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Falls and fall prevention among older adult indigenous people of Australia, Canada, New Zealand and the United States:

A systematic review

Vicky Scott, Clinical Associate Professor, School of Population and Public Health,University of British Columbia, Vancouver, CA; Sarah Metcalfe, Clinical Program Developer, Primary Health Care, Chronic Disease Management and Specialized Seniors, Fraser Health Authority, Vancouver, CA; Yasmin Yassin, Research Coordinator, Centre for Hip Health and Mobility, University of British Columbia, Vancouver, CA. Corresponding Author V Scott: Vicky.scott@hiphealth.ca ..

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Introduction

Falls are a major public health issue among older adults, with approximately one third of those aged 65 years and older typically falling at least once each year.[1] Effective strategies to reduce falls and related injuries include minimizing medications, implementing a tailored exercise program, treating vision impairment, managing circulatory problems, modifying the home environment, and educating older adults about changing risk-taking behaviors.[2] There is substantial literature on the prevalence and prevention of falls and related injuries among the general populations of older people living in Australia, Canada, New Zealand and the United States.[2] However, little is known about the health status in general, and fall injuries and fall prevention specifically, among the indigenous populations in these countries.[3]

The World Health Organization (WHO) defines indigenous populations as "communities that live within, or are attached to, geographically distinct traditional habitats or ancestral territories, and who identify themselves as being part of a distinct cultural group, descended from groups present in the area before modern states were created and current borders defined. They generally maintain cultural and social identities, and social, economic, cultural and political institutions, separate from the mainstream or dominant society or culture."[4] Other characteristics shared by these populations include distinct languages and a "resolve to maintain and reproduce their ancestral

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indigenous environments and systems as distinctive peoples and communities".[3]

According to the WHO's 2007 *Factsheet on the Health of Indigenous Peoples*, the indigenous population comprises about 370 million people around the world.[3] This review refers to literature about the populations of four countries: the Aboriginal people of Australia and Canada, the Maori and Pacific Islanders of New Zealand, the Native American and Alaska Native people of the United States, and other indigenous people in each of these countries. As shown in Table 1 below, between 2010 to 2013 local census reports revealed over 669,900 people with indigenous status in Australia, or 3 percent of the Australian population, 598,605 (14.9% of the total population) in New Zealand[6], and 1,400,685 (4.3% of the total population) in Canada.[7] In the United States, 2.9 million were identified as "American Indian and Alaska Native alone" in the 2010 Census and an additional 2.3 million identified as "American Indian and Alaska Native in combination with one or more other races".[8] Other terms for these "indigenous populations" include Aboriginal (aborigin), First Nation, Indian, Status Indian, non-Status Indian, Treaty Indian, Innu, Inuvialuit, Inuit, Inuk , Métis, Metis, First People, Native, Native American, Indigenous Australian People(s), Torres Strait Islander People(s)/Person, Aborigine, First people/first Australians, Māori, Maori, American Indian, Alaska Native, Eskimo, Eskimo-Aleut, and Native Hawaiian.

Despite their numbers and their unique position in the world, the indigenous elderly population has been largely overlooked with regard to health-related research.[9] In terms of lifespan and health care quality, the 2009 United Nations' *State of the World's Indigenous Peoples* report indicates that indigenous peoples generally receive poorer quality of health care and tend to live shorter lives with the difference ranging from 2.4 to 20 years.[10] Many geriatric conditions prevalent for those aged 65 and older in non-indigenous groups (such as dementia, cardiovascular disease and late-onset diabetes) manifest earlier for those of indigenous ancestry[11,12] and more elderly indigenous people report multiple co-morbidities.[9] It is also important to note there is a great deal of diversity among indigenous populations; as well as many strengths that have positive impacts on health and well-being, such as family and community supports, spiritual beliefs and cultural traditions.[13]

Disparities in fall rates, types of fall-related injuries, and recovery rates have been found among different race/ethnicities.[14] However, little is known about falls among indigenous older adults, and there are no reviews of fall prevention in this population.[15] We therefore conducted a literature search to identify publications that contained epidemiology and prevention interventions on the topic of falls and falls-related injury among older indigenous people of Australia, Canada, New Zealand and the United States. These countries were selected because they have both distinct populations of indigenous people and publications on falls and fall prevention in the English language.

Table 1: Indigenous Populations and Number of Articles on Incidence and/or Risk and Prevention by Country

Countries covered in the systematic review on falls	Estimated population of indigenous people (%total population)	Number of fall-related articles: Incidence and/or prevalence	Number of fall-related articles: Prevention and/or risk factor reduction
Australia	0.7 million (3%)[5]	9	2
Canada	1.4 million (4.3%)[6]	3	3
New Zealand	0.6 million (14.9%)[7]	3	0
United States	5.2 million (1.7%)[8]	9	5

Methodology

A systematic review was conducted to identify peer-reviewed publications using numerous databases. Key words used were combinations of terminology for 'accidental' (term used in databases for 'unintentional') falls and indigenous status. No filters or restrictions were applied to study designs, year of publication, or age of the study population due to the varied age groups used in abstract publications. In addition to the database searching, targeted searching was conducted for records within two key subject area journals, Injury Prevention and Aboriginal Health Research. To capture literature beyond the databases and targeted journals, we conducted a hand search of references in retrieved articles, sought recommendations from relevant organizations (such as the U.S. Indian Health Service), and consulted experts in the field.

The inclusion criteria were publications in peer-reviewed journals and grey literature that addressed unintentional falls and indigenous persons of Australia, Canada, New Zealand or the United States and adults age 45 years and older. Exclusion criteria were occupational falls; equestrian falls; child, youth and young adults (below age 45); and literature addressing falls among Indian people from the country of India. Full-text articles and reports meeting the inclusion criteria were obtained with the assistance of librarians at the University of British Columbia, Canada and the US Centers for Disease Control and Prevention. Articles were reviewed independently for relevance and data extraction by two reviewers (VS/SM). Any discrepancies between reviewers were discussed and a third reviewer (YY) was involved when necessary.

There were 6,427 records identified through database searching. An additional 22 records were retrieved through expert recommendations and searching subject area journals and grey literature. Records were screened for relevance based exclusion criteria, resulting in the exclusion of 6,243 records. After reviewing abstracts for duplication and not matching search criteria, data were extracted from the final total of 34 publications. (For a flow chart of the search methods, see the supplemental files for this publication at: www.canadianfallprevention.ca).

Variability among studies

Of the 34 articles reviewed, 24 (71%) provided information on incidence and prevalence and 10 (29%) discussed fall prevention and related risk factors. Summaries of the findings from each of the individual studies, sorted by country, are available from the corresponding author (VS at www.canadianfallprevention.ca). Most articles reporting falls incidence and prevalence used the International Classification of Diseases (ICD). A variety of ICD versions were used, including ICD-9 [16-19] and ICD-9-Clinical Modification (CM)[20-24], the newer ICD-10[25-27] and ICD-10-Australian Modification (AM).[28-30] One study used both ICD-9 and -10 [16] because their data bridged the transition date from ICD-9 to ICD-10.

Eight studies based on hospital records or primary research data did not rely on ICD-coded data. Four of these articles examined the rate of falls among a specific population, such as older indigenous people with a chronic disease.[12,31-33] The other four studies examined fall-related injury and mortality patterns.[11,34-36] All the studies on incidence and prevalence reported three outcome measures: falls, fall-related injuries and fall-related mortality. Studies also varied in the time periods covered by their data sets. For example, all of the studies from New Zealand were retrospective studies with data from 1984 – 1994.

Findings

As in many non-indigenous populations, we found that falls are the leading cause of injury for older adults in indigenous communities. However, there was little consistency for rates of falls and related injuries within or across the four countries covered by this review. As shown in Table 1, there was little information about fall prevention programs and related risk factors (10 articles). Only three of these articles (from the US and Australia) discussed programs tailored to indigenous elderly populations. Among these three, there was a paucity of information related to process or impact evaluation.[37,38,46] For a description of each article, see the supplemental files for this publication posted at: www.canadianfallprevention.ca.

There is limited data on the relationship between falls, fall injuries, and advancing age.[11,15,25,28,35] A Canadian study reported that the increasing rate of falls found with advancing age starts in earlier ages among aboriginal people compared to non-indigenous elderly.[11] A retrospective study in Australia reported a decline in fall-related mortality rates after the age of 65.[28] One study from the United States indicated that AI/AN individuals ages 45-74 had a higher TBI-related death rate compared to all other groups until the age of 75, where it declined.[15] Another US study suggested that AI/AN elderly may be less likely than other populations to survive fall-related injuries as age increases.[35]

Some similarities were apparent when comparing studies across countries. For example, in Australia, MacIntosh[36] suggested that indigenous elderly may experience fewer bone fractures due to a higher bone mineral density compared to non-indigenous elderly. This finding is corroborated by Barss[39] in Canada who suggested that indigenous elderly may have stronger bones as a result of a more active lifestyle. Studies in both Canada and the United States mention the use of potentially inappropriate medications (PIMs) as a risk factor for falls.[40,45] Over-prescription of certain medications such as benzodiazepines may present a serious fall-risk for older indigenous adults.[40] Among those aged 65-74, use of PIMs is particularly high and may contribute to increased incidence of falls among the elderly.[45]

Conclusion

Falls clearly are a major health issue among indigenous older adults from all four countries. However, further research is warranted to update and broaden the epidemiology of falls within indigenous communities. A

lack of standardized data collection and reporting methods prevents meaningful comparisons of epidemiologic findings both within and across countries. Among our studies were variations in ICD coding versions, reference populations, and age ranges, for example. More studies are needed with larger sample sizes and consistent reporting, such as presenting rates per 100,000 of a standard (age-adjusted) population over comparable person-years**.** It is important that studies present their fall data by comparable age categories beginning at age 45 to reflect the earlier onset of chronic health problems among indigenous elderly. Finally, inaccurate and under-reporting of indigenous status also needs to be addressed.

Most studies were retrospective analyses of secondary data. Prospective and longitudinal studies "are now required to determine the most relevant risk factors for [falls], so that coherent preventative strategies may be introduced".[12] Such studies would benefit from focusing on fall risk factors in order to better understand the impact of biological/behavioural/ socio-economic/
environmental factors on falls and fall injuries among indigenous and other peoples.

Investigations into culturally-relevant prevention approaches are especially warranted.[41] In addition to epidemiologic data, it is important to consider the impact of social determinants of health and wellbeing to gain a better understanding of the holistic contributors to falls and related injuries. Factors to consider include the age of onset of chronic conditions, socioeconomic status, access to health care, prescription drug prescribing practices, and cultural differences between indigenous groups. Evaluations of the impact of fall prevention interventions, their cultural relevance, and cost effectiveness are vital to reducing the burden of fall injuries in indigenous communities. Finally, future research on fall injury epidemiology and prevention among indigenous populations of older adults would be greatly enhanced through international collaboration.

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Indian Health Service
National Pharmacy and Therapeutics Committee
Osteoporosis
NPTC Formulary Brief
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Background:
Osteoporosis affects over 10 million Americans, with another 34 million who have low bone mass. It is projected that from 2005 to 2025 the incidence of osteoporosis-related fractures will rise from 2 million to 3 million annually[1]. While there are many risk factors, the most at-risk segment of the population is post-menopausal women. In May 2016, the National Pharmacy & Therapeutics Committee (NPTC) undertook a comprehensive review of multiple pharmacologic classes approved for the prevention and/or treatment of osteoporosis. As a result of this review, **the NPTC retained the oral bisphosphonate, alendronate,** on the Indian Health Service National Core Formulary.

Discussion:
Beginning around age 30 years, there is an age-related decline in bone mass, affecting both trabecular and cortical bone[2].This decline is most pronounced among women following menopause. Other risk factors for osteoporosis include cigarette smoking, excessive alcohol intake, low body weight, previous fracture, family history and secondary causes such as rheumatoid arthritis or glucocorticoid use. All adults should undergo osteoporosis risk factor assessment as a part of routine preventive care. For those at high risk, an assessment of bone mineral density and a fracture risk assessment using the validated WHO FRAX risk calculator (available at http://www.shef.ac.uk/FRAX/) is warranted to facilitate an individualized treatment plan for the prevention of osteoporosis and osteoporosis-related fracture[3].

Adequate dietary or supplemental intake of calcium and vitamin D is essential to bone health but is not adequate to prevent osteoporosis or osteoporosis-related fracture. Osteoporosis treatment is generally indicated for those with one of the following; 1) History of osteoporotic hip or vertebral fracture, 2) T-score ≤-2.5 (DEXA) at the femoral neck or spine, after appropriate evaluation to exclude secondary causes, or 3) T-score between -1 and -2.5 (DEXA) at the femoral neck or spine, and a 10-year probability of hip fracture ≥3 percent or a 10-year probability of any major osteoporosis-related fracture ≥20 percent based upon the United States-adapted World Health Organization algorithm[4-5].

The NPTC reviewed the following medications and medication classes which are FDA approved for the prevention and/or treatment of osteoporosis; the bisphosphonates, denosumab, the selective estrogen receptor modulator raloxifene, the PTH analog teriparatide, and calcitonin. In a network meta-analysis of 116 trials, the bisphosphonates, teriparatide and denosumab were all found to be effective, with no significant differences. Raloxifene was found to be less effective than the other agents[6]. Among the bisphosphonates, ibandronate appears to have less efficacy for fracture prevention.

In 2013, the Institute for Clinical Systems Improvement published a guideline which included recommendations for the pharmacologic management of osteoporosis and which echoed similar previous guidelines published by other groups[3]. It noted that the use of bisphosphonates was associated with the strongest data showing risk reductions in vertebral, hip, and

other non-vertebral fractures[3]. Teriparatide (PTH 1-34) is indicated for patients at the highest risk of future fracture, for whom it may be considered first-line therapy[3]. Meanwhile, nasal calcitonin is considered a third-line treatment for osteoporosis[3].

Regarding the duration of treatment, indefinite treatment is generally not recommended. The National Osteoporosis Foundation recommends that treatment duration decisions must be individualized[4]. The American Academy of Family Practitioners (AAFP) encourages clinicians to consider stopping bisphosphonate therapy after five years in women without a personal history of vertebral fractures[7]. They referenced the FLEX study which compared women taking alendronate for five years versus those taking alendronate for 10 years and showed no increased incidence in nonvertebral or hip fractures[8]. Furthermore, the AAFP noted that complications of bisphosphonates including osteonecrosis of the jaw and atypical femoral fractures are rare but are associated with longer duration of use. According to guidelines from the American Association of Clinical Endocrinologists, combination therapy with more than one agent is not recommended for the treatment of osteoporosis[1].

As with all pharmacologic interventions, medication non-adherence is associated with reduced efficacy. Non-adherence to oral bisphosphonate therapy has been associated with higher risk of fracture among those with osteoporosis. Clinicians should routinely review and address non-adherence factors.

Findings:
Osteoporosis is common and causes significant morbidity and mortality, particularly among post-menopausal women. Risk factor assessment is indicated for all adult patients as a component of routine preventive care. Treatment decisions are generally based on bone mineral density and fracture risk or prior history of fragility fracture. Lifestyle measures are an important component of osteoporosis prevention and treatment.

Conclusions:
Treatment decisions, including drug choice and duration of therapy, should be individualized based on unique patient needs and preferences. Alendronate, risedronate, zoledronic acid and denosumab may all be considered first-line therapy and likely offer similar efficacy however ibandronate is likely less efficacious. Bisphosphonates generally have the strongest data supporting their use in fracture risk reduction. Teriparatide is indicated for those at very high risk of fracture, particularly those who have failed bisphosphonate therapy. While not a first-line agent, raloxifene may offer unique benefits to women at high risk of breast cancer. Calcitonin is considered a third-line agent.

For questions about this document, please contact the NPTC at IHSNPTC1@ihs.gov. For more information about the NPTC, please visit the NPTC website.

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