

Editorial

Falls research is coming of age

In the face of an ageing population and disintegrating joint family systems in traditional societies, more and more older persons are moving to old-age residential facilities. While science continues to grapple with the traditional clinical syndromes of old age, it is waking up to new medical problems in an institutionalized elderly cohort. Falls in long-term care facilities and resulting injuries present an evolving challenge in older people because they not only lead to morbidity and mortality but also bring about a loss of autonomy and self-imposed restriction of functionality. Falls have a multifactorial causation and any attempt to prevent, protect or rehabilitate needs to address several wide-ranging issues. The study¹ in this issue of the *Journal* addresses the risk factors associated with falls in institutional settings in Delhi and presents some insights into their causation as the field of falls research opens up possibilities offered by machine learning techniques and artificial intelligence.²⁻⁴

It has been established that the world population is steadily ageing, the proportion of older people is growing and that this trend is likely to continue over the coming decades. Advances in technology and rising social aspirations have led to a disintegration of joint family systems in traditional societies. As a result, a larger number of people are either choosing to spend the latter parts of their lives in community residential facilities, or they are being forced to do so. An increased demand for such facilities has put strain on the existing establishments leading to unregulated newer arrangements. As systems of informal family caregiving are weakening and facilities for formal long-term care are limited, it is likely that increasing numbers of older persons will be living in old-age homes with inadequate facilities. Newer challenges in ageing are likely to emerge for doctors as more individuals start using old-age residential homes. Injuries and health problems secondary to unexpected falls are a neglected area, which is likely to be of greater importance in the near future.

Falls are complex to understand and difficult to manage due to their multifactorial associations occurring in the immediate ecosystem of the victim—within his residential and work environment. Besides being a leading cause of injury and long-term morbidity in the community, falls pose an important public health challenge for policy-makers and administrators. Falls research revolves around variations of the 4 Ps: (i) estimation of prevalence and incidence; (ii) prediction and detection; (iii) prevention; and (iv) protection and rehabilitation.

Over 4 decades ago, as many as 668 falls were reported for every 1000 person-years and women had a higher fall rate in all age groups.⁵ These rates have not changed much over time and different fall rates have been reported across the world owing to variable definitions and study designs. Prospective data from the English longitudinal study on ageing have indicated a 28.4% overall weighted prevalence of falls.⁶ Similar rates have been reported in community-living older persons in Turkey, South Africa and Korea.⁷⁻¹⁰ Higher rates have been reported from institutionalized settings and old-age residential facilities due to poorer functional status of inmates.³ Hence, it is not surprising that falls are a major concern among the older independently-living individuals particularly for those living in old-age homes.

Several researchers have explored risk factors associated with falls to develop interventions to reduce their occurrence. While age is often regarded as the universal confounder in most studies, especially those in older subjects, other person-associated risk factors include history of previous falls, reduced physical activity, problems in walking or bending, reduced physical or cognitive function, comorbid or chronic

conditions, reduced gait speed, knee extension or vision, dizziness, fear of falling, living alone, use of walking aids and polypharmacy.^{6,7,10}

A large proportion of falls research has been done in the community among older people living in homes. Interventions to reduce falls are largely targeted to the individual at risk and sometimes to the home environment.¹² Little has been done with a focus at institutional settings where the involvement of the caregiver staff assumes greater importance. Multifaceted interventions and hip protectors have been found to be beneficial.¹³ Repositioning of furniture, augmenting staff strength and organizing restorative activity programmes during fall-prone shifts in cost-conscious establishments have shown promise in reducing falls and resulting injuries.¹⁴ Individually targeted exercise programmes have been found effective although group activities have not been directly effective in reducing the number of falls.¹⁵ The confounding role of dementia (or minimal cognitive impairment) needs to be explored while evaluating any association of falls among residents housed in long-term care facilities. Another major area of concern is the fear of falls and self-imposed restriction of activity among survivors of falls.

Despite considerable advances in global falls research, very few studies have been reported from India.^{16–19} Pathania *et al.*'s study in this issue of the *Journal* addresses the problem of falls among older persons living in long-term residential facilities in Delhi.¹ In a cross-sectional design, the investigators interviewed 335 older inmates across all facilities in 13 randomly selected geographical clusters across the city for the occurrence of falls over 6 months before the time of interview. Fifty-five (nearly 17%) participants reported a total of 98 falls providing a rough incidence of 58.5 falls per 1000 person-years. Twenty participants reported recurrent falls. This, being a retrospective study, has an inherent recall bias and is limited in scope because minimal clinical data on individual participants are associated with falls. Still, the authors have been able to capture the essence and bring into focus an important public health problem in old-age residential facilities.

The field of falls research is growing and exciting developments are expected particularly with the advent of information technology, the development of mobile applications and sensors to detect falls and gait imbalance. The application of artificial intelligence and machine learning in prediction and assessment of falls is likely to revolutionize the scene.^{2,20–22} With the aims to prevent and protect, falls research is a promising subject for the future and will be integral to preserve the autonomy and independence of a rapidly ageing population as well as to enable them to participate proactively in the community.

Conflicts of interest. None declared

REFERENCES

- 1 Pathania A, Haldar P, Kant S, Gupta SK, Pandav CS, Bachani D. Prevalence of fall, and determinants of repeat incidents of fall in older persons living in old age homes in the National Capital Territory of Delhi, India. *Natl Med J India* 1918;**31**:329–33.
- 2 Jensen LJ, Bateman A. The rise and fall of supervised machine learning techniques. *Bioinformatics* 2011;**27**:3331–2.
- 3 Ozdemir AT, Barshan B. Detecting falls with wearable sensors using machine learning techniques. *Sensors (Basel, Switzerland)* 2014;**14**:10691–708.
- 4 Yuwono M, Moulton BD, Su SW, Celler BG, Nguyen HT. Unsupervised machine-learning method for improving the performance of ambulatory fall-detection systems. *Biomed Eng Online* 2012;**11**:9.
- 5 Gryfe CI, Amies A, Ashley MJ. A longitudinal study of falls in an elderly population: I. Incidence and morbidity. *Age Ageing* 1977;**6**:201–10.
- 6 Gale CR, Cooper C, Aihie Sayer A. Prevalence and risk factors for falls in older men and women: The English longitudinal study of ageing. *Age Ageing* 2016;**45**:789–94.
- 7 Kose N, Cuvalci S, Ekici G, Otman AS, Karakaya MG. The risk factors of fall and their correlation with balance, depression, cognitive impairment and mobility skills in elderly nursing home residents. *Saudi Med J* 2005;**26**:978–81.
- 8 Zimba Kalula S, Ferreira M, Swingler G, Badri M, Aihie Sayer A. Prevalence of falls in an urban community-dwelling older population of Cape Town, South Africa. *J Nutr Health Aging* 2015;**19**:1024–31.
- 9 Shin KR, Kang Y, Hwang EH, Jung D. The prevalence, characteristics and correlates of falls in Korean community-dwelling older adults. *Int Nurs Rev* 2009;**56**:387–92.
- 10 Yoo IY. Recurrent falls among community-dwelling older Koreans: Prevalence and multivariate risk factors. *J Gerontol Nurs* 2011;**37**:28–40.
- 11 Luukinen H, Koski K, Hiltunen L, Kivelä SL. Incidence rate of falls in an aged population in northern Finland. *J Clin Epidemiol* 1994;**47**:843–50.
- 12 Gillespie L. Preventing falls in elderly people. *BMJ* 2004;**328**:653–4.
- 13 Oliver D, Connolly JB, Victor CR, Shaw FE, Whitehead A, Genc Y, *et al.* Strategies to prevent falls and fractures in hospitals and care homes and effect of cognitive impairment: Systematic review and meta-analyses. *BMJ* 2007;**334**:82.
- 14 Hofmann MT, Bankes PF, Javed A, Selhat M. Decreasing the incidence of falls in the nursing home in a cost-conscious environment: A pilot study. *J Am Med Dir Assoc* 2003;**4**:95–7.

- 15 Shier V, Trieu E, Ganz DA. Implementing exercise programs to prevent falls: Systematic descriptive review. *Inj Epidemiol* 2016;**3**:16.
- 16 Johnson SJ. Frequency and nature of falls among older women in India. *Asia Pac J Public Health* 2006;**18**:56–61.
- 17 Tripathy NK, Jagnoor J, Patro BK, Dhillon MS, Kumar R. Epidemiology of falls among older adults: A cross sectional study from Chandigarh, India. *Injury* 2015;**46**:1801–5.
- 18 Sharma PK, Bunker CH, Singh T, Ganguly E, Reddy PS, Newman AB, *et al.* Burden and correlates of falls among rural elders of South India: Mobility and independent living in elders study. *Curr Gerontol Geriatr Res* 2017;**2017**:1290936.
- 19 Sirohi A, Kaur R, Goswami AK, Mani K, Nongkynrih B, Gupta SK, *et al.* A study of falls among elderly persons in a rural area of Haryana. *Indian J Public Health* 2017;**61**:99–104.
- 20 Albert MV, Kording K, Herrmann M, Jayaraman A. Fall classification by machine learning using mobile phones. *PLoS One* 2012;**7**:e36556.
- 21 Aziz O, Musngi M, Park EJ, Mori G, Robinovitch SN. A comparison of accuracy of fall detection algorithms (threshold-based vs. machine learning) using waist-mounted tri-axial accelerometer signals from a comprehensive set of falls and non-fall trials. *Med Biol Eng Comput* 2017;**55**:45–55.
- 22 Bourke AK, Klenk J, Schwickert L, Aminian K, Ihlen EA, Mellone S, *et al.* Fall detection algorithms for real-world falls harvested from lumbar sensors in the elderly population: A machine learning approach. *Conf Proc IEEE Eng Med Biol Soc* 2016;**2016**:3712–15.

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