Incidence, risk factors and economic burden of fall-related injuries in older Chinese people: a systematic review

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ABSTRACT
Objective China’s population is ageing and fall-related injury in older Chinese people is a growing public health concern. This review aims to synthesise existing evidence on the incidence, risk factors and economic burden of fall-related injury among older Chinese people to inform health service planning.

Methods A systematic search of literature on falls and injury among older people living in China was performed in six electronic databases including both English and Chinese databases. Results were combined using narrative synthesis due to the heterogeneity of included studies.

Results A total of 93 studies from Mainland China, Taiwan and Hong Kong were included in this review. Most of these studies were descriptive; 82 reported the incidence of fall-related injury among older Chinese people, 7 studies examined the risk factors for fall-related injury and 22 studies described the economic burden of fall-related injury. The incidence of fall-related injury reported among older Chinese people ranged from 0.6% to 19.5%. Risk factors significantly associated with fall-related injury among older Chinese included older age, female sex, walking aid use, living environments, chronic disease, medication usage, visual impairment and a fall direction other than forward. The cost of fall-related injury among older Chinese people ranged from US$16 to US$3812 per person per fall.

Conclusion Falls-related injuries are a significant public health issue for older Chinese people. Further studies using prospective design to identify risk factors and the economic burden of fall-related injuries are needed.

BACKGROUND
The past 40 years have seen a rapid decline in infectious disease in China and a corresponding increase in life expectancy.1,2 Chronic disease and injury have now replaced infectious diseases as the main causes of illness and death in China.1,4 With injury the fourth leading cause of death among older Chinese people.3 Globally, injury is also an important public health issue and in 2013 accounted for 10.1% of the global burden of disease.6

There are more than 130 million older people (≥60 years) in China and more than 20 million of them fall annually.7 Falls, defined as ‘events which result in a person coming to rest inadvertently on the ground or floor or other lower level’, are one of the most common causes of injuries among older people.8 Approximately 30% of people aged 65 and over in high-income countries fall and half of them fall more than once each year.9 Falls can cause a variety of injuries in older people, with hip fracture being the most common and severe.10 Recovery from fall-related injury takes longer for older people due to underlying age-related physiological and functional decline.11 12 Falls can cause long-term disability and dependence and are the leading cause of injury-related death.8 Although the incidence of falls among older people living in China is lower than that reported in people living in high-income countries, with the large population base and rapidly ageing population, the burden of falls in China is high, growing and cannot be ignored.13

Previous studies of falls in Chinese populations have mostly focused on the characteristics and risk factors for falls. These studies have highlighted a range of factors that increase the risk of falling, including female gender; doing less physical exercise; multiple medication use; chronic conditions; increasing age and fear of falling.13-16 However, less is known about the incidence and risk factors for fall-related injuries in China and their economic burden. There is evidence of differences in the mechanism of falls that do not cause physical harm and injurious falls. For instance, studies in high-income settings indicate that falling on hard surfaces, previous fracture history and fall direction (backwards, forwards, sideways), are risk factors for fall-related hip fracture.10 17 18 With the rising disease burden of falls among older Chinese, it is important to develop cost effective interventions to reduce the incidence of costly fall-related injury. Understanding the specific risk factors for falls that result in injuries can provide evidence for the development of such interventions in China and may also provide valuable insights for international efforts in this regard.19 20 Moreover, a recent hospital audit study of hip fracture care in China highlighted large gaps between current practice and international best practice guidelines, suggesting that China may not currently have healthcare systems that provide high quality, efficient and equitable healthcare for fall-related injuries.21 A synthesis of the evidence about the treatment costs associated with fall-related injury will be important to inform service planning efforts to ensure China is ready to face this growing problem.

This systematic review presents a summary of the literature published in English and Chinese on fall-related injuries in older Chinese people living in Greater China (Mainland China, Hong Kong, Taiwan and Macau). The objectives of the review...
are to determine the incidence, risk factors and economic burden associated with fall-related injuries in older Chinese people.

METHODS

Search strategy

The protocol was registered at PROSPERO, ID number CRD42017059232. Searches were conducted for peer-reviewed, published articles in May 2018 in Medline, Cochrane, Embase, China National Knowledge Infrastructure (CNKI), WanFang and Chongqing VIP databases, following Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. Keywords searched included: falls, China, aged, incidence, risk factors and cost. The final search was conducted on 24 May 2018 (online supplementary appendix 1).

Inclusion and exclusion criteria

Full text articles written in English or Chinese and reporting information on falls among older (>60 years) people living in Greater China (Mainland China, Hong Kong, Taiwan and Macau) were included and included in our review. Studies conducted in hospital, nursing home and community settings were included. Observational studies (cross-sectional, case-control and cohort studies) and intervention studies (randomised controlled trials (RCTs), pre-post and intervention cohort studies) were included. We excluded articles focused on specific disease defined populations (eg, diabetes or stroke), those reporting incidence with a sample size less than 500 or papers published prior to 1990. We also excluded articles that did not report fall-related injury, that only reported in-hospital falls or where studies were conducted in extreme conditions (eg, earthquake or snowstorm). Systematic reviews and case series studies were excluded; however, the reference lists of previous reviews were searched for studies that met the inclusion criteria but were not identified in our search.

Data extraction and analysis

One reviewer (PK) screened the titles, keywords and abstracts of all articles for potential inclusion. Three reviewers (PK, LYS and WQL) then independently reviewed the full text articles to determine eligibility for inclusion. PK reviewed all articles, and LYS and WQL reviewed English and Chinese articles, respectively. Disagreements were resolved by discussion or with a fourth reviewer (TMY).

The following information was extracted from each eligible article: authors, location, publication year, study setting, sample size at baseline, number of eligible participants at baseline, study type, fall and injury details (incidence, risk factors, injuries and economic burden). For data relevant to risk factors, ORs, relative risks or HRs with 95% CIs were extracted. Where there was insufficient published information to extract required data, the author was contacted via email to seek this information. The crude median incidence for different age groups and definitions of ‘older’ were used in different studies. Most (48) recruited people aged 60 years and over; 12 studies recruited people aged 65 and over; others included younger participants, but still reported findings separately for those aged 60 and over so have been included in this review. Forty-five studies were conducted in specific community centers, 17 in city settings, 17 in provincial settings, and 2 were national studies. A summary of the characteristics of included studies are shown in the table of online supplementary file 1. Of the 93 papers included, 7 had a primary focus on fracture, and others (86) focused on all fall-related injuries. The majority (92/93) were observational studies and only one was an intervention study.

The incidence of fall-related injury

A total of 82 studies reported fall-related injury incidence data for Chinese people aged 60 and over. Of these, 29 studies reported the incidence of fall-related fracture only and 75 studies reported the incidence of all fall-related injury, including abrasion, bruises, extrusion injury, superficial injury, soft tissue injury, fracture, sprain, open wound, cerebral concussion, organ system injury, cranioencephalic injury, haemorrhage and coma.

All fall-related injury

Of the studies that reported the incidence of all fall-related injuries, most (71/75) were cross-sectional studies. The incidence of all fall-related injury in the past year among all older Chinese people (aged 60+ and 65+) ranged from 0.6% to 19.5% in retrospective studies (n=73) and 5.8% and 16.3% in prospective studies (n=2). Of the 75 studies, 66 studies reported incidence of all fall-related injury while 4 reported incidence only for a single-sex population. The median incidence of all fall-related injury from the remaining 62 studies was 6.4%; and the other 9 studies reported person-time incidence. Of the studies that reported person-time incidence, one study reported person-time incidence by sex and region and one reported person-time incidence by age groups not aligned with this review. In the remaining seven studies, the person-time incidence of general fall-related injury among older Chinese people ranged from 6.4 to 15.2/100 person-years (median 13/100 person-years).

Thirteen studies reported the incidence of general fall-related injury by age groups. Of these, 10 categorised age in 10-year intervals (7 from age 60+, 2 from age 65+ and 1 from age 70+) and 3 categorised age by 5-year intervals (7 from age 60+, 2 from age 65+ and 1 from age 70+).
intervals (2 from age 60+ and 1 from age 65+). The median incidence of fall-related injury by age category in the seven studies that reported incidence from age 60 was: 4.7% in people aged 60–69, 6.3% in people aged 70–79 and 10% in people aged 80+. The incidence of all fall-related injury among people aged 65–74 was reported as 1.8% and 13.3% from a Mainland China study and a Taiwanese study, respectively, while the incidence among people aged 75 and over were 3.6% and 10.8%; 13.8/100 person-years in people aged 70–79 and 21.1/100 person-years in people aged 80 and over. The other three studies reported the incidence and person-time incidence by 5-year age interval, the median incidence for people aged 60–64 was 5.2%, 4.6% for aged 65–69, 4% for aged 70–74 and 4.4% for aged 75–79; the person-time incidence was reported as 2.8/100 person-years for aged 65–69, 3.3/100 person-years for aged 70–74, 4.4/100 person-years for aged 75–79, 3.3/100 person-years for aged 80–84 and 7.2/100 person-years for aged 85 and over. There were 30 studies reporting incidence and 1 study reporting person-time incidence of fall-related injury by sex. The median incidence of fall-related injury in older Chinese females was 11.6% and 6.6% for older Chinese males; the person-time incidence of fall-related injuries were 3.1 and 3.2 for older Chinese women living in urban and rural, respectively; 2.7 and 2.0 for older Chinese men living in urban and rural, respectively, from the national survey study.

### Fall-related fracture

Thirty-one studies reported on the incidence of all fall-related fracture; most were cross-sectional (29/31). Twenty-four studies reported overall incidence of all fall-related fracture, two reported overall incidence of all fall-related fracture only in single sex participants (one women only and one men only), three reported incidence of fall-related hip fracture and two reported the incidence of both all fracture and hip fracture. The overall incidence of all fall-related fracture ranged from 0.5% to 6% from 19 studies (median 2.2%). The person-time incidence of fall-related fracture ranged from 0.8 to 8.3/100 person-years from seven studies (median 1.7/100); the incidence of fall-related hip fracture ranged from 0.04 to 0.5 from four studies (median 0.4) and the person-time incidence of fall-related hip fracture was reported as 1.4/100 person-years from 1 Mainland
study. There were five studies categorised incidence of all fall-related fracture by sex. One study reported incidence of all fall-related fracture only in women and one only in men. The incidence of all fall-related fracture among older Chinese women ranged from 0.3% to 2.7% and from 0.6% to 7.9% for men.

**Other fall-related injuries**

Fall-related soft tissue injury was reported in 12 studies. The incidence was reported in seven studies and ranged from 1.7% to 9.2%. The person-time incidence was reported in five studies and ranged from 1.6/100 to 9.1/100 person-years. The incidence of superficial injury was reported in seven studies and ranged from 1.5% to 8.2%, while the person-time incidence was reported in four studies and ranged from 1.4/100 to 11/100 person-years. Nine studies reported the incidence of sprain/dislocation, which ranged from 0.6% to 3.4%, and two studies reported the person-time incidence of sprain/dislocation as 0.6/100 person-years and 0.8/100 person-years. Fewer studies reported the incidence or person-time incidence of other injuries: open wound (n=7), cerebral concussion (n=7), cranio-cerebral injury (n=3), contusion and bruise (n=3), organ system injury (n=2), haemorrhage (n=1) and coma (n=1). Six studies reported the incidence of fall-related injuries by severity: the incidence of mild fall-related injury ranged from 2.2% to 14.7%; the incidence of moderate fall-related injury ranged from 2.9% to 3.7% and the incidence of severe fall-related injury ranged 0.9% to 4.5%. One study reported the person-time incidence of fall-related injuries by severity; 3.3/100 person-years, 2.6/100 person-years and 0.5/100 person-years for mild, moderate and serious injury, respectively.

**Factors associated with fall-related injury**

Seven studies examined the factors associated with fall-related injuries among older Chinese people with adjustment for confounders; five were case-control studies and two were cross-sectional studies. All of these studies used logistic regression models; five were rated as high quality, one as fair quality and one as low quality on the Newcastle-Ottawa Scale. Four of the seven studies used hospital record or health insurance data and the remaining three used interview data. Two studies had a primary focus on fall-related hip fracture, two focused on general fall-related fracture and three focused on general fall-related injury. The risk factors examined can be divided into three categories: demographic, extrinsic and intrinsic factors.

**Demographic factors**

Two studies, one case-control and one cross-sectional study, investigated the effect of age on fall-related injury. One Taiwanese study found that the incidence of fall-related injury was significantly higher in those aged 75 and over compared with those aged 65–74, while people aged 85 and over had the highest risk of fall-related injuries. A study from Mainland China likewise found a higher risk of sustaining an injury after a fall for those in an older age group.

Four studies, two case control studies and two cross sectional studies, investigated the influence of sex on fall-related injury. Two studies, one from Taiwan and one from Mainland, compared the characteristics between injurious fallers and non-injurious fallers. The other two studies investigated the risk factors by comparing fallers with fracture and people free of falls or fractures. All four studies found that older women were more likely to be injured after a fall in comparison to older men.

A case-control study conducted in Mainland China revealed that single marital status and low levels of education were associated with a higher risk of fall-related injury.

**Extrinsic factors**

Walking aid usage was associated with increased risk of fall-related injury in a study conducted in Hong Kong. One Taiwanese study found that living in a rented home was associated with increased risk of fall-related hip fracture among older women. Another Taiwanese study found that living in rural locations increased the risk of fall-related injury. Long-term residence away from their home province (household register out of province) and mean daily temperature lower than 13° were associated with a higher risk of fall-related injury in a Mainland study.

**Intrinsic factors**

Six studies examined the impact of medical conditions and health status on fall-related injury; five found that chronic conditions increase the risk of fall-related injury. Visual impairment, orthostatic hypotension, urinary incontinence and depression were associated with increased risk of fall-related injury. Osteoporosis was associated with increased risk of fall-related injury in three studies, one from Taiwan, one from Hong Kong and one from Mainland. A Taiwanese study found that having three or more chronic conditions increased the risk of fall-related injury, while a Mainland study found that at presence of one or two comorbidities increased the risk of a fall-related injury. Taking anti-Parkinson’s medication, benzodiazepines, Z-drugs (zolpidem, zopiclone and zaleplon), first-generation antihistamines and antidiabetics medication (women only) were associated with increased risk of fall-related injury as was taking four or more medications. People who did not believe that falls could be prevented were more likely to sustain a fall-related injury. One Taiwanese study found that falling backwards, sideways and straight-down was associated with a higher risk of fall-related injury compared with falling forwards, while more activities of daily life (men only) and hormone replace therapy (women only) were shown to decrease the risk of fall-related hip fracture.

**The cost of fall-related injury**

Twenty-two studies reported on some aspect of the cost of fall-related injuries. Cost type included hospitalisation costs, direct costs and medical costs. Medical costs include hospitalisation costs, outpatient costs, operation costs and drug costs. Direct costs consist of medical and non-medical costs. Non-medical costs include medical care, nutrition support, accommodation and transportation.

Of these 22 studies, three cross-sectional studies reported the hospitalisation costs of fall-related injury based on health insurance and hospital records. The hospitalisation costs were reported as US$3812 and US$743 per person respectively in two Mainland studies and US$1761 per person in one Taiwan-based study. The Taiwanese study also reported that average expenses paid by patients varied from 0 to US$2629, and the average reimbursement for medical expenditure claimed varied from US$45 to US$19 468. The other 19 studies reported the direct or medical costs of fall-related injury.
injury based on information collected by face to face interviews, all of which were conducted in Mainland China. Of these 19 studies, three cross-sectional studies reported the direct cost of fall-related injury, which ranged from US$113 to US$576. Two of them, one from Shenzhen and another from Beijing, divided direct cost into medical cost and non-medical cost. The third study, conducted in Shanghai, reported the direct cost of fall-related injury by medical costs, medical care fees and other fees (e.g., transportation, nutrition) as well as average reimbursement for drug costs, outpatient costs and hospitalisation costs. The average cost was US$103 for direct medical expense, US$227 for medical care fees and US$75 for other fees, and the median reimbursement claim for drugs was US$6, US$49 for outpatient and 1194 for hospitalisation. In 16 studies (15 cross-sectional studies and 1 intervention study), the reported medical costs of fall-related injuries ranged from US$16 to US$878. Two studies examined cost differences in rural and urban areas. In one study conducted in Shanghai, there was no difference in fall-related cost between rural (US$475) and urban areas (US$488), while in another study conducted in urban Guangzhou and rural Laizhou, the cost of fall-related injury in rural Laizhou (US$16) was half that in urban Guangzhou (US$32).

Quality assessment
Almost all included studies (92/93) were observational; 78 cross-sectional, 7 cohort and 7 case-control studies. Of the 92 observational studies, only 8 were rated as good quality (3 from Taiwan, 1 from Hong Kong and 4 from Mainland China). Fifty-five studies were rated as being of fair quality. The average quality rating of all included observational studies was just under 8. The average quality according to the Cochrane Risk of Bias Tool. The quality rating of all included observational studies was just under 5. Fifty-five studies were rated as being of fair quality. The average quality rating of all included observational studies was just under 8.

Table 1  The cost of fall-related injury

<table>
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<tr>
<th>Author, year, location</th>
<th>Type of cost</th>
<th>Data source</th>
<th>Further category</th>
<th>Cost (US$)</th>
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Note: All cost units have been converted to US$.

DISCUSSION
This systematic review presents data from 93 published studies on the incidence, risk factors and economic burden of fall-related injuries in Chinese older people. It includes data from 77 studies only published in Chinese, thus improving the accessibility of these findings for those who do not speak Chinese.

Incidence
The incidence of fall-related injury in older Chinese people varied considerably between studies in this review for several reasons, but the incidence reported in most studies included in the review was lower than that reported in studies conducted in high-income countries. For instance, a study from the Netherlands and a study from the USA reported the incidence of fall-related injury in older (65+ years) older Dutch and Americans as approximately 20% in 2005 and 2006, respectively, which was much higher than the median incidence of fall-related injury in older Chinese in this review (6%).

The findings were broadly consistent in sex-specific and age group-specific comparisons. The sex-specific incidence of fall-related injury among older American people (23.4% in females and 15.0% in males aged 65+), has been reported as nearly twice as high as that among older Chinese people calculated in this review (11.6% for females and 6.6% for males aged 60+ and 65+). That said, direct comparison is difficult because some Chinese studies reported incidence in people aged 60+ years and others 65+ years. The incidence of fall-related injury among older American aged 65–69 was 16.0%, 70–74 was 17.8% and 75–79 was 19.5%, which was almost four times the incidence of fall-related injury among older Chinese (3.5% for those aged 65–69 group, 4% for 70–74 and 4.4% for 75–79). Similarly, a study from the Netherlands reported that the incidence of fall-related injury for Dutch people aged 60–69 was 15.5%, for people aged...
The lower incidence of fall-related injury among older Chinese was higher among women than men, and higher in older age groups compared with younger ones, which was consistent with our findings. The overall incidence of fall-related injury was found to be 5.5% in their study which was slightly lower than the median incidence found in our study, which may be attributed to the different inclusion/exclusion criteria adopted in the two studies. Moreover, we included the studies from Hong Kong and Taiwan in our review, which had a higher incidence of fall-related injury than those based in Mainland China.

The incidence of fall-related fracture in Chinese people calculated in this review is also much lower than that reported in studies of Caucasian people. The median incidence of fall-related fracture was 1.3%, and the median person-time incidence of fall-related fracture was 1.7/100 person-years (aged 60+ and 65+). The median incidence of fall-related hip fracture was 0.4% from four studies, and the person-time incidence of fall-related hip fracture was only reported by one study from Beijing as 1.4/100 person-years. An estimated incidence of fall-related fracture among older American was about 3%–4.5%, which was nearly three times higher than the incidence of fall-related fracture among older Chinese. The incidence rate of hip fracture among older Canadians was reported as 0.74% from a population-based study. Falls are responsible for nearly 95% of hip fractures in older people. The lower incidence of fall-related fracture and hip fracture among older Chinese people has been noted previously; theories about why this is the case include the fact that Asian people tend to have a shorter hip axis and a lower prevalence of osteoporosis, hence they are less likely to suffer a fracture after falls.

The variation in incidence reported in review papers can be attributed to many factors, including differences in geographic location, age groupings, sociodemographic factors and a lack of standardised injury measures. For instance, the incidence of fall-related injury of older people in Hong Kong and Taiwan was higher than that reported in studies from other parts of China, which may be because the definition of older people was 65 and over in Taiwan and Hong Kong, but in Mainland China it was aged 60 and over. Alternatively, it might be due to the different sociodemographic status, culture and lifestyle between older people living in Taiwan/Hong Kong and older people living in Mainland China.

**Risk factors**

Relatively few studies (seven) explored the risk factors for fall-related injury in our review. A total of 24 risk factors for fall-related injury were identified in our review. Many similarities in the risk factors for fall-related injury were found between older Chinese and their Caucasian counterparts. Older age, being female, visual impairment, having orthostatic hypotension, living in a rural area, comorbidity and multimedications usage increased the risk of sustaining a fall-related injury. These risk factors were similar to those reported in Caucasian people.

The direction in which a fall occurred was also found to increase the risk of fall-related hip fracture in our review, particularly for women. Falling in a direction other than forwards was more likely to result in a hip fracture, a finding which echoes that of a study conducted in the USA. The other risk factors for fall-related hip fracture in our review were urinary incontinence, chronic conditions, medication usage (eg, antidiabetics, first generation antihistamines, anti-Parkinsons), poor bone mineral density, walking aids use, depression and reduced daily activity, while hormone-replacement therapy was found to be a protective factor for women. All of these findings were consistent with those from previous studies in Western countries.

However, this review highlights that some risk factors for fall-related injury may be particular to older Chinese people. For instance, living in a rural location was associated with a greater risk of sustaining a fall-related fracture in our review but this association has not been observed in high-income settings. This might be due to differences in the living environments in rural China those in rural areas in Western countries. In China, rural areas are less developed and myriad environmental risk factors, such as uneven ground, less street lighting and water access points, could increase the risk of fall-related injury for older Chinese people. A similar result was found by an Indian study.

There were, however, some risk factors commonly reported in Caucasian studies that have not been investigated among older Chinese. For instance, fall-related injury risk is associated with lifestyle factors such as alcohol consumption and cigarette smoking in studies of Caucasian people. In Chinese studies, the associations between lifestyle factors and fall-related injuries have not been well explored and future study is required in this space.

**Economic burden**

Most studies that reported the economic burden of fall-related injuries were incidence-based studies. The cost of falls and injuries among older Chinese were lower than costs reported in high-income settings. The mean medical cost reported in studies in this review ranged from US$16 to US$776, and the median medical cost was US$272. A study conducted among older Australian community-dwellers reported the average cost of each fall as US$4307, much higher than the cost of falls among older Chinese. The hospitalisation cost for fall-related injury among older Chinese was reported ranged from US$743 to US$3742, with a median cost of US$1768. The average hospitalisation cost for a fall in a study recently conducted in the USA was US$29 562. Similarly, a study conducted in Beijing reported that the direct cost of fall-related hip fracture was US$2500, while the mean cost of hip fracture among Canadians older than 50 was US$19 743.

Although some studies reported the economic burden of fall-related injury among older Chinese, it was still unclear that how big the economic burden was due to lack of consistent methodology and heterogeneity of the studies. Only three studies reported the economic burden based on hospital records, and the other studies were based on patient recall of medical expenses. The large differences in the costs associated with fall-related injury between Chinese and high-income settings may be due to differences in medical expenses in different countries and differences in healthcare utilisation and quality.
burden of fall-related injuries in older Chinese people remains unclear. While many studies have attempted to determine the incidence of fall-related injury in older Chinese people, results vary considerably, largely due to inconsistent definitions and measures of fall-related injury and limitations in study design, which were mostly retrospective and community based. Additionally, few prospective studies examined the factors associated with fall-related injuries, particularly the associations between lifestyle factors and fall-related injuries. There was less emphasis on the economic burden of fall-related injury in the research conducted in Greater China. Most information on economic burden was reported in incidence-oriented studies based on the recall from the patients with limited information about reimbursement (by government and private insurance company) and the economic impact of fall-related injury for individuals and families.

**Strengths and limitations**

Two previous reviews, one from Kwan reported the incidence, risk factors and consequences of falls in older Chinese and another from Jiang summarised the incidence of overall fall-related injuries among older Chinese living in Mainland, were identified. To our knowledge, our study is the first systematic review examining the risk factors and cost for fall-related injury among older Chinese people. The findings of our review provide a summary of the latest evidence available and will inform the development of interventions to prevent and manage injurious falls. This systematic review has several limitations. First, although the search strategy employed was comprehensive and rigorous, some studies may have been missed and publication bias might also exist. Second, studies differed considerably in terms of location, selection criteria, population, methodology and the definition of fall-related injury, hence the comparison of findings between areas was not possible. Last, most included studies were retrospective and cross-sectional, thus causal assertions about identified risk factors cannot be made. The relatively weak level of evidence of the studies included in this review may affect the reliability of the findings synthesised herein. Nonetheless, this review represents the most current and comprehensive synthesis of evidence about the incidence, risk factors and costs associated with fall-related injury in China to date and highlights the knowledge gaps that researchers and policy-makers in China must strive to fill.

**CONCLUSION**

With a rapidly ageing and vast population, fall-related injury is a large and growing health problem in older Chinese people, which is likely to become a growing social and financial burden for China. To date, insufficient attention has been given to fall-related injury and there is a lack of developed infrastructure for managing fall-related injury in China. This may in part be due to the limited high quality research information available. While there have been many studies on falls among older Chinese people in many regions of China, fewer studies have examined fall-related injury, particularly in Mainland China. Further high quality research focusing on the incidence, risk factors and economic burden of fall-related injury in older Chinese people is needed to provide a sound evidence base for the development of effective prevention and treatment programme and policies to ensure China is prepared for this looming health crisis.

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