

# Fracture Liaison Service in Korea: 2022 Position Statement of the Korean Society for Bone and Mineral Research

Jae-Young Lim<sup>1</sup>, Young Yul Kim<sup>2</sup>, Jin-Woo Kim<sup>3</sup>, Seongbin Hong<sup>4</sup>, Kyunghoon Min<sup>5</sup>, Jaewon Beom<sup>1</sup>, Byung-Ho Yoon<sup>6</sup>, Sang Yoon Lee<sup>7</sup>, Sung Hye Kong<sup>8</sup>, Jun-Il Yoo<sup>9</sup>, Myung Sook Park<sup>10</sup>, Jae-Hwi Nho<sup>11</sup>, Sangbong Ko<sup>12</sup>, Min Wook Joo<sup>13</sup>, Dong Hwan Kim<sup>14</sup>, Chan Ho Park<sup>15</sup>, Tae-Young Kim<sup>16</sup>, Seil Sohn<sup>17</sup>, So Young Park<sup>18</sup>, A Ram Hong<sup>19</sup>, Young Joo Kwon<sup>20</sup>, Sung Bae Park<sup>21</sup>, Young-Kyun Lee<sup>22</sup>, Nam Hoon Moon<sup>23</sup>, Bo Ryun Kim<sup>24</sup>, Yongsoon Park<sup>25</sup>, Yonghan Cha<sup>26</sup>, Yong-Chan Ha<sup>27</sup>

<sup>1</sup>Department of Rehabilitation Medicine, Seoul National University Bundang Hospital, Seoul National University College of Medicine, Seongnam;

<sup>2</sup>Department of Orthopaedic Surgery, Daejeon St. Mary's Hospital, The Catholic University of Korea, Daejeon;

<sup>3</sup>Department of Orthopaedic Surgery, Nowon Eulji Medical Center, Eulji University, Seoul;

<sup>4</sup>Division of Endocrinology and Metabolism, Department of Internal Medicine, Inha University Hospital, Inha University School of Medicine, Incheon;

<sup>5</sup>Department of Rehabilitation Medicine, CHA Bundang Medical Center, CHA University School of Medicine, Seongnam;

<sup>6</sup>Department of Orthopaedic Surgery, Ewha Womans University, College of Medicine, Mokdong Hospital, Seoul;

<sup>7</sup>Department of Rehabilitation Medicine, Seoul National University Boramae Medical Center, Seoul National University College of Medicine, Seoul;

<sup>8</sup>Department of Internal Medicine, Seoul National University Bundang Hospital, Seoul National University College of Medicine, Seongnam;

<sup>9</sup>Department of Orthopaedic Surgery, Inha University Hospital, Inha University School of Medicine, Incheon;

<sup>10</sup>Department of Nursing, Konkuk University, Chungju;

<sup>11</sup>Department of Orthopaedic Surgery, Soonchunhyang University Seoul Hospital, Soonchunhyang University College of Medicine, Seoul;

<sup>12</sup>Department of Orthopaedic Surgery, Daegu Catholic University Medical Center, Catholic University of Daegu School of Medicine, Daegu;

<sup>13</sup>Department of Orthopaedic Surgery, St. Vincent's Hospital, College of Medicine, The Catholic University of Korea, Seoul;

<sup>14</sup>Department of Physical Medicine and Rehabilitation, Kyung Hee University Hospital at Gangdong, Kyung Hee University College of Medicine, Seoul;

<sup>15</sup>Department of Orthopaedic Surgery, Bucheon Daesung Medical Center, Bucheon;

<sup>16</sup>Department of Orthopaedic Surgery, Konkuk University Medical Center, Konkuk University School of Medicine, Seoul;

<sup>17</sup>Department of Neurosurgery, CHA Bundang Medical Center, CHA University, Seongnam;

<sup>18</sup>Division of Endocrinology and Metabolism, Department of Internal Medicine, Kyung Hee University Hospital, Kyung Hee University College of Medicine, Seoul;

<sup>19</sup>Department of Internal Medicine, Chonnam National University Medical School, Gwangju;

<sup>20</sup>Division of Nephrology, Department of Internal Medicine, Korea University Guro Hospital, Korea University College of Medicine, Seoul;

<sup>21</sup>Department of Neurosurgery, Seoul National University Boramae Medical Center, Seoul National University College of Medicine, Seoul;

<sup>22</sup>Department of Orthopaedic Surgery, Seoul National University Bundang Hospital, Seoul National University College of Medicine, Seongnam;

<sup>23</sup>Department of Orthopaedic Surgery, Pusan National University Hospital, Pusan National University School of Medicine, Busan;

<sup>24</sup>Department of Physical Medicine and Rehabilitation, Korea University Anam Hospital, Korea University College of Medicine, Seoul;

<sup>25</sup>Department of Food and Nutrition, College of Human Ecology, Hanyang University, Seoul;

<sup>26</sup>Department of Orthopaedic Surgery, Daejeon Eulji Medical Center, Eulji University School of Medicine, Daejeon;

<sup>27</sup>Department of Orthopaedic Surgery, Seoul Bumin Hospital, Seoul, Korea

## Corresponding author

Yong-Chan Ha

Department of Orthopaedic Surgery, Seoul Bumin Hospital,

389 Gonghang-daero, Gangseo-gu, Seoul 07590, Korea

Tel: +82-2-6299-1577, Fax: +82-2-822-1710

E-mail: hayongch@naver.com

Received: December 16, 2022

Revised: December 28, 2022

Accepted: January 5, 2023

Copyright © 2023 The Korean Society for Bone and Mineral Research

This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<https://creativecommons.org/licenses/by-nc/4.0/>) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

Osteoporosis and osteoporotic fractures cause socioeconomic concerns, and medical system and policies appear insufficient to prepare for these issues in Korea, where the older adult population is rapidly increasing. Many countries around the world are already responding to osteoporosis and osteoporotic fractures by adopting fracture liaison service (FLS), and such an attempt has only begun in Korea. In this article, we introduce the operation methods for institutions implementing FLS and characteristics of services, and activities of the FLS Committee for FLS implementation in the Korean Society for Bone and Mineral Research. In addition, we hope that the current position statement will contribute to the implementation of FLS in Korea and impel policy changes to enable a multidisciplinary and integrated FLS operated under the medical system.

**Key Words:** Aged · Hip fractures · Korea · Osteoporotic fractures · Fracture liaison service

## INTRODUCTION

The Statistics Korea announced that the 2020 life expectancy at birth is 83.5 years old (male 80.5 years old, female 86.5 years old), and this has been increasing steadily.[1] Due to advances in medicine and improvement in socioeconomic level, the aging population in Korea is growing at the fastest rate among the Organisation for Economic Co-operation and Development (OECD) countries. The proportion of the population aged 65 years and above and 80 years and above in 2020 was 14.9%, 8.9%, respectively.[2] By 2050, Korea is expected to have the highest proportion of elderly population in the world (about 40%).[2] In 2017, medical expenditures for people aged 65 and above amounted to approximately 27 billion dollars, and increasing medical expenditures have become a significant socioeconomic problem for Korean society.[3]

Osteoporosis is a metabolic bone disease characterized by low bone mass and microarchitectural deterioration of bone tissue leading to enhanced bone fragility.[4] In a study on the prevalence of chronic disease among older patients in Germany, osteoporosis was observed in about 12.1%, and according to a survey by The Korean Society for Bone and Mineral Research (KSBMR), 22.4% of the population over the age of 50 in Korea have osteoporosis.[5,6] Elderly patients suffer from various chronic diseases, and osteoporosis is associated with these chronic diseases and/or comorbidities. The medications used to treat these conditions can affect one another and worsen the patient's condition; it increases risks of osteoporotic fractures.[7-9] Osteoporotic fracture is a fragility fracture, which is defined as a fracture resulting from low trauma such as a fall from a standing height and a significant consequence of osteoporosis.[10] It has been recognized as a geriatric condition associated with various complex problems that significantly compromise whole-body conditions and functions in addition to the musculoskeletal problems due to fracture per se.[11] The common sites of fragility fracture are hip, spine, proximal humerus, and distal forearm. Compared to other fragility fractures, hip fractures especially tend to have more severe consequences; 1-year mortality rate of hip fracture was reported to be 15.6% in Korean patients with hip fractures.[12]

Developed countries that have suffered socioeconomic burdens due to osteoporosis and fragility fractures intro-

duced fracture liaison service (FLS) to effectively treat osteoporosis and fragility fractures and to prevent secondary fractures.[13,14] FLS refers to a program that systematically identifies patients over the age of 50 with fragility fractures and provides appropriate treatment and services to reduce the risk of subsequent osteoporotic fractures. In addition, this service could be applied to inpatients and outpatients for secondary prevention of osteoporotic fractures with multidisciplinary services for diagnostic tests and treatments. It has already been proven that this service not only improved the clinical results of patients but also reduced medical costs.[15] In the USA, FLS is covered by Medicare when fracture patients are appropriately identified, evaluated, and treated for osteoporosis and future fracture risks. Secondary fracture prevention intervention for Medicare beneficiaries diagnosed with new osteoporotic fractures was reported to improve health outcomes and reduce healthcare costs compared to usual care.[16] Particularly in Japan, the medical insurance fee for FLS was newly established in 2022. Despite significant progress of FLS in other regions and countries, FLS system is not yet established in Korea. The national health care support and the efforts of medical personnel to treat osteoporosis and prevent secondary fractures are insufficient compared to other major chronic diseases such as hypertension and diabetes in Korea.[17]

Therefore, we aimed to introduce the activities of FLS Committee in KSBMR, and provide recommendations for the implementation of FLS and suggest future directions for effective treatment of osteoporosis and fragility fractures and prevention of secondary fractures.

## JOURNEY OF FLS COMMITTEE (FRAGILITY FRACTURE NETWORK [FFN] KOREA) ACTIVITIES IN KSBMR

In 2018, the KSBMR formed an FLS committee and made various efforts to implement FLS. The activities of the FLS committee can be categorized into domestic and international activities.

Domestic activities include the FLS education symposiums for training FLS coordinators every year, the activities of policy proposals to government agencies and the national assembly, the development of various FLS services, and the release of the first FLS guidebook and subse-

quent revisions. The education symposium for FLS coordinators started in 2019 and has been held quarterly every year except for 2020. The contents of the education range from the concept and treatment of osteoporosis to fragility fracture, the conditions related to chronic diseases, nutrition management and rehabilitative approach. Experts from the FFN and the International Osteoporosis Foundation (IOF) have been invited to share their experiences of implementing FLS in their circumstances at the Annual Meetings of KSBMR and education symposiums. The KSBMR has been holding policy forums to improve the milieu of patient care and to offer policy suggestions for integrated care to overcome osteoporotic fragility fractures. The executive members of FLS committee often contact the National Assembly to deliver policy proposals for implementing FLS in the clinical setting. As the Korean “blue book”, benchmarked from the British Blue Book, the first edition of FLS guidebook was published in January 2019 and is being renewed to be released by the end of 2022. Since the guidebook covers the epidemiology of osteoporotic fractures to primary treatment and secondary prevention of fractures, it can serve as a useful guide in conceptualizing the FLS and to implement the system in all institutions. Several programs have been developed to assist in the implementation of FLS services. In a multicenter trial, the alarm services to increase the diagnosis rate of osteoporosis and prescription rate of anti-osteoporosis medication have been adopted in hip fracture patients who visited emergency room or outpatient clinic.[18] The diagnostic code of hip fracture activates this service, and whenever the medical staff checks the patients’ medical records, a pop-up reminds them not to omit osteoporosis treatment. It has been proven that the evaluation rate of osteoporosis and the prescription rate of osteoporosis medication increased through the alarm service. In addition, the Fragility Fracture Integrated rehabilitation management program for hip fracture patients who underwent surgical treatment has been suggested as a post-acute care model including discharge care plans and home-based medical care for fragility fractures.[19,20]

International activities can be divided into collaborative works with Global FFN and Asia-Pacific Regional Expert Meeting under global network and other works with IOF such as joining the Capture the Fracture® program and FLS mentorship program. For the first time in 2018, several mem-

bers of FLS committee attended the Asia-Pacific Regional Expert Meeting of FFN held in Japan. Ever since, we have been attending many online meetings (Asia-Pacific FFN Pocket Meeting, Asia-Pacific FFN Virtual Conference, FFN Korea Symposium) held by the Asia-Pacific Regional Committee of FFN and Special Interest Groups in FFN, and actively participated in the academic and policy activities as a representative of FFN Korea endorsed by Global FFN. We hope to host the Asia-Pacific Regional Expert Meeting in Korea one day. FFN is conducting the project to build the international hip fracture registry based on the minimum common dataset applicable to any region in the world. Early this year, global FFN developed a Global Orthogeriatric Survey to map the world’s preparedness to face the challenge of fragility fracture by documenting how efficiently fracture patients receive the care necessary across the acute, rehabilitative, and secondary prevention settings. The FLS committee also plans to join these initiatives. The goal of the IOF Mentorship Program is to connect experienced FLS champions with clinics wishing to establish a FLS, and to pass on the required knowledge and skills. The members of the FLS committee will first complete the training, and then it will be expanded to general members in KSBMR.

## RECOMMENDATIONS FOR IMPLEMENTATION OF FLS

The first position statement of FLS committee in KSBMR includes recommendations for essential components in FLS implementation. These are the common opinions of members in FLS committee considering international treatment standards for osteoporotic fracture.

### 1. Multidisciplinary co-management of the acute fracture episode

All patients with fragility fractures should be treated early, especially patients with fragility hip fractures should be hospitalized and should have surgery early.

The surgical management of elderly patients with a fragility fracture in the peri-operative period should be a comprehensive multidisciplinary orthogeriatric approach.

### 2. Optimizing rehabilitation to recover function, independence and quality of life

Early mobilization and rehabilitation are now a standard

of care in the management of fragility fracture patients.

Optimizing rehabilitation for inpatients and outpatients with fragility fractures should be applied to recover function, independence, and quality of life

In order to achieve early mobilization and rehabilitation, a stable surgical repair that allows the patient to bear weight or ambulate as tolerated, as well as effective pain control and fluid management protocols that ensure volume adequacy and avoid orthostatic hypotension are essential.

Rehabilitation should be involved diagnosing and treating impairments, preventing and treating complications, and deterring loss of function, and where this is not possible, compensating for lost functions.

### 3. Reliable delivery of secondary fracture prevention after every fragility fracture

A comprehensive and multidisciplinary secondary fracture prevention strategy should be applied for patients with every fragility fracture.

The process of reliable delivery of secondary fracture prevention should include (1) education for both older patients, caregivers, and healthcare professionals in terms of general lifestyles and medical measures to optimize bone health and prevent falls; (2) screening and optimizing management of older people with bone fragility or high risk of falling; and (3) strong collaboration between FLSs, departments of geriatric medicine or rehabilitation medicine, and primary care.

### 4. Policy change

Policy makers, professional and patient organizations, and opinion leaders need to play a major role in driving the policy changes to enable FLSs at local and national levels that include both assessment and management of patients with fragility fracture and optimizing medical management in those with bone fragility to reduce fracture risk.

## WHAT TO CHANGE IN THE FUTURE

The key hurdles for FLS to be implemented in Korea are the cost of infrastructure setting, personnel recruitment, and database collection. In order to provide FLS, various services should be developed in a multidisciplinary approach, and communication between medical staff who provide these services is of utmost importance. Therefore, FLS

can be more effectively provided when the coordinator plays a mediating role. In addition, the coordinator can play various roles, such as educating patients about the need for osteoporosis screening and treatment, contacting them periodically to monitor whether osteoporosis and comorbidities are well managed, and contributing to the improvement of FLS by collecting medical information.[21] However, the reimbursement system for coordinator employment and office maintenance costs has not been established, so the coordinator-based FLS has not appropriately been established in Korea. In many countries around the world, such as United Kingdom, Australia, Canada, and USA, the cost-effectiveness of FLS has already been proven.[22-25] Such studies have also been reported in Japan, which has a medical system similar to that of Korea.[26] Thus, among the activities of the FLS committee, the priority is to enable the FLS services to be provided in clinical practice supported by the Korean medical insurance system and to identify whether it makes differences in the clinical course of osteoporosis patients and fragility fractures, especially for hip fractures, and collect evidence that these services can improve the clinical outcome of the patients and reduce medical cost.

Early surgery is essential to prevent complications in hip fractures and to lower short-term and long-term mortality rates.[27] However, to perform early surgery for hip fracture, each department should confirm preoperative comorbidities such as taking anticoagulants and preoperative evaluation such as echocardiography or pulmonary function tests because most patients who need hip fracture surgery have multiple comorbidities and risk factors.[12] Although delayed surgery due to this process continues to be a serious problem, Korean medical system has not changed to address these problems. Thus, it is necessary to change the medical system toward faster decision-making and an integrated multidisciplinary approach. For example, the operation of the orthogeriatric liaison inpatient unit is a prospective model system worth introducing in clinical practice. It is a system in which all specialists related to geriatric care take rounds of patients admitted to the unit according to a regular schedule, and the hip fracture nurse collects and communicates the opinions of all specialists and other healthcare professionals and improves care through weekly integrated multidisciplinary meetings.

## CONCLUSIONS

FLS is essential to make osteoporosis and fragility fracture care more effective and efficient. The current position statement will contribute to implementing FLS in Korea and drive policy changes to enable multidisciplinary and integrated FLS to be operated in the medical system.

## DECLARATIONS

### Ethics approval and consent to participate

Not applicable.

### Conflict of interest

No potential conflict of interest relevant to this article was reported.

## ORCID

Jae-Young Lim	<a href="https://orcid.org/0000-0002-9454-0344">https://orcid.org/0000-0002-9454-0344</a>
Young Yul Kim	<a href="https://orcid.org/0000-0003-2383-6444">https://orcid.org/0000-0003-2383-6444</a>
Jin-Woo Kim	<a href="https://orcid.org/0000-0003-0186-5834">https://orcid.org/0000-0003-0186-5834</a>
Seongbin Hong	<a href="https://orcid.org/0000-0002-8189-395X">https://orcid.org/0000-0002-8189-395X</a>
Kyunghoon Min	<a href="https://orcid.org/0000-0003-3357-9795">https://orcid.org/0000-0003-3357-9795</a>
Jaewon Beom	<a href="https://orcid.org/0000-0001-7984-9661">https://orcid.org/0000-0001-7984-9661</a>
Byung-Ho Yoon	<a href="https://orcid.org/0000-0001-8518-6331">https://orcid.org/0000-0001-8518-6331</a>
Sang Yoon Lee	<a href="https://orcid.org/0000-0002-2906-3094">https://orcid.org/0000-0002-2906-3094</a>
Sung Hye Kong	<a href="https://orcid.org/0000-0002-8791-0909">https://orcid.org/0000-0002-8791-0909</a>
Jun-Il Yoo	<a href="https://orcid.org/0000-0002-3575-4123">https://orcid.org/0000-0002-3575-4123</a>
Myung Sook Park	<a href="https://orcid.org/0000-0003-1708-2789">https://orcid.org/0000-0003-1708-2789</a>
Jae-Hwi Nho	<a href="https://orcid.org/0000-0003-1053-456X">https://orcid.org/0000-0003-1053-456X</a>
Sangbong Ko	<a href="https://orcid.org/0000-0003-3527-9251">https://orcid.org/0000-0003-3527-9251</a>
Min Wook Joo	<a href="https://orcid.org/0000-0003-1348-2187">https://orcid.org/0000-0003-1348-2187</a>
Dong Hwan Kim	<a href="https://orcid.org/0000-0002-3812-5509">https://orcid.org/0000-0002-3812-5509</a>
Chan Ho Park	<a href="https://orcid.org/0000-0003-0409-8132">https://orcid.org/0000-0003-0409-8132</a>
Tae-Young Kim	<a href="https://orcid.org/0000-0003-2028-0460">https://orcid.org/0000-0003-2028-0460</a>
Seil Sohn	<a href="https://orcid.org/0000-0001-5724-8099">https://orcid.org/0000-0001-5724-8099</a>
So Young Park	<a href="https://orcid.org/0000-0002-4820-9415">https://orcid.org/0000-0002-4820-9415</a>
A Ram Hong	<a href="https://orcid.org/0000-0002-2494-9902">https://orcid.org/0000-0002-2494-9902</a>
Young Joo Kwon	<a href="https://orcid.org/0000-0002-2066-2138">https://orcid.org/0000-0002-2066-2138</a>
Sung Bae Park	<a href="https://orcid.org/0000-0002-4652-3056">https://orcid.org/0000-0002-4652-3056</a>
Young-Kyun Lee	<a href="https://orcid.org/0000-0001-6564-4294">https://orcid.org/0000-0001-6564-4294</a>
Nam Hoon Moon	<a href="https://orcid.org/0000-0001-9975-0992">https://orcid.org/0000-0001-9975-0992</a>
Bo Ryun Kim	<a href="https://orcid.org/0000-0001-7788-7904">https://orcid.org/0000-0001-7788-7904</a>
Yongsoon Park	<a href="https://orcid.org/0000-0001-5110-5716">https://orcid.org/0000-0001-5110-5716</a>
Yonghan Cha	<a href="https://orcid.org/0000-0002-7616-6694">https://orcid.org/0000-0002-7616-6694</a>

Yong-Chan Ha <https://orcid.org/0000-0002-0069-3797>

## REFERENCES

- Lee HJ, Chou LS. Balance control during stair negotiation in older adults. *J Biomech* 2007;40:2530-6. <https://doi.org/10.1016/j.jbiomech.2006.11.001>.
- Organisation for Economic Co-operation and Development. Health at a glance 2011. OECD indicators. Vol. 15. 2011 [cited by 2015 Feb 1]. Available from: [https://doi.org/10.1787/health\\_glance-2015-en](https://doi.org/10.1787/health_glance-2015-en)
- Park EC. The first comprehensive plan of national health insurance. *Health Policy Manag* 2019;29:99-104.
- Yoo JH, Moon SH, Ha YC, et al. Osteoporotic fracture: 2015 Position statement of the Korean Society for Bone and Mineral Research. *J Bone Metab* 2015;22:175-81. <https://doi.org/10.11005/jbm.2015.22.4.175>.
- Jacob L, Breuer J, Kostev K. Prevalence of chronic diseases among older patients in German general practices. *Ger Med Sci* 2016;14:Doc03. <https://doi.org/10.3205/000230>.
- Ahn SH, Park SM, Park SY, et al. Osteoporosis and osteoporotic fracture fact sheet in Korea. *J Bone Metab* 2020;27:281-90. <https://doi.org/10.11005/jbm.2020.27.4.281>.
- Cha YH, Ha YC, Park HJ, et al. Relationship of chronic obstructive pulmonary disease severity with early and late mortality in elderly patients with hip fracture. *Injury* 2019;50:1529-33. <https://doi.org/10.1016/j.injury.2019.05.021>.
- Yonekura H, Ide K, Onishi Y, et al. Preoperative echocardiography for patients with hip fractures undergoing surgery: A retrospective cohort study using a nationwide database. *Anesth Analg* 2019;128:213-20. <https://doi.org/10.1213/ane.0000000000003888>.
- Omari A, Madsen CM, Lauritzen JB, et al. Comorbidity and mortality after hip fracture in nineteen thousand six hundred and eighty two patients aged eighteen to sixty five years in Denmark from 1996 to 2012. *Int Orthop* 2019;43:2621-7. <https://doi.org/10.1007/s00264-019-04323-z>.
- Curtis EM, Moon RJ, Harvey NC, et al. The impact of fragility fracture and approaches to osteoporosis risk assessment worldwide. *Bone* 2017;104:29-38. <https://doi.org/10.1016/j.bone.2017.01.024>.
- Johnell O, Kanis JA, Odén A, et al. Fracture risk following an osteoporotic fracture. *Osteoporos Int* 2004;15:175-9. <https://doi.org/10.1007/s00198-003-1514-0>.
- Cha YH, Ha YC, Yoo JI, et al. Effect of causes of surgical de-

- lay on early and late mortality in patients with proximal hip fracture. *Arch Orthop Trauma Surg* 2017;137:625-30. <https://doi.org/10.1007/s00402-017-2674-2>.
13. Ganda K. Fracture liaison services: past, present and future : Editorial relating to: The impact of Fracture Liaison Services on subsequent fractures and mortality: a systematic literature review and meta-analysis. *Osteoporos Int* 2021; 32:1461-4. <https://doi.org/10.1007/s00198-021-05982-8>.
  14. Barton DW, Piple AS, Smith CT, et al. The clinical impact of fracture liaison services: A systematic review. *Geriatr Orthop Surg Rehabil* 2021;12:2151459320979978. <https://doi.org/10.1177/2151459320979978>.
  15. Cha YH, Ha YC, Lim JY, et al. Introduction of the cost-effectiveness studies of fracture liaison service in other countries. *J Bone Metab* 2020;27:79-83. <https://doi.org/10.11005/jbm.2020.27.2.79>.
  16. Nayak S, Singer A, Greenspan SL. Cost-effectiveness of secondary fracture prevention intervention for Medicare beneficiaries. *J Am Geriatr Soc* 2021;69:3435-44. <https://doi.org/10.1111/jgs.17381>.
  17. Cha YH, Ha YC, Lim JY. Establishment of fracture liaison service in Korea: Where is it stand and where is it going? *J Bone Metab* 2019;26:207-11. <https://doi.org/10.11005/jbm.2019.26.4.207>.
  18. Ok HS, Kim WS, Ha YC, et al. Alarm services as a useful tool for diagnosis and management of osteoporosis in patients with hip fractures: A prospective observational multicenter study. *J Bone Metab* 2020;27:65-70. <https://doi.org/10.11005/jbm.2020.27.1.65>.
  19. Lim SK, Lee SY, Beom J, et al. Comparative outcomes of inpatient fragility fracture intensive rehabilitation management (FIRM) after hip fracture in sarcopenic and non-sarcopenic patients: a prospective observational study. *Eur Geriatr Med* 2018;9:641-50. <https://doi.org/10.1007/s41999-018-0089-4>.
  20. Lee SY, Beom J, Kim BR, et al. Comparative effectiveness of fragility fracture integrated rehabilitation management for elderly individuals after hip fracture surgery: A study protocol for a multicenter randomized controlled trial. *Medicine (Baltimore)* 2018;97:e10763. <https://doi.org/10.1097/md.00000000000010763>.
  21. Cha YH, Ha YC, Park KS, et al. What is the role of coordinators in the secondary fracture prevention program? *J Bone Metab* 2020;27:187-99. <https://doi.org/10.11005/jbm.2020.27.3.187>.
  22. McLellan AR, Wolowacz SE, Zimovetz EA, et al. Fracture liaison services for the evaluation and management of patients with osteoporotic fracture: a cost-effectiveness evaluation based on data collected over 8 years of service provision. *Osteoporos Int* 2011;22:2083-98. <https://doi.org/10.1007/s00198-011-1534-0>.
  23. Major G, Ling R, Searles A, et al. The costs of confronting osteoporosis: Cost study of an Australian fracture liaison service. *JBMR Plus* 2019;3:56-63. <https://doi.org/10.1002/jbm4.10046>.
  24. Yong JH, Masucci L, Hoch JS, et al. Cost-effectiveness of a fracture liaison service—a real-world evaluation after 6 years of service provision. *Osteoporos Int* 2016;27:231-40. <https://doi.org/10.1007/s00198-015-3280-1>.
  25. Solomon DH, Patrick AR, Schousboe J, et al. The potential economic benefits of improved postfracture care: a cost-effectiveness analysis of a fracture liaison service in the US health-care system. *J Bone Miner Res* 2014;29:1667-74. <https://doi.org/10.1002/jbmr.2180>.
  26. Moriwaki K, Noto S. Economic evaluation of osteoporosis liaison service for secondary fracture prevention in postmenopausal osteoporosis patients with previous hip fracture in Japan. *Osteoporos Int* 2017;28:621-32. <https://doi.org/10.1007/s00198-016-3777-2>.
  27. Simunovic N, Devereaux PJ, Sprague S, et al. Effect of early surgery after hip fracture on mortality and complications: systematic review and meta-analysis. *CMAJ* 2010;182:1609-16. <https://doi.org/10.1503/cmaj.092220>.