times per week plus outdoor walk ≥2 times per week</td>
<td><a href="http://www.med.unc.edu/ag...">www.med.unc.edu/ag...</a>, <a href="http://www.med.unc.edu/ag.../PRD_EXT_CSMP/groups/external_providers/documents/publications_promotion/prd_ctrb118334.pdf">www.acc.co.nz/PRD_EXT_CSMP/groups/external_providers/documents/publications_promotion/prd_ctrb118334.pdf</a></td>
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<tr>
<td>Erlangen Fitness Program&lt;sup&gt;13&lt;/sup&gt;</td>
<td>23%</td>
<td>Home setting, delivered by physical therapists or nurses</td>
<td>1-hour class session (32 sessions total) twice weekly for 16 weeks plus selected daily home exercises</td>
<td><a href="http://www.cdc.gov/HomeandRecreationalSafety/Falls/compendium.html">www.cdc.gov/HomeandRecreationalSafety/Falls/compendium.html</a></td>
<td>Unavailable</td>
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<tr>
<td>Tai Chi: Moving for Better Balance&lt;sup&gt;14a&lt;/sup&gt;</td>
<td>55% risk of multiple falls</td>
<td>Local senior centers and adult activity centers, delivered by a tai chi grand master</td>
<td>1-hour class session (48 sessions total) twice weekly for 24 weeks</td>
<td><a href="http://tjqmbb.org/program.html">tjqmbb.org/program.html</a></td>
<td><a href="http://tjqmbb.org">tjqmbb.org</a></td>
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<td>Australian Group Exercise Program&lt;sup&gt;15&lt;/sup&gt;</td>
<td>22% for the whole study sample; 31% for a subsample who had fallen in previous year</td>
<td>Residential care community centers and senior centers, delivered by trained exercise instructors</td>
<td>1-hour class session (96 sessions total) twice weekly for 12 months</td>
<td><a href="http://www.cdc.gov/HomeandRecreationalSafety/Falls/compendium.html">www.cdc.gov/HomeandRecreationalSafety/Falls/compendium.html</a></td>
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<td>Veterans Affairs Group Exercise Program&lt;sup&gt;16&lt;/sup&gt;</td>
<td>6 falls per 1,000 hours of activity</td>
<td>Clinical settings, delivered by trained exercise physiology graduate students</td>
<td>90-minute class session (36 sessions total) 3 times weekly for 12 weeks</td>
<td><a href="http://www.cdc.gov/HomeandRecreationalSafety/Falls/compendium.html">www.cdc.gov/HomeandRecreationalSafety/Falls/compendium.html</a></td>
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<td>Falls Management Exercise Intervention&lt;sup&gt;17&lt;/sup&gt;</td>
<td>31%</td>
<td>Community leisure centers and homes, delivered by trained exercise instructors, physical therapists, and occupational therapists</td>
<td>1-hour class session (36 sessions total) weekly plus 30-minute, twice-weekly home exercise session for 36 weeks</td>
<td><a href="http://www.laterlifetraining.co.uk/">www.laterlifetraining.co.uk/</a></td>
<td><a href="http://www.cdc.gov/HomeandRecreationalSafety/Falls/compendium.html">www.cdc.gov/HomeandRecreationalSafety/Falls/compendium.html</a></td>
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<td>Central Sydney Tai Chi Trial&lt;sup&gt;18&lt;/sup&gt;</td>
<td>35%</td>
<td>General community settings (e.g., town halls, senior centers), delivered by experienced tai chi instructors or instructors experienced in teaching physical activity to older people</td>
<td>1-hour class session (16 sessions total) weekly for 16 weeks</td>
<td><a href="http://www.cdc.gov/HomeandRecreationalSafety/Falls/compendium.html">www.cdc.gov/HomeandRecreationalSafety/Falls/compendium.html</a></td>
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<td>Simplified Tai Chi&lt;sup&gt;19&lt;/sup&gt;</td>
<td>47% risk of multiple falls</td>
<td>Facilities in a residential retirement community, delivered by tai chi grand master</td>
<td>25-minute class session (30 sessions total) twice weekly, with an encouragement of 15 minute practice daily, for 15 weeks</td>
<td><a href="http://www.cdc.gov/HomeandRecreationalSafety/Falls/compendium.html">www.cdc.gov/HomeandRecreationalSafety/Falls/compendium.html</a></td>
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Table 1 (Cont.)

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<tr>
<td>Lifestyle Approach to Reducing Falls Through Exercise(^{20})</td>
<td>31%</td>
<td>Home settings, delivered by a physical therapist, occupational therapist, or exercise physiologist</td>
<td>Weekly 40–90 minute sessions for 5 weeks with 2 booster visits</td>
<td><a href="http://www.cdc.gov/HomeandRecreationalSafety/Falls/compendium.html">www.cdc.gov/HomeandRecreationalSafety/Falls/compendium.html</a> ses.library.usyd.edu.au/handle/2123/10627</td>
<td>Unavailable</td>
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<tr>
<td>Senior Fitness and Prevention(^{21})</td>
<td>46%</td>
<td>Community gymnasiums, delivered by certified exercise instructors</td>
<td>Twice-weekly 60-minute classes plus two 20-minute home exercise sessions for 18 months</td>
<td><a href="http://www.cdc.gov/HomeandRecreationalSafety/Falls/compendium.html">www.cdc.gov/HomeandRecreationalSafety/Falls/compendium.html</a></td>
<td>Unavailable</td>
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<tr>
<td>Adapted Physical Activity Program(^{22})</td>
<td>60%</td>
<td>A local community sport center, delivered by a physical therapist and a physical therapy student assistant</td>
<td>1-hour class session (48 sessions total) twice weekly for 25 weeks</td>
<td><a href="http://www.cdc.gov/HomeandRecreationalSafety/Falls/compendium.html">www.cdc.gov/HomeandRecreationalSafety/Falls/compendium.html</a></td>
<td>Unavailable</td>
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<tr>
<td>Music-Based Multitask Exercise Program(^{23})</td>
<td>54%</td>
<td>Common areas of residential retirement Communities, delivered by certified Jaques-Dalcroze instructors</td>
<td>1-hour weekly classes (25 sessions total) for 25 weeks</td>
<td><a href="http://www.cdc.gov/HomeandRecreationalSafety/Falls/compendium.html">www.cdc.gov/HomeandRecreationalSafety/Falls/compendium.html</a></td>
<td>Unavailable</td>
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<tr>
<td>Multitarget Stepping Program(^{24})</td>
<td>65%</td>
<td>A community health center, delivered by a physical therapist or an exercise trainer</td>
<td>Twice weekly 5- to 7-minute multitask stepping exercises plus 30-minute physical exercise (including mild strength training, aerobic, balance, flexibility exercises) sessions (48 sessions total) for 24 weeks</td>
<td><a href="http://www.cdc.gov/HomeandRecreationalSafety/Falls/compendium.html">www.cdc.gov/HomeandRecreationalSafety/Falls/compendium.html</a></td>
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\(^{a}\) The program has been renamed Tai Ji Quan: Moving for Better Balance\(^{31,36}\)
Clinicians and Community Providers Do Not Connect

Although it seems obvious that maximizing the impact of any intervention relies primarily on clinicians referring patients to existing community-based programs, little effort has been made to bridge the communication gap between clinicians and community service providers. Most communities have no coordinated system that allows clinicians to determine what specific interventions are available, which would be the best fit for a particular patient, or whether a patient has enrolled in and completed a program. Similarly, community providers have no standard means to gauge potential demand for specific interventions and generally have offered programs using an “if you build it, they will come” approach rather than responding to a clear need identified by healthcare professionals. These gaps have made implementation of any proven intervention challenging for clinicians and community service providers.

SOLUTIONS

Conducting More Translation/Effectiveness Research

Once efficacy has been established, RCTs that have an effectiveness focus need to be implemented in settings where the targeted populations reside and sustainable programs are to be established. Additional research into the optimal training modes (i.e., strength, balance, gait), specificity (duration, intensity, frequency), and delivery methods (e.g., referrals, covered services) in practical settings is necessary. Findings from these studies would improve translation of research into practice and policy.

Studies must include successful public health models, such as RE-AIM (Reach, Effectiveness, Adoption, Implementation, and Maintenance),30 to evaluate translation and dissemination of interventions. For example, when utilizing the RE-AIM model, Li et al.31 found that a customized Tai Ji Quan program was successfully adopted by healthcare providers (i.e., patients were referred to the program), had excellent reach into the target population (referred patients enrolled in the program), was delivered with high fidelity, and produced significant improvements in physical performance and reductions in falls among participants. This type of data provides critical practice-based information related to program dissemination and implementation.

Increasing Clinician Awareness and Adoption of Proven Exercise Interventions

To integrate American Geriatrics Society and British Geriatrics Society guidelines into clinical practice, the CDC has developed the toolkit Stopping Elderly Accidents, Deaths, and Injuries,32 which provides clinicians with tools to assess and reduce fall risks among older adults. The materials include recommendations for participation in evidence-based exercise programs. For example, in the section Integrating Fall Prevention into Practice, providers are encouraged to identify community exercise fall prevention programs for their patients, but as noted previously, clinicians are often unaware of available resources in their community. Links to local community resources that

Lack of Specific Utilization Directions

Current clinical guidelines6–8 and recommendations9 do not translate into specific exercise prescriptions for older adults with varying risks of falling, nor are there sufficient resources for making specific referrals to community-based exercise programs. These deficiencies create obstacles for prescribing fall-prevention exercise interventions, especially for primary care physicians who are often overburdened with competing healthcare priorities.25

Adoption of Guidelines by Healthcare Providers Is Limited

Adoption of guidelines in clinical practice has been limited and slow.26 Jones and colleagues showed that only 8% of primary care physicians based their fall prevention practices on guidelines from any recognized organization.27 Commonly cited barriers to adoption include the lack of time, training opportunities, financial incentives, and coordination among healthcare providers, and the need for simpler and more easily disseminated materials and referral resources.25–27 In rehabilitation settings, Peel et al. reported that although home physical therapists were knowledgeable in identifying fall risk factors, they had difficulty linking them to prescribed interventions or identifying available interventions.28

Few Comprehensive Community Programs Are Available

Although community service providers may wish to sponsor fall prevention programs, they often do not have adequate knowledge of best practices in fall prevention22 nor do they have the expertise to support program implementation (e.g., determining the cost and financing for the intervention, training instructors, and monitoring fidelity of intervention delivery). In addition, most CDC-compiled interventions do not provide an implementation plan with details on program installation, instructor training requirements, class conduct, or program fidelity and adaptation. Consequently, the majority of the interventions are not easily accessible, readily available, or widely disseminated to local communities (Table 1).
provide details of community fall-prevention programs must be created so that clinicians can use available resources. Another useful example is the National Council on Aging, which provides excellent resources for professionals, including a checklist for assessing the quality of fall prevention programs, a guide to state coalition building, and a compendium of initiatives from state coalitions.

Professional organizations and the public health sector must actively campaign for, and sponsor, in-service and continuing education opportunities for healthcare providers to expose them to specific fall prevention interventions and bring available resources (e.g., referral procedures, ready-to-use pamphlets, referral pads) directly to their attention. Research shows that offering providers opportunities to undertake training programs as part of their continuing education increases referrals to fall prevention programs.31

Increasing Support for Community Intervention Programs

Two keys to broadening availability of evidence-based exercise fall prevention programs are enhancing the expertise of community providers and securing financial support. Although interested community providers can improve their understanding of operational challenges associated with fall prevention programs by attending workshops or inviting in experts, substantial progress will require an increase in the availability of turnkey packages derived from translational research that provide specific directions for all aspects of a program (e.g., advertising, recruitment, instructor training, class teaching procedures, program adaption, outcome assessment). To increase the number of these packages, research funding agencies must extend support for research that focuses on the transition of efficacy research findings into effectiveness studies in clinical and community service delivery settings. In the meantime, program developers and physical therapists (who are already directly involved in managing patients with falls and balance deficits)7 might be contracted on an ad hoc basis to assist community implementers in translating efficacy-based training protocols into practical programs and provide ongoing training and technical support to ensure implementation integrity and intervention fidelity.

Although local community organizations (e.g., Archstone Foundation) fully sponsor a few fall prevention programs, the majority are self-supported, fee-based enterprises, which may limit their reach to populations with limited financial resources. Fall prevention exercise programs require financial support through Medicare, Medicaid, and private health insurers to make them truly accessible to all older adults at risk of falls.33 The current model of coverage for screening for fall risk but not for exercise interventions, especially for noninstitutionalized individuals, is shortsighted. This should be a policy priority for national organizations with elder care or public health mandates. Cost-effectiveness data exist for public policymakers and insurers to underwrite these programs. For example, several of the CDC-identified programs are shown to deliver excellent returns on investment, with Tai Ji Quan programs returning 509% per dollar invested and the Otago program returning 127% per dollar invested for persons aged 80 and older.34 Funds that support health promotion and disease prevention programs (including falls) sponsored by the Administration on Community

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**Figure 1.** Proposed model to incorporate evidence-based fall prevention interventions into integrated practice by healthcare professionals and community service providers. STEADI = stopping elderly accidents, deaths, and injuries
The current challenges and possible solutions to disseminating evidence-based exercise fall prevention interventions have been presented (Table 2). The results of efficacy studies on fall prevention provide a strong foundation on which to build a more-cohesive and more-comprehensive approach to this persistent healthcare dilemma. CDC-complied interventions provide healthcare practitioners and community-based organizations with clear directions for linking those at risk of falling to specific evidence-based programs in the community as part of their care plans, but...
translational research and uptake of the exercise interventions that the CDC cites have been limited in the community. Unless the challenges to providing exercise-based options for fall prevention to millions of older adults currently at risk of falling are recognized and overcome, the personal, social, and fiscal costs related to falls will continue to rise. The solutions articulated in this article could bridge evidence-to-practice gaps and facilitate clinical and community integration of proven fall-prevention exercise interventions.

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REFERENCES