

Introduction of the Cost-Effectiveness Studies of Fracture Liaison Service in Other Countries

Yong Han Cha¹, Yong-Chan Ha², Jae-Young Lim³, Woo-Suk Kim¹

¹Department of Orthopaedic Surgery, Eulji University Hospital, Daejeon;

²Department of Orthopaedic Surgery, Chung-Ang University Hospital, Chung-Ang University College of Medicine, Seoul;

³Department of Rehabilitation, Seoul National University Bundang Hospital, Seongnam, Korea

Corresponding author

Yong-Chan Ha

Department of Orthopaedic Surgery, Chung-Ang University College of Medicine,
102 Heukseok-ro, Dongjak-gu, Seoul 06973,
Korea

Tel: +82-2-6299-1577

Fax: +82-2-822-1710

E-mail: hayongch@naver.com

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Osteoporosis and osteoporosis related fractures contribute a large part of the medical cost in developed countries. Considering the preventive effect of osteoporotic medications, high rate of mortality and complications, poor quality of life after osteoporosis related fractures, the growing trend of older populations in the future, osteoporosis and osteoporosis related fractures are important targets of preventive treatment and also targets of socioeconomic cost reduction. Treating osteoporosis and preventing osteoporosis related fractures have become an essential element in Korean medical system. Despite the various differences in the health care system, hospitals in many other countries are operating fracture liaison service and they have confirmed its cost-effectiveness. In Korea's health care system, further research on cost-effectiveness as well as its clinical effects is needed.

Key Words: Hip fractures · Osteoporotic fractures · Secondary prevention

KOREAN AGING AND ECONOMIC BURDEN

According to the 2019 Organization for Economic Co-operation and Development (OECD) health statistics, the life expectancy of Korean-born children in 2017 is reported to be 82.7 years old, which is the same as Norway and which is close to 84.2 years old in Japan.[1] One report on future life expectancy in 35 industrialized countries predicts that life expectancy will be the highest in the world for both men and women born in 2030.[2] In 2017, life expectancy was over 20 years at age 65 and the world's highest rise rate of the elderly population 65 years or older is observed in Korea.[2] However, 81.5% of these ages assess their health status as poor or fair, which is very high compared to an average of 56.8% in 35 OECD countries. This change is also observed in medical facilities with an increase in the elderly population. Number of long-term care beds in facilities and hospitals were 60.9 per 1,000 population aged 65 and over.[2] This is an increase of 36.1 compared to 2007, which is the highest increase compared to the average -3.4 in 24 OECD countries over the same period. In addition, Korea's medical expenditure trend is also the highest in the world. Annual growth in health expenditure per capita was 5.4% in 2008 to 2013 and 7.3% in 2013 to 2018.[2] According to the

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National Health Insurance Comprehensive Plan of the Ministry of Health and Welfare, medical expenditure was expected to be 62.29 trillion won in 2018, and it is expected to increase significantly to 94.32 trillion won in 2023.[3] However, despite the rising medical expenses, the government's medical expenditure on long-term care is only 0.6% of growth domestic product, which is less than half of the OECD average of 1.7%.[2]

SOCIOECONOMIC BURDEN OF OSTEOPOROSIS & OSTEOPOROTIC FRACTURE

The debate on how to reduce the cost of health care due to the increasing aging population has emerged as an important social issue in socioeconomic aspects as well as in health care systems. Among senile diseases, osteoporosis and osteoporosis related fractures contribute a large part of the medical cost in developed countries.[4-6] Considering the preventive effect of osteoporotic medications, high rate of mortality and complications, poor quality of life after osteoporosis related fractures (especially in hip fractures), the growing trend of older populations in the future, osteoporosis and osteoporosis related fractures are important targets of preventive treatment and also targets of socioeconomic cost reduction.[7] Cost of Medicare programs in the US are reported to increase by 50% by 2020 compared to 2012, and most of these are expected to be caused by ages 65 and older.[8] In the US, the total cost of fracture care with osteoporosis in 2005 is estimated to be \$17 billion and increase to \$25 billion by 2025.[8,9] In the analysis of the health care costs of osteoporotic fractures over 50 years old using the Korea national claim database from 2008 to 2011, Kim et al. [10] reported that total estimated healthcare costs of osteoporotic fractures was \$722 million in 2011, and this is an increase of 31.6% compared with 2008. During this period, the number of osteoporotic fractures increased by 28.9% and the mean healthcare cost was highest for hip fractures (\$8,302 in 2011). In 2016, the number of hip fractures was 35,729 and it is expected to increase by 1.4 times to 51,259 by 2025.[6] In Australia, direct or indirect medical expenditures for osteoporosis and osteopenia over the age of 50 are estimated at 2.75 billion Australian dollars (AUD) in 2012 and 3.84 billion AUD in 2022.[11] A study examining the economic burden of care-

givers in hip fracture patients reported that 20% of caregivers felt a high economic burden and even increased depression scores at 6 months after hip fracture.[12] Therefore, many countries are working to reduce medical costs for osteoporosis and osteoporosis related fracture, one of which is fracture liaison service (FLS).

INTRODUCTION OF COST-EFFECTIVENESS OF FLS

There are various reports of FLS for the prevention of osteoporotic secondary fractures.[13] These studies implemented various types of FLS services and reported good results in increased rates of osteoporosis medication and bone mineral density (BMD) testing, high fracture prevention rate.[7] Nevertheless, the overall implementation of all hospitals in countries where FLS is implemented is not possible because the costs associated with FLS settings are a barrier.[14] Therefore, this review introduces reports on cost-effectiveness among FLS reports of other countries.

1. Glasgow FLS in United Kingdom

West Glasgow FLS, established in 1999, covers all men and women who have had low-trauma fractures over 50 years old.[15] Patient identification is performed by an osteoporosis nurse specialist, assessment of osteoporosis and fracture risk is performed in the osteoporosis nurse specialist fracture risk-assessment clinic. The patient is then sent to the general practitioner (GP) and medication is started. A cost-effectiveness study of FLS reported by McLellan et al. [14] compared the FLS pathway with the usual pathway. The FLS pathway has 2 pathways depending on the assessment of osteoporosis and is further subdivided according to the use of osteoporosis medication and performing of dual energy X-ray absorptiometry (DXA). The usual pathway has 3 pathways: assessment by GP, hospital assessment, and no assessment and is further subdivided according to the use of osteoporosis medication and performing of DXA. Analysis of the database revealed that 74% of patients in West Glasgow FLS and 15% to 38% of patients in usual care needed treatment and they designed a Markov model using this ratio. New vertebral fractures were excluded due to their low cost and severity, and included only hip, wrist and humerus fractures. Evaluation contents for this study were number of refrac-

tures, life-years, and quality adjusted life-years (QALYs; a unit of measurement of both the quality and quantity of life lived).

When 1,000 hypothetical cohorts were applied to the Markov model, the number of patients receiving medication was 686 in the FLS pathway and 193 in the usual care pathway. Compared with the manual care pathway, the FLS pathway was able to prevent 18 fractures, resulting in a cost savings of £312,000. In addition, FLS pathway gained 3 life-years, 22 QALYs, and saved 266 hospital bed days. The cost of assessments was £98,000 and £14,000 for the FLS and usual care, respectively; the cost of medications was £292,000 and £85,000, respectively. Overall, the FLS saved an estimated £21,000 over the lifetimes of 1,000 patients.

2. FLS of John Hunter Hospital in Australia

Most cost-effective analysis studies of FLS have analyzed its economic effects by calculating the current level of medical use or cost, and creating a model for predicting medical costs. However, Major et al. [16] analyzes the economic impact of FLS, including the past actual direct medical costs charged to patients in the FLS group and patients in the usual care group and all costs used to run the FLS office in the hospital where the FLS was implemented. This study was conducted on patients over 50 years of age who visited the emergency department with minimal trauma fracture from July to December 2010. The medical cost and refracture fractures were checked for 3 years. There were 515 FLS groups and 416 usual care groups. The mean age was 77 and 79 years, respectively. The medical costs of the FLS group included the wages of nursing staff, the paper, postage and telephone costs involved in operating the FLS, and the cost of medication and osteoporosis evaluation and the cost of re-fracture treatment.

FLS could reduce the risk of actual fractures by 29% and prevent 62 refractures per 1,000 patients. The cost of implementing FLS for 1000 patients over 3 years was \$2,804,378, including \$343,753 for the FLS operation and \$2,460,624 for the treatment of 150 refractures. In contrast, in the usual care group, only \$3,421,653 of treatment costs for 212 refractures were used and there was no cost for fracture prevention. In conclusion, FLS saved \$617,275 per 1,000 patients over a 3-year period.

3. Fracture clinic screening (FCS) program in Canada

In 2007, the FCS program was introduced at 31 outpatient fracture clinics in Ontario, Canada.[17] The FLS covers patients over 50 years of age who have experienced fragility fractures and enrolled 37,920 patients in the program from 2008 to 2013. The study analyzed not only the FCS program but also the cost effectiveness of the BMD Fast Track program, the screening coordinators ordered a DXA test for patients rather than referring them to their primary care physicians. Refractures were limited to hip fractures and analyzed using the Markov model.

The FCS program prevented 3 hip fractures per 1,000 patients and the program improved QALYs by 4.3 years and led to increased costs of 83,000 Canadian dollar for every 1,000 patients screened, at a cost of \$19,132 per QALY gained. The Fast Track program could save an additional \$5,720 per QALY.

4. Cost-effectiveness analysis of FLS in US health-care system

Post-fracture treatment rates in the US Medicare population are reported to be below 25%.[8] This is due to the complex health care settings and fragmented nature of post-fracture care. Despite the development of the health care system, FLS has not been widely implemented in the US in 2014. Solomon et al. [8] developed a Markov state-transition computer simulation model to assess the cost-effectiveness of an FLS in US health care system. They estimated the costs and benefits of an FLS, the probabilities of refracture while on osteoporosis treatment, as well as the utilities associated with various health states from published literature.

If 10,000 patients who had a hip fracture with an average life span of 8.6 years underwent usual care, the model projected 5,579 subsequent fractures: 1,958 hip fractures, 453 distal forearm fractures, 998 vertebral fractures, and 2,170 other fractures. However, if universal FLS applies to them, this model estimates that an FLS would result in 153 fractures (109 hip, 5 wrist, 21 spine, 17 other fractures), 37.43 more QALYs, and save \$ 66,879 compared with typical post-fracture care per every 10,000 post-fracture patients.

5. Cost-effectiveness of osteoporosis liaison service in Japan

In Japan, the life expectancy at births in 2017 was 84.2 years, the highest in the world. And, the age-standardized all-cause mortality rates per 100,000 in 2017 were 567, the lowest in the OECD.[1] A nationwide survey of hip fractures in Japan reported that the total number of hip fractures in 2012 was 175,700, which is a significant increase compared to 116,800 in 2007.[18,19] The annual costs for osteoporotic fractures is estimated to be US \$7,974 to 9,895 billion, which is expected to increase in the future.[20] Moriwaki and Noto [21] conducted a patient-level state transition model-based cost-effectiveness analysis of 65-year-old women who experienced femoral neck fracture below BMD -2.5. In this study, secondary fracture prevention resulted in an additional lifetime cost of \$3,396 per person and conferred an additional 0.118 QALY, resulting in an incremental cost-effectiveness ratio of \$28,880 per QALY gained. According to the results of scenario analyses, Secondary fracture prevention by osteoporosis liaison service is cost-effective in Japanese women with osteoporotic hip fracture.

CONCLUSIONS

Osteoporosis and osteoporosis related fractures are major health concern not only in Korea but also in other developed countries. Mortality and comorbidity, as well as the medical cost of osteoporosis and osteoporosis related fractures, have a significant impact on the quality of life of patients and are socioeconomic burdens. Therefore, treating osteoporosis and preventing osteoporosis related fractures have become an essential element in Korean medical system. Despite the various differences in the health care system, hospitals in many other countries are operating FLS and they have confirmed its cost-effectiveness. In Korea's health care system, further research on cost-effectiveness as well as its clinical effects is needed.

DECLARATIONS

Ethics approval and consent to participate

Not applicable.

Conflict of interest

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

ORCID

Yong Han Cha <https://orcid.org/0000-0002-7616-6694>
 Yong-Chan Ha <https://orcid.org/0000-0002-6249-0581>
 Jae-Young Lim <https://orcid.org/0000-0002-9454-0344>
 Woo-Suk Kim <https://orcid.org/0000-0001-6098-0117>

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