

Fragility Fracture Systems: International Perspectives - Asia & Australia

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Abstract

Background: The incidence and burden of fragility fractures have reached the level where comprehensive systematic care is warranted to optimize the care of these patients. Hip fractures are the most frequently lethal and independence level changing fragility fractures, responsible for 30-day mortality comparable to high-energy trauma patients with injury severity scores over 12. It is a reasonable expectation that countries have a hip fracture treating system of care in place for this high-risk population. This review explores the systems of care from the Asia-Pacific Perspective.

Methods: From the International Orthopaedic Trauma Association's member societies, nations from the Asia-Pacific Region were requested to contribute with an overview of their fragility fracture management systems. The content of the review was standardized by a template of headings, which each country endeavored to cover.

Results: Australia, Japan, and South Korea contributed voluntarily from the 5 member countries of the region. Each country has made considerable efforts and achievements with diverse approaches to standardize and improve the care of fragility fractures, particularly hip fractures. Beyond the individual nations' efforts there is also an existing Asia-Pacific Collaborative. The data collection and in some counties the existence of a registry is promising; funding and recognition of the problem among competing health care budget priorities are common.

Conclusions: Our review covers some of the countries with strongest economy and highest health care standards. The lack of a universal robust system for hip fracture care is apparent. The data collection from registry initiations is expected to drive system development further in these countries and hopefully fast track the development in other countries within the most populous geographical region of the Earth.

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1. Introduction

The population based epidemiology of fragility fractures in Asia and Australia has been poorly defined apart from geriatric hip fracture (GHF); however, based on European projections, it can be assumed that all fragility fractures are increasing in incidence.^[1] With its diverse range of ethnicities, hospital systems, and access to resources, the region has a wide spectrum of treatment standards and organizational structures. Although vertebral fractures constitute approximately half of fragility fractures, their management is not structured due to the relatively insidious nature of the injury, the tendency to not present acutely to healthcare and the controversial role of surgical intervention.^[2] GHF is by far the most serious acute osteoporosis related clinical condition; conservative estimates suggest Asia currently sustains 1.3 million GHFs that will approach 3 million by 2050. Whilst mortality is often a key marker of institutional performance, loss of independence and quality of life is arguably more important to patients. This, in tandem with the costs of care and care inefficiencies, result in increasing health, emotional, and financial burdens on Asia-Pacific societies.

2. Australia

2.1. National guidelines and standards

In Australia, approximately 5% of the population have osteoporosis with over \$1.5 billion USD in fracture-related costs. More than 50% of postmenopausal women and 30% of men over the age of 60 years will suffer at least 1 fragility fracture with over 165,000 fragility fractures presenting to hospital in individuals aged 50 and above with an additional 60,000 that do not present to hospital. The Australian Federal Government's Department of Health has a structured national strategy for osteoporosis led by Osteoporosis Australia. Specific to fracture, the plan outlines the need for Fracture Liaison Service (FLS) models of care across Australia and pilots an integrated national approach to secondary fracture prevention with primary care.^[3] Australia sits within the broader framework of instituting FLS models throughout the populous Asia-Pacific region via interest groups such as the Asia-Pacific Bone Academy and Asian Federation of Osteoporotic Societies.^[4]

Approximately 20,000 GHF are sustained annually, equating to \$330 million USD in healthcare costs,^[5] with projections to 60,000 GHF in 2050.^[2] Acute costs of care are \$24,000 USD^[4] and the risk of sustaining a secondary GHF is approximately 3% within a year, 6% within 3 years, and 9% within 8 years.^[6] Regarding management systems, the only fragility fracture that has organized, interacting units of care provision is GHF and will be focused on subsequently in this section.

Australia has firm GHF guidelines and contributes to the binational hip fracture registry to document trends in current care and facilitate improvements. The Australian Commission on Safety and Quality in Health Care (ACSQHC)^[7] is a component of the Health portfolio of the Australian Government and is accountable to the Australian Parliament and the Health Minister. The ACSQHC has set 7 clinical standards for GHF management: (1) Care at presentation (timely assessment, imaging, analgesia, cognitive screening); (2) Pain management (multimodal analgesia, emergency department nerve blocks, pain pathways); (3) Orthogeriatric model of care; (4) Timing of surgery (within 48 hours if no clinical contraindication exists); (5) Mobilization and weight-bearing (unrestricted weight-bearing provided the day after surgery); (6) Minimizing risk

of another fracture (falls assessment, bone assessment and management plan); and (7) Transition from hospital care (individualized care plans acknowledging ongoing care goals and involving the family doctor).

The Australian and New Zealand Hip Fracture Registry (ANZHFR) is a voluntary registry providing quality assurance for ACSQHC guidelines. Similar to other registries,^[8] it has inclusion criteria of being aged 50 or above with a low-energy GHF. Approximately 75% of hospitals contribute to the binational registry, which now constitutes approximately 50,000 patients.

All arthroplasty for GHF and subsequent revisions necessitating component exchange is mandated to be reported in the Australian Orthopaedic Association National Joint Replacement Registry (AOANJRR).^[9] This registry, with compliance approaching 100%, has total hip arthroplasty (THA) for GHF reported as a distinct entity. There is also an additional separate report on partial (hemi-) hip arthroplasty. This registry has demonstrated the increase in THA for fracture and the decrease in monoblock hemiarthroplasty.^[10] Whilst revision is the primary outcome, the inclusion of patient-reported outcome measures is being instituted and will inevitably become standard care, helping inform the surgical community on optimal management.

2.2. Organization

2.2.1. Models of care. The orthogeriatric model of care is the advocated standard.^[7] For contributing hospitals to the ANZHFR, 28% utilized a shared-care arrangement with orthopedics, 31% a geriatric medicine liaison service, and 16% an alternative-orthogeriatric service model. Geriatric review occurs in 91% of patients during the acute orthopedic hospital stay, 32% being assessed pre-surgery. National median time to surgery is 30 hours from admission and 40 hours for patients transferred from another hospital.^[11] Despite this discrepancy in time to surgery, adjusted analysis suggests there is no difference in mortality as an outcome for transferred patients.^[5]

2.2.2. Funding. The ANZHFR receives financial support via the Australian Government Department of Health, New Zealand Accident Compensation Corporation, Amgen (a multinational pharmaceutical company), New South Wales (NSW) Health Agency for Clinical Innovation, South Australia Health, Western Australia Health and Queensland Health.^[11] Funding for the AOANJRR has occurred since its inception in 1998 through the Department of Health and Ageing.^[9]

The majority of hip fracture surgical costs are covered by the public hospital system through the universal national health insurance scheme, Medicare. The public hospital system cares for 85% of hip fracture patients, with the remainder occurring in the private sector.^[11] In the public system, the care is funded by Medicare; for patients who receive treatment within the private system, Medicare will pay a proportion of the medical costs in the private hospital (up to 75%) with the private insurer and patient contributing the remainder.

Incentive based funding for hip fractures does not exist nationwide in Australia, despite international evidence suggesting the benefit.^[12] Trials of incentivized funding models suggest an improvement in performance without direct linkage to classical outcomes.^[13]

2.3. Outcomes

2.3.1. Successes. Examination of patient deaths is mandatory if it occurs within 30 days after an operation or if the final

hospital admission was under the care of a surgeon, irrespective of operative intervention. This is overseen by the Australian and New Zealand Audit of Surgical Mortality (ANZASM), the only national peer reviewed audit of all surgical mortalities in the world.^[14] ANZASM is a Royal Australasian College of Surgeons project to ensure appropriate governance, standardization and consistency in the audit process, which is funded by all the states and territories besides NSW.^[15] A national Steering Committee with Clinical Directors from each region governs ANZASM.

For the state of NSW, the Collaborating Hospitals Audit of Surgical Mortality (CHASM) provides similar data to ANZASM.^[16] CHASM is independently managed by the Clinical Excellence Commission and funded by the NSW Health Department. Program information is protected by privilege under the Health Administration Act 1982. Over a 13-year period (1/1/2008-31/12/2020), 1676 hip fracture deaths in patients aged 50 and above have been examined by CHASM. As expected, a higher proportion of deaths were male (43%) and older (mean age 85.9 years) than the hip fracture population.

Participation in ANZASM and CHASM (as a clinical audit) is a requirement of the Continuing Professional Development program of the Royal Australasian College of Surgeons. The admitting consultant surgeon provides information through an on-line portal as outlined in the surgical case form. A first-line assessment is compiled based on the surgical case form, with feedback relayed to treating surgeons for reflection. If there are systematic errors that need further investigation, or a paucity of detail to make adequate judgement, a second-line assessment is made with all available documentation from the admission.^[17]

The ANZHFR, whilst not focusing on mortality outcomes initially, has been linked to patients through the Australian Institute of Health and Welfare's National Death Index in the 2020 report.^[11] An adjusted 30- and 365-day mortality figure allows Australia to be compared with other international registries.^[8] Mobility, place of residence, revision surgery, and mortality are collected at the 120day mark.^[18] The registry can collect EuroQol's EQ-5D5L; however, this is not part of the minimum data set.^[19] The registry offers hospitals the ability to see how their standard of care compares with other participating hospitals and the national average. Preoperative cognitive assessment, timely assessment of pain in the emergency room, nerve blocks implementation, operative involvement of consultant surgeon, and delirium assessment have all shown improvement in the last year.^[11]

The AOANJRR offers the outcome of revision surgery against the competing risk of death. Whilst revision surgery is not a classical outcome of hip fracture, revision surgery is expensive and associated with a morbidity risk profile in a frail patient population.^[10] Through dedicated analysis, the AOANJRR has recently demonstrated that bipolar modular stemmed arthroplasty has a lower revision rate than unipolar heads for patients who survive more than 2.5 years,^[20] that large heads (36 mm and above) have equivalent results to more expensive dual mobility and constrained liners in THA,^[21] that for conversion to THA from hemiarthroplasty, the index operation does not influence revision outcomes,^[22] and that there is variation in the utilization of THA not related to patient factors.^[23] There has also been successful use of AOANJRR data with local health care system costings to generate data that cemented femoral prostheses are cost effective,^[24] reinforcing international recommendations for the use of cemented stems.

2.3.2. Barriers. Barriers include the nonmandatory reporting to the ANZHFR and reliance of institutions to improve their own

results. Since the ANZHFRs first report in 2016,^[25] binational hospital participation of patient level data has increased from 25 to 77 hospitals.^[11] Whilst up to 121 hospitals have contributed facility level data (basic information on admission numbers, model of care, protocols, and processes and post-acute stay care),^[25] not all hospitals have the resources to contribute patient data outlined in the minimum data set. The ANZHFR facilitates sustainable contribution ideas that can subsequently improve the veracity of the registry and the ability of hospitals to monitor ACSQHC standards.

Resource allocation and traditional attitudes towards post-operative care remain barriers to several key markers of performance that have not shown marked change in the last 5 years of the ANZHFR. Preoperative medical assessment, unrestricted weight bearing, postoperative day 1 mobilization, and delay to surgery have shown little improvement.^[11] With publicly available performance outcomes,^[26] it is theorized that services will be obliged to access expert knowledge to improve standards of care in the absence of payment-based performance incentives.^[27]

Despite efforts from expert groups and national osteoporosis plans, as of 2019 there were only 32 FLSs established nationally.^[3] Locally-based FLS models have demonstrated reductions of major secondary fractures by 40% over 3-years.^[28] The national strategy is to increase this to 100 hospital sites, and into 200 primary care sites.^[3]

2.3.3. Future direction. Increased scrutiny of outcomes by registries and the government will lead hospitals to reflect upon practice-standards and resource allocation towards the increasing burden of GHFs. With motivated organizations such as the ANZHFR advocating best practices and adherence to national ACSQHC guidelines, and ANZASM and CHASM performing high-quality mortality audits, it is expected that the standard of hip fracture care within Australia will consequently improve.

3. Korea

3.1. Introduction

By 2050, over 38.1% of the population is projected to be 65 or over, and 15.8% of the population are projected to be 80 or over, which would make Korea's population 1 of the oldest, and 1 of the fastest aging populations.^[29]

3.2. National guidelines and standards

Korea has updated information about the epidemiology of hip, vertebral, and wrist fracture. The national database center has cooperated with the Korean Society for Bone and Mineral Research (KSBMR) and published an osteoporosis and osteoporotic fracture fact sheet in 2017, 2018, and 2019.^[30] These data are based on the Korea National Health and Nutrition Examination Survey collated by the Korea Centers for Disease Control and Prevention and the National Health Information database provided by the National Health Insurance Service (NHIS) of Korea.^[30]

With the above information systems, Korea has contemporary epidemiological hip fracture data. The incidence of hip fractures rose from 159.1/100,000 in 2008 to 181.5/100,000 in 2012. The total number of hip fractures is estimated to increase by 1.4 times over the next 10 years, from 35,729 in 2016 to 51,259 in 2025.^[31]

The Korean government is aware of the importance of hip fracture prevention; however, there are no national standards for

hip fracture care. This is largely due to the majority of patients being managed in private hospitals. There are several registries based on region, city, or for organized academic purposes, but a national registry has not yet been developed.

3.3. Organization

3.3.1. Models of care. The orthogeriatric model of care is the advocated standard,^[7] with select hospitals running geriatric medicine liaison services. Several hospitals have their own standards^[32,33] and the government has been conducting pilot projects. Standard guidelines have additionally been established based upon recommendations from academic societies. The Korean academy of rehabilitation medicine released a clinical practice guideline for hip fracture rehabilitation^[34] and KSBMR released a FLS guidebook.^[35] KSBMR has developed a coordinator training program, conducted educational symposia, and offered training sessions every year since 2018.^[36]

3.3.2. Funding. The majority of hip fracture surgical costs are covered by the NHIS program. Inpatient care is subject to a 20% co-payment, while the Medical Aid Program covers both the insurance premium as well as co-payments for people with low incomes. The coverage of NHIS was 97.2% of the population in 2018, while 2.8% was covered by the Medical Aid Program.

In Korea, there is not a well-established primary care system. Patients who sustain a hip fracture have easy access to any community specialty clinic or general hospital, or can present to a tertiary hospital. In Korea, most of hip fractures are managed in private hospitals (95.8% vs 4.2% of public) and in teaching hospitals (92.8%).^[37] Incentive based funding for hip fractures does not exist nationwide in Korea, despite international evidence suggesting the benefit.^[12]

3.4. Outcomes

3.4.1. Successes. Reduction of mortality in hip fracture patients is a primary aim, and review of surgical mortality is essential to improving health care. In Korea, there are no programs to review outcomes, but reports based upon the NHIS database demonstrate mortality incidence and trends. The mortality within 1 year after hip fracture decreased from 2006 to 2015 (206.6 vs 201.4 person per 1000 person-years).^[38] When subcategorized by gender, the 1-year mortality rate in women decreased by 10% (196.7 vs 177.7 person per 1000 person-years) from 2006 to 2015; however, this rate increased in men by 13% (228.7 vs 260.3 person per 1000 person-years) over the same time period. During the past decades, individual institutional guidelines have been ineffective to reduce mortality, which highlights the need for overarching national practice guidelines.

A rehabilitation clinical pathway pilot-project sponsored by the government revealed that whilst cognitive impairment and poor balance may inhibit recovery of ambulatory function after hip fracture, a well-designed rehabilitation program could improve ambulatory function in older patients.^[39] The KSBMR has begun leading FLS management in Korea. The FLS structure has been divided into 3 distinct entities: (1) primary treatment; (2) secondary prevention; and (3) database construction and feedback. Although it is challenging to instigate the use of FLS nationwide, it will ultimately be helpful to acquire clinical data and quantify socioeconomic effects.

3.4.2. Barriers. To generate a nationwide registry and guidelines, there are many obstacles in Korea. The first is the national policy support costs for appropriately trained staff and database

management. It is questionable whether the hospitals under the current low fee system are able to pay such costs. At present, Korean medical care is divided into areas of specialization, and changes in healthcare systems and facilities are needed. For orthogeriatric patients, multidisciplinary management is mandatory, which requires the relocation of facilities and personnel to facilitate communication between healthcare systems.

3.4.3. Future direction. Looking towards the future, reflection on registry outcomes and national standards will lead to more successful outcomes; this is the logical step that can lead to the improvement of hip fracture care within Korea.

4. Japan

4.1. Introduction

Patients who suffer fragility fractures are at high risk of sustaining a secondary fracture. It is thus exceedingly important to prevent recurrent fractures, not only for the patient, but also their family, the community, and overall healthcare economics. FLS programs were first implemented in European countries and are now used worldwide to effectively prevent hip fractures. A program called the osteoporosis liaison service, which includes FLS, was first implemented in Japan and has become popular for solving problems related to osteoporosis treatment.^[40] FLS programs aim to increase initiation and continuation of falls prevention programs and improving metabolic bone health in order to break the cycle of fragility fractures.

4.2. National guidelines and standards

Japan has no specific government-led guidelines. However, there is “Clinical Standards for Fracture Liaison Services in Japan” developed by the Japan Osteoporosis Society and Fragility Fracture Network Japan (FFN-J) that involves 20 Japanese hospitals in its databank.

FFN-J was formally established as a nonprofit organization in 2015. In 2019, FFN-J and the Japan Osteoporosis Society developed “Clinical Standards for Fracture Liaison Services in Japan” which describes the intervention agenda of FLS for hospitals. The ten societies and organizations, including the Japanese Society for Fracture Repair (JSFR) and Japanese Orthopaedic Association, endorse these clinical standards.

As summarized in Figure 1,^[41] the following 5 factors are considered important in improving the initiation and ongoing rates of osteoporosis treatment for patients with fragility fractures: (1) identification of the at-risk patients (Identification); (2) evaluation of secondary fracture risk (Investigation); initiation of treatment, including medication (Initiation); patient follow-up (Integration); and education and information provisions to patients and medical staff (Information).

In 2020, the Japanese Orthopaedic Association and JSFR published clinical guidelines for hip fractures (3rd edition) to promote evidence-based treatments for hip fractures in Japan. This was based upon the first edition published in 2005 and the second edition published in 2011.

4.3. Organizations

4.3.1. Models of care. An example of the multidisciplinary team (MDT) approach in Japan exists in the Toyama Municipal Hospital, with its effective employment of an MDT for GHFs.^[42] The MDT approach is a method of care that provides active treatment through collaboration among all specialists involved

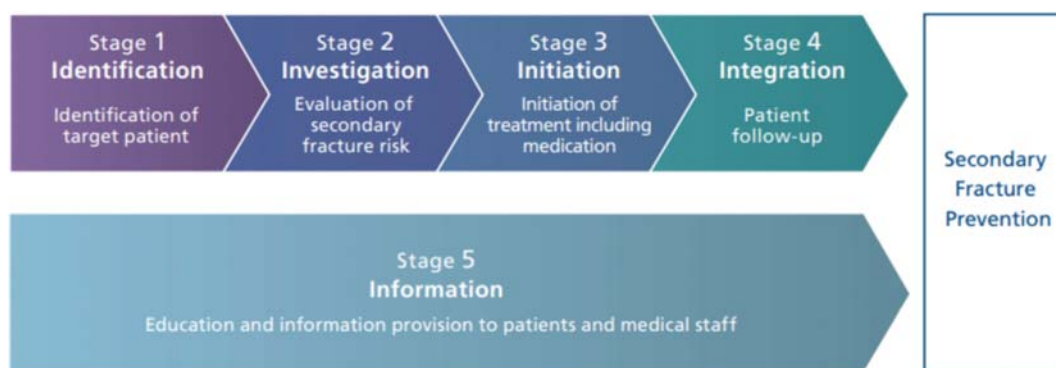


Figure 1. The 5 factors considered important in improving the initiation and continuation of osteoporosis treatment for patients with fragility fractures.

with hip fracture treatment, including the orthopedic surgeon, internist, anesthesiologist, psychiatrist, nurse, physical therapist, ward pharmacist, medical social worker, and registered dietitian. This approach resulted in time to surgery from admission being approximately 3 days shorter than the national average and a hospital length of stay more than 14 days shorter than the national average. The incidence of serious complications was additionally lowered. The MDT has maintained a high rate of osteoporosis treatment at discharge (88%) and, at 1 year followup, continuation of pharmacotherapy was 95%. Furthermore, better functional recovery and the total hospitalization-related medical costs per person for the multidisciplinary treatment was less than the national average.

4.3.2. Funding. The JSFR, Union Chimique Belge (biopharmaceutical company), and Amgen (biopharmaceutical company) provide the FFN-J funding for its data bank.

4.4. Outcomes

4.4.1. Successes. The International Osteoporosis Foundation's Best Practice Framework serves as the benchmark for FLS standards globally. The "Best Practice Recognition" is the acknowledgement of a successful FLS program, as measured by its ability to adhere to the Best Practice Framework standards.^[43] The International Osteoporosis Foundation has subsequently awarded 7 gold, 17 silver, and 12 bronze ratings to FLSs in Japan.

In 2021, Osaki reported that a fracture liaison coordinator was able to improve bone density assessment, treatment rates, and continued treatment rates following fragility fracture in a multicenter, randomized controlled trial. The findings suggest that a liaison-based intervention may help both fracture and osteoporosis physicians in the evaluation of osteoporosis and initiation and continuation of osteoporosis medication.^[44]

4.4.2. Barriers. Under the Japanese healthcare insurance system, there is a perception that a FLS is costly and it decreases work efficiency. There are several issues with the Japanese osteoporosis liaison service; 1 is that secondary fracture prevention is not covered by public health insurance. At present, FLS is supported by the voluntary efforts of individual medical facilities to prevent secondary fractures. Without further support for FLS through public health insurance coverage, the expansion of FLS models will be limited. Second, the reimbursement system that has been introduced in many acute-care and rehabilitation hospitals, stipulates that the expense of prescribed drugs is

included in the overall treatment costs specified for a condition. Therefore, hospitals tend to minimize drug prescriptions, including antiosteoporosis medication. Third, osteoporosis managers are drawn from a variety of professionals. Osteoporosis managers' activities, which include not only secondary but also primary fracture prevention, are conducted at a variety of facilities. These include hospitals, clinics, dispensing pharmacies, and nursing care facilities.^[40]

4.4.3. Future direction. In Japan, more than 200,000 hip fractures occur annually, which will increase towards 2050. Priority is to help policy makers understand the current cost and burden of fragility fractures in Japan. The FFN-J intends to describe the benefits of secondary fracture prevention in terms of reducing healthcare use, reducing long-term care admissions, and ultimately healthcare costs in Japan. In order to establish the optimal hip fracture care, FFN-J had launched the Japan National Hip Fracture Database supported by JSFR since 2017. More activity is needed to achieve a change in healthcare policy to drive greater awareness of the significance of fragility fractures.

5. Conclusions

Within the Asia-Pacific region the systems managing fragility fractures need improvements, even in the highest income countries. As the most populous geographic region on earth, Asia-Pacific nations require a more collaborative approach to address the increasing burden of all fragility fractures. Australia and New Zealand have national hip fracture standards and a hip fracture registry with incomplete national uptake, but Japan and Korea, which have highly developed health care systems with combined populations of over 175 million, have neither uniting governmental standards nor registries. Whilst hip fractures are associated with the greatest morbidity and mortality, focus on other fragility fractures is warranted. Diagnosis and treatment of osteoporosis by primary care is necessary to prevent fracture, FLS need to be alerted to reduce refracture, and epidemiological surveillance, ideally through prospectively collected registries, is required to ensure that any implemented changes in the system are effective.

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