

ORIGINAL ARTICLE

Factors of risk in an elderly population: Evaluation scales for the prevention of hip fractures

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KEYWORDS

Scale FRAX;
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Risk factors;
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Abstract

Objective: Describe and quantify risk factors (RF) present in a population hospitalised for hip fracture (HF), apply evaluation scales in patients susceptible to HF and conclude recommendations to prevent them.

Methods: Descriptive cross-sectional study in 87 patients over 64 yrs old admitted for HF. RF were quantified and evaluated in this population. A pharmaceutical-medical education was given at admission and a full reviewed at discharge. The 87 patients studied (77.0% female) had mean age of 83 yrs. 81.6% suffered falls; 42.5% had previous fractures since the age of 50 yrs. All HF were for falls from standing

Variables: age, sex, RF, HF cause, genetic history, hospital mortality, among others. The index Black was applied to all patients and the scale FRAX to 75 patients.

Results: The 42.5% of the patients reported genetic background. 98.9% consumed milk products. The 48.3% presented osteoarticular diseases and only 8.0% received treatment. The 75% waited at least 5 days to undergo surgery. Hospital mortality was 12.6%. According to index Black, 85.1% had a high risk of a new HF. According to SF, 12% were likely to suffer a new HF in the following 10 yrs.

Conclusions: Most patients showed a high number of RF for HF prior hospitalisation that was not detected in time. Index Black and Scale Frax are useful tools to detect patients susceptible to HF. Preventive education, particularly focussed on RF, would decrease HF.
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PALABRAS CLAVE

Escala FRAX;
Escala Black;
Factores de riesgo;
Fractura de cadera;
Prevención

Factores de riesgo en una población anciana: escalas de valoración para la prevención de fracturas de cadera

Resumen

Objetivos: Describir y cuantificar factores de riesgo (FR) en una población hospitalizada por fractura de cadera (FC), utilizar escalas de valoración en pacientes susceptibles de tenerla y establecer las recomendaciones para su prevención.

Metodología: Estudio descriptivo transversal en 87 pacientes mayores de 64 años, con una edad media de 83 años, ingresados por FC. El 77% fueron mujeres. Se cuantificó y se evaluó los FR en esta población. El 81,6% tuvo caídas y el 42,5% fracturas después de los 50 años. Todas las FC fueron por caídas desde bipedestación.

Se realizó una charla educacional farmacéutico-médica al ingreso y un repaso completo al alta hospitalaria. Las variables analizadas fueron edad, sexo, FR, motivo de la FC, antecedentes genéticos y mortalidad intrahospitalaria, entre otras. En todos los pacientes se aplicó la escala Black y en 75 la escala FRAX® (*fracture risk assessment tool*).

Resultados: El 42,5% señaló antecedentes hereditarios. El 98,9% consumía productos lácteos. El 48,3% presentó efeciones osteoarticulares aunque sólo el 8% recibía tratamiento. El 75% esperó al menos 5 días para su intervención. El 12,6% falleció durante la hospitalización. Según la escala de Black, el 85,1% presentó alto riesgo de tener una nueva FC y, según la escala FRAX, el 12% tiene probabilidad de que esto ocurra en los siguientes 10 años.

Conclusión: La mayoría de los pacientes mostraron un alto número de FR de FC previo al ingreso hospitalario que no se detectaron a tiempo. Las escalas de Black y FRAX son herramientas útiles para valorar pacientes susceptibles de tener una FC. Una educación preventiva centrada en los FR disminuiría las FC.

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Introduction

Hip fracture (HF) is one of the most important consequences of osteoporosis in terms of morbidity, mortality and cost.¹

Several prospective studies have shown a close relation between risk factors (RF) and the observation of HF, showing increased rates of HF as the number of RF increase.² The main RF for FC are³ old age, female gender, low bone mineral density (BMD), low body mass index, previous fractures after 50 years of age (hip, vertebrae, wrist), diseases (osteoporosis, rheumatoid arthritis, osteoarthritis), low intake of calcium and vitamin D, use of tobacco, alcohol and caffeine, low physical activity, Caucasian origin, drugs (benzodiazepines, proton-pump inhibitors among others), family history of HF, history of falls, slow walking pace, reduced visual acuity and small calf diameter.

The Black scale⁴ and the FRAX scale (*fracture risk assessment tool*) have been developed to predict the risk of HF in patients, the latter scale having been proposed by the WHO. The Black scale predicts the risk of HF for the 5 years subsequent to its application and has been validated in the EPIDOS study group.⁴ The FRAX tool is based on individual models that combine and integrate clinical risk factors with the femoral neck BMD. These models have been developed from the study of population groups in Europe, North America, Asia and Australia. The FRAX scale algorithms calculate the greatest probability of fracture for the following 10 years, whether it be hip related or other osteoporotic fractures (vertebral, forearm or shoulder fractures).⁵

Various studies have shown that health education is of great interest, not only when directed towards this group of patients, but also for professional specialists in this field, among whom there is a need for more knowledge about this subject.⁶

Currently, a significant increase has been detected in the incidence of these injuries due to the increased longevity of the population, especially women. The incidence of HF varies by geographic region. In Spain, the risk of suffering a HF after the age of 50 is 12%, a figure that is within the European average. However, this percentage increases as age increases.⁷ The overall incidence of HF in Spain in the elderly over 64 years is 517 cases per 100,000 inhabitants per year and particularly in the Community of Andalusia where the incidence is higher than the Spanish average (531 HF per 100,000 inhabitants per year).⁸

Due to this fact, we decided to describe and quantify RF present in the population hospitalised for HF and use rating scales in patients likely to have this fracture, as well as finalise recommendations to the health care team and patients/caregivers of HF, recommendations disseminated through printed materials and medical/pharmaceutical educational talks.

Materials and methods

We conducted a cross-sectional study in a tertiary hospital in Granada for four months, from February to May of 2008. We selected all patients over 64 years of age admitted for

HF, competent to take the medication, who were being cared for by a third party and who agreed to enter the study by signing an informed consent form. We excluded patients whose HF were due to high energy trauma, such as car accidents, or who could not respond to the study. The Hospital Ethics Committee approved this project.

Information source

The RF data was collected through personal interviews with the patient or caregiver on the day of admission to the unit and through information from the clinical centre's database software. At the same time, data from medical sessions was extracted for information about new admissions.

Procedure

Initially the protocol was presented during the department's clinical session to the doctors, who demonstrated a need to know relevant information related to this surgical condition. The pharmacist reviewed the number of patients admitted with diagnosed HF in the computer system on a daily basis. Subsequently, the pharmacist participated in the clinical sessions to gain greater information about the study population. Once the patients had been identified in their respective beds, the pharmacist explained the purpose of study to them. The patients who agreed to the study signed the informed consent. An initial interview was then immediately carried out for each patient with questions relating to RF and then, through an educational brochure, the educational and preventive measures related to HF were explained. Once the interview and the educational talk had finished, the medical records for each patient were reviewed to obtain information that the patients had not disclosed and that were considered relevant to the study. Subsequently, RF were quantified for each patient and the Black and FRAX scales were applied separately. The variables outlined in table 1 were used for the Black scale. There are 2 ways of calculating the Black scale: with or without BMD. If the sum of the points obtained from the variables without BMD is ≥ 4 or the same sum with BMD is ≥ 6 , the patient is included in the "high risk patient" for HF category. For the FRAX scale, the variables considered were age (between 40-90 years), sex, weight (kg), height (cm), prior fracture, parents with HF, active smoker, glucocorticoids, rheumatoid arthritis, secondary osteoporosis, alcohol consumption (3 or more units per day) and BMD result. In considering whether the patient had the variable "secondary osteoporosis", this was defined as that caused by diseases or medications as opposed to bone loss attributed to the post menopause stage or aging. The final result determined the likelihood of having a HF in the next 10 years. As with the previous scale, the BMD may or may not be considered (www.shef.ac.uk/FRAX/chart_SP.htm).

At the time of hospital discharge, both the patient and the caregiver were provided with a complete review of the information, emphasising the prevention of a new HF. To this end, they were given the earlier mentioned brochure and were urged to strictly follow the recommendations. Furthermore, they were asked, with the doctor present, (medical/pharmaceutical intervention) to visit the family doctor for an evaluation of their general state and daily

Table 1 Black scale for assessing the risk of hip fractures

Risk factors	Points
Current age	
<i>Less than 65 years</i>	0
65-69	1
70-74	2
75-79	3
80-84	4
<i>Older than 85</i>	5
Fractures after the age of 50	
Yes	1
No	0
Mother with HF after the age of 50	
Yes	1
No	0
Current smoker	
Yes	1
No	0
Needs to use their arms to rise from a chair	
Yes	1
No	0
Total hip BMD results (T-score)	
<i>T-score > 1</i>	0
<i>T-score between -1 and -2</i>	2
<i>T-score between -2 and -2.5</i>	3
<i>T-score < -2.5</i>	4
The cutoff point is 4 points (if a bone mineral density value is not available) or 6 (if bone mineral density is available). BMD: bone mineral density; HF: hip fracture.	

treatment, as well as to consider the incorporation of anti-osteoporotic treatment if needed. This request was also recorded in the discharge report for each patient. This visit should also serve to verify compliance with the recommendations provided.

In addition, other variables measured as reasons for HF were number of densitometries performed to date, person(s) with whom the patient lives, orthopaedic means for walking, intrahospital mortality, drug treatment used for bone mineral status (antiresorptive, calcium and vitamin D, among others).

Statistical analysis

Through the use of the SPSS 15.0 Statistics programme for Windows, a descriptive analysis of the patient sample was performed, means and standard deviations or medians and percentiles for the numerical variables were calculated, whether they followed a normal distribution or not, respectively. Frequencies and percentages were calculated for the qualitative variables.

Results

During the study period, a total of 87 patients were included who met the inclusion criteria with a mean age (both for women and men) of 83 years. The characteristics and RF present in the study population are summarised in table 2. According to the Black scale, 85.1% were at high risk of

Table 2 Summary of the quantitative description of the risk factors found in the population

Risk factors	Results
Age (years)	
Mean \pm SD:	83.1 \pm 7
64-75	13.8%
76-85	42.5%
Older than 85	43.7%
BMI	
Low (<18.50)	4.6%
Normal (18.50-24.99)	49.5%
Overweight (\geq 25.00)	28.7%
Obese (\geq 30.00)	17.2%
Current lifestyle	
Alcohol (\geq 1 glass/day)	3.4%
Tobacco	1.1%
Caffeine (\geq 1 cup/day)	5.7%
Exercises	24.1%
Prior falls	81.6%
Number of falls	2 (1.4) ^a
Previous fractures after age 50 ^b	42.5%
Direct family history of HF	40.0%
Vision problems ^c	95.4%
Calcium intake	
From milk products	98.9%
Milk (\geq 1 glass/day)	86.2%
Yogurt (\geq 125 g/day)	79.3%
Cheese (\geq 50 g/day)	74.7%
Bone diseases	48.3%
Osteoporosis	34.5%
Osteoarthritis	21.8%
Arthritis	14.9%
Regularly consumed drugs	
Benzodiazepines	51.7%
PPI (omeprazole)	47.5%
Corticoids	4.6%
Anticonvulsants	2.2%

SD: standard deviation; HF: hip fracture; PPI: proton-pump inhibitor; BMI: body mass index.

^aPercentile: P₅₀ [P₂₅, P₇₅].

^bThree patients had previous hip fractures. All female.

^cCataracts, untreated cataracts, partial or total blindness.

having a HF. According to the FRAX scale, the probability of a new HF in the next 10 years was 12% with a maximum of 40%. All of the HF were caused by falls (slipping, tripping, dizziness) from the standing position. A total of 95.4% of the fractures occurred at home or in a retirement community, while the rest occurred on the street. Forty-six percent of the group lived alone and 11% lived in a retirement home, while the rest lived with family or caregivers. Seventy-seven percent of the patients (53% of women and 14% of men) required assistance for everyday tasks (showering, dressing, eating, etc.). Some 58.7% of the patients used an orthopaedic device for walking (cane or walker). None of the patients had had a densitometric examination until that time. Almost half of the group had a diagnosed bone disease and only 8% took medications for bone mineral treatment (one patient took the active ingredient Alendronato®, 2 patients took Risedronato-Actonel®, one patient took Raloxifeno-Evista®, one patient took Teriparatida-Forsteo®, and 2 patients took Calcio-Calcium Sandoz Forte®). The average hospital stay for the patients was 15 days (SD: 12), with a wait for surgery expressed in percentiles of 3 days (1.3, 5). Death occurring during the hospital stay was 10.4% for women (7/67) and 20% for men (4/20), which represented 12.6% overall.

Discussion

According to the FRAX scale, approximately one in every 10 of our patients will have a new HF in the next 10 years. It is probable that due to their advanced age some will not have it. For this reason, the application of this scale requires them not to pass a certain maximum age and to be slightly suspicious about the susceptibility of a fracture. Due to the first requirement, 12 patients were not considered, which constitutes a limitation of the study. For the Black scale, the entire study group was considered and a high percentage of patients at high risk for HF was found. Since the patients' BMD was not available, the sum of the variables should be \geq 4 points (table 1).

Based on the identified RF, being female (77%) was the predominant RF, which is consistent with studies that show that women comprise between 75-80% of the population that have HF.⁹ In Andalusia this figure is precisely 77.8%.⁸ There were no significant differences between the average age of men and women, with values similar to other studies. Furthermore, the average overall age (83 years) of the study group is consistent with those of studies carried out in Spain (78 to 82 years).^{10,11}

All of the HF in the study group were products of falls, which are also the principal RF described in the medical literature.¹² This may be related to the fact that about half of the group consumed drugs that trigger falls, such as benzodiazepines.¹³ Indeed, other studies show that the overall risk of falls was lower for the group who had their psychotropic medication withdrawn.¹⁴ As a consequence, a recommendation was added to the discharge papers for the family doctor to carry out a schedule for withdrawal or adjustment of psychotropic medication. At the same time, it has been shown that the consumption of proton pump inhibitors such as omeprazole, taken regularly at high doses and over a long period of time, has an associated higher risk

of HF due to the reduction in calcium absorption.¹⁵ In our study nearly half of the group took this medication.

Various studies show that 90% of the HF seen in hospitals are attributable to osteoporosis (osteoporotic fractures) and not to the trauma itself.¹⁶ In our patients, all of them presented this characteristic since the falls were from a standing position and the impact, in the majority of cases, was not sufficient for fracturing a normal bone. Historically, about 4 out of 10 of our patients had prior bone fractures after the age of 50 (wrists, arms, vertebrae).

A study carried out in Spain reported that elderly patients who lived alone were more prone to falls and HF in their homes.¹⁷ The results of our study confirmed this result, however the number of patients that lived alone was three times that of the earlier study, which indicates a greater susceptibility to falls in our group.

A considerable percentage of the population showed characteristic signs and symptoms of osteoarticular diseases that were not mentioned in the medical records. It should be noted that densitometry is an accepted test for evaluating BMD,¹⁸ however, for unknown reasons, none of the patients in the study group had been given this examination.

Similarly, only a small percentage of the patients were undergoing antiosteoporotic drug treatment, which shows little attention to the treatment of osteoporosis or perhaps a lack of knowledge about education and treatment of this disease and its consequences: HF. This situation can also be found in other countries.¹⁹ In our study especially, all the orthopaedic surgeons stated that they were aware of the importance of drug treatment for osteoporosis. However, they were unaware of the existence of the hospital's protocols for dealing with this disease. Furthermore, they indicated that in order to make a proper diagnosis and decide on a drug treatment, a proper examination must be performed, which carries with it an increase in hospital stays and the consequences that such an extension implies. However, there is a willingness to change this situation. For this reason, medical/pharmaceutical educational talks with the patients/caregivers were carried out during the study period as part of the preventive intervention, emphasizing healthy living habits that prevent the RF. Furthermore, during discharge from the hospital, the orthopaedist advised the family doctor, "I recommend that you add anti-osteoporotic therapy due to the presence of RF for osteoporotic fractures". The effectiveness of education in the prevention of HF by means of printed material (information brochures) and medical/pharmaceutical talks will be evaluated systematically over time, and the results will be reported in a forthcoming publication.

In the prestigious clinical guidelines there is much evidence that patients undergoing treatment with drugs such as Alendronato[®] are at reduced risk for HF due to fragility and increase BMD in the femur,^{20,21} as well as the fact that an association of vitamin D (700-800 UI) with calcium (1-1.2g) reduces the incidence of HF.^{22,23}

Additionally, the consumption of products with high levels of calcium by the group was acceptable and was common among older people. The consumption of foods rich in calcium provides benefits to normal bone development. On the other hand, it has been shown that a high intake of animal protein has a negative effect on bone metabolism by increasing acid

levels in the body.²⁴ Research performed on postmenopausal Chinese women found that the BMD of the hip area in vegetarian women was less than in omnivorous women, but similar to those of lacto-vegetarians.²⁵ Other studies have concluded that apparently high intakes of animal protein in the diet do not have an effect on the loss of bone mass.^{26,27}

Some 42.5% of our patients acknowledged having direct family history of HF, which agrees with the assertion that HF have a genetic component.^{28,29} These results highlight the need for further research on the genetic characteristics of this disease.

Another RF present in the group was a low level of physical activity (30 minute walks at best). Studies on pre- and postmenopausal women indicate that the combination of aerobic and impact exercises increases BMD. Therefore, it is recommended that this practice be adopted from an early age.³⁰

The early resolution of vision problems significantly reduces the number of falls.¹⁴ Almost all of the study group had vision problems (untreated cataracts, partial or total blindness).

The overall in-hospital mortality of the study group (12.6%) was greater than that reported for Spain (5-6%).¹⁷ This greater mortality may be due to the fact that the patients in question had various diseases, numerous medications and were of an advanced age. This was compounded by the delays in surgical interventions, which in our study were at least 5 days for 75% of the group. According to existing protocols, these delays should not exceed 24 hours post-fracture.³¹ Our patients' hospital stay was similar to or lower than the average for Spain (16 days) and equal to the overall stay for Andalusia (15 days). This stay could be reduced by speeding up surgeries whenever possible.

Our results were consistent with a previous study³² in which the proportion of deaths during hospitalisation was greater in men than in women. This previous study found that age, male sex, dementia, poor functional status prior to the HF and having the HF during winter were indicators of a poor prognosis.

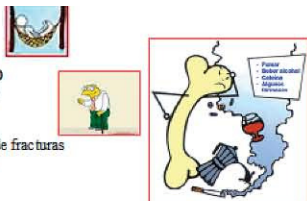
In considering the important consequences of this surgical condition, during the hospital stay we undertook a preventive education program directed both at patients/caregivers and the nursing group with the objective of teaching them practical measures to avoid fractures and for treating them during hospitalisation.

In this study we noted a deficiency in the determination of RF, a lack of BMD studies and inadequate drug therapy for the prevention of bone fragility. In view of this, we believe it necessary to provide various useful recommendations for these actions such as educational talks, the creation of the previously mentioned brochure and teamwork with the medical staff.

In summary, almost all of the patients studied were candidates for having HF prior to admission to the hospital, which indicates a need for providing health education focused on patients at risk for HF and on those that already have had one. Apparently no preventive measures had been established despite the considerable RF present. In addition, our results show that the Black and FRAX scales are appropriate tools for the detection of patients at risk for having HF and, therefore, are of use to the medical team

Appendix 1. Educational brochure on healthy lifestyles and prevention of hip fractures.

- Osteoporosis
- Edad
- Raza blanca
- Densidad masa ósea baja (DMO)
- Ingesta baja de Calcio y Vitamina D
- Índice de masa corporal baja (IMC)
- Tabaco, alcohol, cafeína.
- Baja actividad física.
- Historia familiar con antecedentes de fracturas
- Dificultad para andar y equilibrio
- Agudeza visual disminuida
- Diámetro de pantorrilla pequeño.
- Fármacos (anticonvulsivantes, litio, heparina, omeprazol)



El ejercicio mantiene el calcio que se encuentra en el hueso. El mantener el peso y aumentar el tono muscular por medio del ejercicio, mejora la agilidad, la fuerza, y el equilibrio lo que puede reducir el riesgo de caídas. A tolerancia se recomienda: trotar, bicicleta, natación, caminar en plano. Además una exposición moderada al sol es recomendable para la prevención de osteoporosis.

3.- Dejar de fumar



Además de ser perjudicial para la salud: problemas cardiovasculares, pulmonares, pérdida del gusto y olfato, etc. El tabaco incrementa el riesgo de padecer fractura de cadera, reduciendo el porcentaje de calcio en los huesos.

HABITOS DE VIDA SALUDABLES

1.- Dieta saludable



Consumir una alimentación equilibrada sin exceso de grasa, ni proteínas. Que sean ricos en calcio y vitamina D, como productos lácteos: leches, yogurt, quesos. Verduras: acelgas, espinacas, cardos, entre otros y frutas. Pescados y mariscos. Frutos secos: almendras, avellanas. Legumbres.

Los productos desnatados no reducen el aporte de Calcio.

Se necesitan consumir 1200mg de calcio al día en el adulto mayor. Esta cantidad se obtiene con:

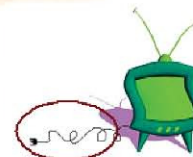
- 5 vasos de leche al día ó 7 yogures ó 150 g de queso manchego curado. Los quesos frescos contiene menor cantidad de calcio.
- Una combinación diaria podría ser:
 - 1 vaso de leche en el desayuno u otro en la cena.
 - 1 batido de leche a media mañana.
 - 1 yogurt o un trozo de queso en la comida.
 - 1 yogurt o un bocadillo de queso en la merienda



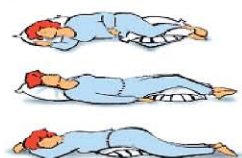
PREVENCIÓN de FRACTURAS



En el hogar los suelos deben mantenerse libres de obstáculos con los que se pueda tropezar (picos de la alfombra, juguetes, cables, etc). Las escaleras deben tener pasamanos y el baño alfombrillas antideslizantes y pasamanos. Mantenga limpio y seco el suelo de la cocina. La iluminación debe ser buena. Utilice zapato con suela de goma. Esté atento por donde anda, puesto que puede haber alguna limitación: aceras, charco, escalones, etc.



4.- Recomendaciones posturales:



Las mejores posiciones para dormir son de lado con las piernas flexionadas y una almohada entre las rodillas (A); boca arriba con una almohada bajo las rodillas (B) y boca abajo con la almohada en el vientre (C).



Para una correcta posición de pie mientras se realizan tareas hogareñas, se debe utilizar un taburete y contraer los músculos abdominales y con los hombros hacia atrás.



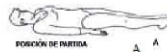
La mejor amiga de la espalda es la silla recta, y no excesivamente baja. Los pies deben estar apoyados en el suelo o en un pequeño soporte. La espalda y el cuello deben formar una línea recta un poco adelantada de las caderas.








Si lleva bolsa en la mano, es mejor repartir en peso entre los 2 brazos y si es solo 1 objeto, llevarlo cogido contra el pecho.

RECOMENDACIÓN DE EJERCICIOS TRAS UNA FRACTURA DE CADERA

Tras una FC es recomendable realizar los siguientes ejercicios durante unos 15-20 min al acostarse y otros antes de levantarse.



	Tumbado boca arriba con las piernas extendidas (A), doblar la derecha sobre el pecho y estirla hasta la vertical (B) y luego bajar lentamente la pierna extendida hasta llegar a la posición de partida.
	Desde la posición inicial (A), separar la pierna derecha lateralmente (C). Volver a la posición inicial. Repetirlo con la pierna izquierda.
	Tumbado boca arriba con las piernas flexionadas y con los pies apoyados en el suelo (D), levantar las nalgas lo más alto posible (D ₁).
	Tumbado lateralmente, con la mano en la nuca y la otra apoyada en el suelo delante del pecho. La pierna de lado debe quedar flexionada y la otra extendida hacia delante (E). Levantar la pierna extendida hasta la vertical y volver al suelo por detrás del cuerpo describiendo un círculo, después hacerlo en sentido inverso (E ₁). Repetir con la otra.
	De pie sobre un escalón (F), descargando el peso del cuerpo sobre la pierna sana y dejando colgar la otra en el vacío. Balancear la pierna hacia adelante y hacia atrás.

for taking preventive measures. Furthermore, we have observed that in our hospital environment there is no drug therapy consensus for the prevention and treatment of these fractures. The intervention must focus on avoiding

potentially reversible RF, such as falls and low BMD, and on using appropriate drug treatments which should reduce the number of osteoporotic hip fractures and thus have a positive impact on public health.

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