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The Public Health Approach to Older Adult Fall Prevention: Comments from the U.S. Centers for Disease Control and Prevention

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Abstract: Unintentional falls among persons aged 65 years and older are an important public health issue, associated with significant mortality and morbidity. About one third of older adults fall annually and, although many fall outcomes are minor, between 10% and 20% cause serious injuries such as traumatic brain injury, contusions, and fractures. Therefore the U.S. Centers for Disease Control and Prevention (CDC) is working to prevent injuries and fatalities due to older adult falls. The public health approach to older adult falls focuses on prevention and is based on scientific rigor. Its steps include defining the problem, identifying causes, developing and testing interventions, and then implementing effective approaches on a large scale. We highlight current CDC activities that map onto each step of the public health model and close by providing future directions for older adult fall prevention, including improved surveillance, support for program implementation, and enhanced partnership building.

Keywords: Older adult falls, public health, prevention.

THE PROBLEM OF OLDER ADULT FALLS

Unintentional falls among persons aged 65 years and older are an important public health issue, associated with significant mortality and morbidity. About one third of older adults fall annually [1,2] and, although many fall outcomes are minor, between 10% and 20% cause serious injuries such as traumatic brain injury, contusions, and fractures [3]. Such injuries often result in decreased functional abilities, loss of independence, and early admission to nursing homes [4-6].

In 2007, falls among older adults were responsible for 18,334 deaths and 1.92 million visits to hospital emergency departments (EDs) [7]. About 1%-2% of falls result in hip fracture [8], one of the most severe injuries and one that often leads to long term disability and nursing home admission. More than 90% of hip fractures are caused by falls, usually by falling onto the hip [9,10]. In 2007 there were approximately 281,000 hospital admissions for hip fracture [11].

In addition to physical injury, falls can have major psychological and social consequences. Fear of falling and loss of self-confidence can cause seniors to restrict their activity, leading to reduced mobility, a decline in social interactions, decreased physical fitness, and increased fall risk [12-14]. Falls also have an enormous economic impact. In 2000, the direct medical cost of fatal and nonfatal fall injuries was just over $19 billion [15].

THE PUBLIC HEALTH APPROACH

Since the early 1980s, the Centers for Disease Control and Prevention (CDC) has focused on injury prevention by using a public health approach. Currently, CDC's National Center for Injury Prevention and Control (NCIPC) is funded to strengthen efforts to prevent a multitude of unintentional injuries, including older adult falls. CDC's prevention efforts are best characterized by an emphasis on primary prevention, or keeping adverse health events from occurring in the first place. To prevent older adult falls and their consequences – injuries, disabilities, and deaths – we must include strategies that focus on the behavior of older adults as well as the medical and environmental risk factors associated with falling. The public health perspective emphasizes changes at all levels of social life, including individual, family, community (e.g., neighborhood or school), and the broader society.

Four basic steps characterize the public health approach. First we ask, "What is the extent of the health problem?" Collecting and analyzing surveillance data provides basic information about the underlying patterns and the health burden. Data on both fatal and nonfatal injuries are used to quantify the magnitude of older adult falls. In the second step of the model we ask, "What is the cause of the problem?" Answering this question leads public health professionals to understand underlying causes of older adult falls and identify modifiable risk factors. For the third step, we ask, "What strategies effectively prevent this problem?" The key activities at this step include integrating information about patterns and risk factors to identify and evaluate interventions that may decrease the likelihood of older adult falls. The fourth and final step asks, "How do we employ 'what works' on a large scale?" At this stage, we take evidence-based interventions into state and local settings. This process includes "translating" interventions for application in real-world settings, disseminating them widely, and ensuring effective implementation of those interventions.

This four-step approach has resulted in dramatic successes, from the development of safe drinking water and sanitation systems, to the eradication of smallpox and improved motor vehicle safety. We believe it can have an

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equally impressive impact when applied to older adult falls. Below, we describe CDC's current fall prevention activities that map onto the public health approach. By following these steps and working collaboratively with a wide range of partners, CDC aims to reduce the number of injuries and deaths attributable to older adult falls.

CDC'S EFFORTS TO PREVENT OLDER ADULT FALLS

Defining, Describing, and Tracking Older Adult Falls (Step One)

CDC uses vital records data to help define the problem of fatal falls. Vital records are based on data from all U.S. death certificates and are compiled by the National Center for Health Statistics (NCHS). Vital records are coded for the underlying cause of death, with specific codes that designate unintentional falls. Although these data suffer from acknowledged shortcomings (e.g., incomplete coding leads to undercounting, delays in data availability), they represent the most comprehensive information available and can be used to calculate national and state-specific fall death rates.

A larger number of older adults suffer nonfatal fall injuries. CDC uses the National Electronic Injury Surveillance System – All Injury Program (NEISS-AIP), which is a collaborative effort by NCIPC and the Consumer Product Safety Commission, to assess nonfatal falls. This system collects data from a nationally representative sample of approximately sixty EDs (depending on the year) about injuries treated in their facilities. These hospitals represent a stratified (by size and type of hospital) probability sample of all U.S. hospitals that have at least six beds and provide 24-hour emergency services. The sample includes very large inner-city hospitals with trauma centers as well as urban, suburban, rural, and children's hospitals. Given that the ED captures the more severe injuries, such as fractures or head trauma, NEISS-AIP data allow us to estimate national rates of serious nonfatal fall injuries, but do not include injuries that are treated in other outpatient settings.

Both of these data bases are accessible to the public through CDC's interactive web-based system, WISQARS (Web-based Injury Statistics Query and Reporting System). WISQARS provides information on fatal injuries from 1981 to 2007 and on nonfatal injuries from 2001 to 2009. WISQARS allows users to develop customized reports by type of injury, sex, race, ethnicity, and various age groupings. Thus, this data tool allows public health professionals, policy makers, and the general public to examine older adult fall injuries and gain a clearer understanding of the scope of this important public health issue.

For example, vital statistics data (available in WISQARS) for 2007 shows that falls were the leading cause of deaths from injuries among people aged 65 and older [7]. About 48%, or approximately 18,300 deaths, were attributable to falls, which means that every 29 minutes an older adult died from a fall injury. Roughly 50% of these fall-related deaths were due to a traumatic brain injury and 30% were due to lower extremity injuries [7].

Death rates for both men and women increase sharply with age. If we examine trends over time (2000-2007) and adjust for the aging of the US population, we see that fall death rates are higher among men than women and rates are increasing. Rates for men increased 45% and rates for women increased 55%. Men are more likely to die from a fall, while women are more likely to suffer serious nonfatal injuries such as contusions and fractures [7].

In 2009, falls accounted for 2.2 million nonfatal injuries among people age 65 and older treated in EDs. This means that every 17 seconds an older adult was treated in an ED. About three quarters of seniors treated in EDs for falls were treated and released, while roughly one quarter was hospitalized for their injuries. Like fatal fall rates, nonfatal rates also have increased, although to a lesser extent [7].

Identifying Causes of Older Adult Falls (Step Two)

Research has provided a wealth of information about fall risk factors. In general, risk factors can be categorized into three groups: intrinsic or biological; environmental; and behavioral. Some conceptualizations include a fourth category for social factors.

Biological Factors

Some biological factors are important but cannot be modified, such as older age, being female, having certain chronic disease conditions (e.g., diabetes, arthritis), or being mentally impaired. However, several factors are appropriate targets for public health prevention efforts because they can be modified. These include: muscle weakness in the legs, which on average, increases the risk of falling by a factor of four; gait and balance problems, which almost triple fall risk; and vision problems, which increase the risk of falling about two and a half times, on average [16].

Environmental Factors

Some environmental factors, such as cold temperatures, uneven pavement, and poorly designed public spaces (e.g., street crossings and parking lots) are difficult or impossible to change. Fortunately, however, there are risk factors, especially those in the home, which can be modified. Examples include clutter in walkways, tripping hazards, dim lighting, and lack of stair railings or grab bars in the bathroom [17].

Behavioral

Behavioral factors are commonly targeted by public health efforts because they are generally considered modifiable. Risky behaviors include: climbing on ladders or chairs [18]; taking four or more medications or taking psychoactive medications such as tranquilizers and antidepressants [19]; and importantly, being inactive, which leads to poor physical conditioning and muscle weakness [16]. While all these factors are potentially modifiable through well developed interventions, it is well documented that human behavior is difficult to change, especially for sustained periods of time [20]; changing older adults' behaviors to prevent falls is no exception [21].

There is mounting evidence to support an additional bundle of risk and protective factors related to social and psychosocial conditions. For example, social integration, as measured by size and quality of family and friendship networks, has been shown to protect against falls [22] and fall-related fractures [23]. Conversely, some psychosocial condi-

tions such as depression increase the risk of falls and their related injuries [23-25].

This entire body of information about modifiable risk factors, across categories, helps public health professionals to develop prevention approaches. However, this information is based largely on studies of community-dwelling older adults. More research is needed to identify risk factors for adults aged 65 and older who have special needs (e.g., homebound, cognitive impairments), and those who live in nursing homes and other assisted living facilities

Developing and Testing Interventions to Prevent Falls (Step Three)

Research has demonstrated that the more risk factors a person has, the greater his/her chances of falling [26]. Therefore, the more risk factors we can target at one time, the better. Fortunately, several effective multi-factorial (or multifaceted) programs exist to address multiple co-occurring risk factors. Elements of these effective programs are described below.

First, an individualized assessment by a physician or health care provider to identify the older adult's specific risk factors is critical to understanding and providing an appropriate medical or programmatic course of action. A person may have multiple risk factors, such as a number of chronic conditions, fear of falling, and difficulty walking [27].

Second, exercise that develops balance and lower body strength has been identified as one of the most important components of effective fall prevention programs. All forms of exercise have positive health benefits but to prevent falls, exercise must challenge balance and get progressively harder over time [28]. People at high risk of falling may need individualized physical therapy, while others may benefit from a group class. Again, these individualized needs should be assessed by a trained health care provider.

The third element is medication management, which involves having a doctor or pharmacist review all the over-the-counter and prescription medications an older adult may be taking. Reducing the number of medications, finding alternative drugs, and adjusting dosages can reduce side effects and interactions that sometimes lead to falls [19,29].

Fourth, eye examinations and vision correction can help reduce the risk of falling. Many older adults have glasses with multifocal lenses that can reduce edge contrast and depth perception, creating a fall hazard. Single vision lenses may be a better choice for activities such as walking that require good depth perception. Removing cataracts has also been shown to reduce falls [30].

Finally, since more than half of falls happen at home [18], modifying this environment to make it safer is a key element in any fall prevention program. Along with reducing tripping hazards and adding railings and grab bars, it is important to improve visibility by having good lighting throughout the home [17].

Translation, Dissemination, and Implementation of Effective Fall Prevention Interventions (Step Four)

To make an impact on the public's health, evidence-based strategies must be widely adopted and used effectively. This final step of the public health approach aims to bring the best existing scientific strategies to the greatest number of appropriate settings where implementation can occur –state health departments, hospitals, community organizations, and homes. Moving research into practice in this fashion requires three steps: translation, dissemination, and implementation support. For the purposes of this manuscript, *translation* includes any steps that may be required to prepare a proven intervention for wider use in new settings or with new audiences (e.g., creating training materials, repackaging a curriculum, modifying an implementation strategy); *dissemination* includes the intentional spreading of a particular intervention; *implementation* occurs when an intervention is adopted and used.

Translation of Scientific Interventions into Community-Based Programs

Evidence-based programs can be developed using a combination of the five key elements described above. In fact, many communities have already developed their own programs to meet local needs and preferences. However, very few of these efforts have been rigorously evaluated and therefore do not qualify as "proven" or "effective" interventions. When feasible, it is optimal to use an intervention that has been tested in a randomized controlled trial and shown to reduce falls. There are over a dozen such interventions from around the world, such as Australia and New Zealand, but most have not yet been translated for community settings in the U.S. In 2008, CDC published a document describing fourteen effective interventions [31] and began translating two of them – *Tai Chi: Moving for Better Balance* and *Stepping On*-- for widespread use in the U.S. These two interventions were selected because they were the closest to being ready for community-based implementations due to the availability of training materials and a program curriculum.

A Tai Chi intervention developed by Dr. Fuzhong Li at the Oregon Research Institute, was designed for adults aged 70 and older. Participants learned 24 body-movement exercises during one-hour classes offered three times a week for twenty six weeks. A randomized controlled trial of physically inactive community dwelling adults aged 70 and older found that Tai Chi participants had 55% fewer falls six months later, compared to a control group enrolled in a stretching class [32]. Having met the standard for an effective strategy, CDC funded Dr. Li to translate this intervention into a community-based program with potential for widespread adoption [33, 34]. As a result of this funding, Dr. Li has refined (and shortened) the program and developed materials to support dissemination efforts, including a multimedia program package with an instructor's manual, an instructional DVD, and a participant's course book.

Stepping On, developed by Dr. Lindy Clemson in Australia, was selected as the second effective intervention for CDC translation efforts. In a randomized controlled trial of community-dwelling adults aged 70 and older who had fallen in the previous year or who were concerned about falling, intervention participants had 31% fewer falls, compared to a control group that received two social visits at home from an Occupational Therapist [35]. *Stepping On* uses adult learning principles in a group setting over a seven-week period to develop knowledge and skills related to falls prevention. It helps older adults increase their awareness of risks, encourages home modifications (e.g., installing grab bars),

and promotes behavioral changes such as using stair railings and crossing at designated crosswalks. Importantly, the two-hour classes address a number of critical issues discussed previously, including engaging in exercises, having a doctor or pharmacist review their medications, making home modifications, and getting their vision checked.

In 2007, CDC funded Dr. Jane Mahoney at the University of Wisconsin to translate *Stepping On* into a community-based program appropriate for U.S. audiences and settings. As a result of this effort, Dr. Mahoney has revised the program manual and developed training materials and methods for large-scale implementation. She is also researching optimal delivery personnel and organizational formats to expedite the widespread use of this effective approach.

Dissemination of Scientific Tools

After the best existing scientific evidence has been identified, it must be translated for maximum use, packaged and disseminated to key audiences that work with older adults. To this end, CDC published *Preventing Falls: What Works – A CDC Compendium of Effective Community-based Interventions from Around the World* [31]. This publication is designed for public health professionals and senior service providers to give them detailed information about effective interventions, that is, interventions that have been tested in randomized controlled trials and shown to reduce falls among older adults. To stimulate the use of these interventions, CDC included information about each intervention's setting, audience, session length, training required, and contact information for the Principal Investigator.

For community-based organizations that may not have much experience addressing older adult fall prevention, CDC developed a companion document, *Preventing Falls: How to Develop Community-based Fall Prevention Programs for Older Adults* [36]. This guide helps community organizations understand the key elements of effective fall prevention programs and provides how-to information on program planning, implementation, and evaluation. This publication and the CDC compendium described above can be ordered or downloaded from www.cdc.gov/ncipc/preventingfalls.

CDC also provides materials and resources for older adults and their caregivers. Research-based but easy-to-read brochures such as "What you can do to prevent falls" and "Check for Safety: A Home Fall Prevention Checklist for Older Adults" are available in English, Spanish, and Chinese. All materials are free of charge and are available at www.cdc.gov/HomeandRecreationalSafety/Falls/fallsmaterial.html

Support for Implementation of Effective Programs

Broad, large scale support for the implementation of effective fall prevention activities is growing. For example, in 2010, CDC funded a small number of state health departments to partner with local senior service providers to deliver either *Moving for Better Balance* or *Stepping On*. These initial efforts will begin to build the infrastructure necessary to support state-wide prevention programs around the country. CDC's programmatic support also builds upon the work of the Administration on Aging, which funded six states in 2006 to deliver the *Matter of Balance* program to reduce the fear of falling among older adults.

It is worth noting that colleagues in other parts of the world have already made impressive strides toward translating research into action. For example, the Canadian province of British Columbia began a collaborative process for priority setting to reduce falls, which resulted in the release of policy recommendations, research reports, and the formation of the British Columbia Falls and Injury Prevention Coalition (for more information, see www.injuryresearch.bc.ca). This momentum in British Columbia has spurred increased adoption of effective programs and a decrease in fall-related deaths and hospitalizations across the province [37]. Similarly, the Australian Leadership Group of the National Falls Round Table, with representation from leaders in fall prevention from each State and the Commonwealth Government, has developed a strategic policy direction for falls prevention and expanded their programming into major, multi-state initiatives [37]. The European Community-funded Thematic Network to promote effective falls prevention among older persons – ProFaNE, the Prevention of Falls Network Europe – has over 1100 website members from more than 30 countries. ProFaNE's website provides links to published papers, reports, and useful measurement scales (e.g., fear of falling). For more information, go to www.profane.eu.org.

FUTURE DIRECTIONS

The aging of the U.S. population and escalating health care costs underscore the need for a greater focus on older adult fall prevention. By 2050, the number of persons aged 65 and older is expected to double to 89 million and the number of persons aged 85 and older is expected to quadruple to 19 million [38]. Older adults will comprise 20 percent of the U.S. population by 2050 [38]. Without the widespread adoption and use of effective interventions, we can estimate that almost 30 million older adults will fall in 2050, contributing to a public health problem that is more extensive and costly than exists today.

There is a need to strengthen older adult fall surveillance, further delineate the risk and protective factors for falls with special attention to gender, racial and age-based differences, and improve interventions that tailor components based upon the unique characteristics of the setting and target populations [39]. Currently, the most pressing need and the greatest opportunities to reduce the burden of older adult falls are to enhance the widespread adoption of evidence-based interventions [39, 40].

As discussed above, the most effective interventions include comprehensive risk factor assessment linked to targeted interventions including exercise (specifically balance and strength), medication management, vision correction, and home modification [16, 31, 41]. Although CDC resources that describe these effective interventions are available and provide step-by-step information on how to develop an effective community-based fall prevention programs, only a limited number of these interventions are being implemented and none is being employed on the scale needed to significantly reduce the number of fall-related injuries, disabilities, and deaths.

Currently, there are gaps in our ability to bring evidence-based programs to scale. Attending to these deficiencies in a

timely way will make possible greater and more immediate progress. These include:

- CAPACITY BUILDING: Strengthen the capacity of state and local health departments to conduct older adult fall prevention programs.
- TRAINING: Educate physicians and other health care providers about evidence-based older adult fall prevention strategies and provide mechanisms and incentives for referral to community-based programs.
- PUBLIC AWARENESS: Improve public awareness about older adult falls and the steps individuals can take to reduce their risk of falling. This includes educating individuals who care for aging parents who are at risk of falling.
- PROGRAM EVALUATION: Evaluate the success of community-based fall prevention programs, refine the programs as needed, and tailor program components to the unique needs of communities. Translation research is needed to identify optimal recruitment strategies, delivery channels, and implementation formats that will facilitate widespread adoption of interventions.
- MEDICAL REIMBURSEMENT AND INCENTIVES: Provide a mechanism for health care providers to be reimbursed for older adult fall screening and/or assessment during routine care, which may include referral to community-based organizations that provide falls prevention education. Also, provide incentives for individuals to participate in effective programs.

There is growing interest and legislative action to prevent older adult falls. In 2004, the National Council on Aging (NCOA) convened experts and stakeholders from across the country to develop a national action plan entitled *Falls Free: Promoting a National Falls Prevention Action Plan* [42]. This plan laid out a road map across key fall prevention strategies. Subsequently, a Falls Free Coalition was formed with more than 65 national organizations and state coalitions working together to advance the national action plan. More recently, the Safety for Seniors Act (Public Law 110-202) was signed into law in 2008 calling for enhanced efforts to educate the public on fall prevention, support provider health care provider training and education, conduct research focused on at-risk populations, and support community demonstration projects.

Partnerships are key to our achievements in fall prevention. Organizations such as NCOA, the Administration on Aging, the Centers for Disease Control and Prevention, the Home Safety Council, the National Safety Council, the Safe States, Alliance, and Archstone Foundation are providing important national leadership. By leveraging partnerships at the federal level to activities with state and local health departments, Area Agencies on Aging, senior centers, health systems, non-governmental agencies and other venues, we can achieve significant gains. Furthermore, making the business case for greater investment in older adult fall prevention to health care organizations and employers will strengthen local efforts.

In summary, we are encouraged by the growing interest in older adult fall prevention across a wide spectrum of state, community and organizational sectors; however, much work remains to be done. By using the public health model to support the scientific development of data systems, effective programs, and widespread adoption, CDC aims to contribute significantly to needed advances in prevention. These advances will be expedited by continuing to build momentum in the practice field and leveraging our many partnerships. Together we hope to realize the ultimate goal of fall prevention: keeping older adults active and independent.

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

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