



Integrated care pathways for bone health

An overview of global policies



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Contents

SAC

3	About this report				
5	Executive Summary				
7 Background					
12	Components of the care pathway				
12	Strengthening primary care				
15	Building on secondary care				
16	Improving guidelines to promote public health				
18	Stakeholder action				
22	Next steps—what can be done?				
22	Call to action				
24	References				
27	Appendix 1				
28	Appendix 2				
29	Appendix 3				
30	Appendix 4				
32	Appendix 5				

About this report

Integrated Care Pathways for Bone Health: An Overview of Global Policies is a report by The Economist Intelligence Unit examining the global policy environment for bone health.

The goal of this research is to propose an integrated care pathway for bone health that takes into account the challenges and opportunities from countries around the world. This work examines risk factors for fractures, prevention strategies and other concerns associated with healthy ageing, as well as the economic and epidemiological burden of poor bone health across selected countries. We analyse how countries can build awareness, prioritise prevention, improve early detection and diagnosis and ensure access to high-quality treatment.

Our goal is to build and strengthen integrated care pathways for bone health throughout the life course by bringing together health professionals, policymakers and civil society to improve the care of bone health across the world. We hope to do this by providing an analysis of evidence-based best practices in effective health systems worldwide.

The Economist Intelligence Unit carried out an evidence review and convened an expert panel meeting monthly over a period of five months to help identify the critical components of an integrated care pathway for bone health which incorporated key building blocks of good practice in health policy and system development in the field of bone health. Alongside this, our researchers conducted a series of interviews with experts from around the world. Resulting from this research, and published alongside this global report, we have prepared a policy briefing paper presenting the rationale for having an integrated care pathway for bone health. Due to its concise nature, the policy briefing paper is a useful adjunct to this report, designed for those working in the field of health policy.

The research programme was sponsored by Amgen. We would like to thank the following individuals for sharing their insight and experience:

Expert Panel

- **Professor Robert Blank**, Professor Emeritus of Medicine, Medical College of Wisconsin; Visiting Scientist, Garvan Institute of Medical Research, Australia
- **Professor Cyrus Cooper, OBE**, Professor of Rheumatology and Director of the MRC Life Course Epidemiology Unit; Vice-Dean of the Faculty of Medicine at the University of Southampton; Professor of Epidemiology at the Nuffield Department of Orthopaedics, Rheumatology and Musculoskeletal Sciences, University of Oxford, United Kingdom
- **Professor Michael Graven**, Retired faculty from Dalhousie University; Former Director, Medical Informatics, United States
- **Dr Samuel Hailu**, Orthopaedic Trauma and Arthroplasty Surgeon, Addis Ababa University, Tikur Anbessa (Black Lion) Specialized Hospital, Ethiopia
- Dr Phillippe Halbout, Chief Executive Officer, International Osteoporosis Foundation, Switzerland
- **Ms Teréza Hough**, Chief Executive Officer, National Osteoporosis Foundation of South Africa
- Dr Andréa Marques, Rheumatology Department, Centro Hospitalar e Universitário de Coimbra; Nursing, Health Sciences Research Unit, Portugal
- Dr Eugene McCloskey, Professor, Adult Bone Diseases; Director of the MRC Versus Arthritis Centre for Integrated Research in Musculoskeletal Ageing; Healthy Lifespan Institute; Mellanby Centre for Musculoskeletal Research, Department of Oncology and Metabolism, University of Sheffield, United Kingdom

- Dr Rosa Maria Pereira, Department of Rheumatology, Hospital das Clinicas HCFMUSP; Professor at the Faculty of Medicine of the University of São Paulo, Brazil
- Ms Lisa Qualls, Director of Partner Relations, American Bone Health, United States
- Professor Jean-Yves Reginster, MD, PhD, University of Liège, Belgium; King Saud University
- Dr Kanwaljit Soin, Orthopaedic and Hand Surgeon, Former Nominated Member of Parliament of Singapore, Founding President of Women's Initiative for Ageing Successfully; Author of 'Silver Shades of Grey: Memos for Successful Ageing In the 21st Century', Singapore
- Dr Maria Belen Zanchetta, Medical and Academic Director, IDIM; Director, Postgraduation Chair in Osteology and Mineral Metabolism at Salvador's University; Member, ASBMR Membership Engagement Committee; Ambassador, LATAM ASBMR; Regional Advisory Committee, International Osteoporosis Foundation, Argentina

External Consultant

• Dr Liesbeth Borgermans, Professor of Primary Care, Faculty of Medicine and Health Sciences, Department of Public Health and Primary care, University of Ghent, Belgium

Interviewees

- Dr Gemma Adib, Founder and President, Syrian National Osteoporosis Society; Board member, International Osteoporosis Foundation Regional; Advisory Committee Chair, RAC; Pan Arab Osteoporosis Society GS (PAOS), Syria
- **Dr Paul Anderson**, Professor, Department of Orthopedics Surgery and Rehabilitation, University of Wisconsin, United States
- **Dr Bruno Boietti**, Medical Professional, Hospital Italiano of Buenos Aires; Consultant, Ministry of Health in Argentina
- **Professor Matthew Costa**, Professor of Orthopaedic Trauma, University of Oxford; Honorary Consultant Trauma Surgeon, John Radcliffe Hospital, United Kingdom

- **Professor Juliet Compston**, Professor Emeritus of Bone Medicine, Cambridge Biomedical Campus, United Kingdom
- Dr Greg Lyubomirsky, CEO, Osteoporosis Australia
- **Dr Jay Magaziner**, Chair, Department of Epidemiology and Public Health; Director, Center For Research on Aging, University of Maryland, United States
- **Dr Polyzois Makras**, Consultant Endocrinologist, Department of Endocrinology and Diabetes, Head of the Department of Medical Research, 251 Hellenic Air Force and VA General Hospital, Greece
- **Dr Paul Mitchell**, Founder, Synthesis Medical Limited, New Zealand
- **Professor Sonia Cerdas Pérez**, Professor of Endocrinology, University of Costa Rica; Endocrinologist, Hospital CIMA; Founder, Costa Rican Menopause and Osteoporosis Society, Costa Rica
- **Professor Leith Zakraoui**, Professor of Rheumatology, University of Tunis School of Medicine; Head of the Department of Rheumatology, Hospital Mongi Slim La Marsa; Founder, Tunisian Osteoporosis Prevention Society (TOPS), Tunisia

In addition, we are grateful to various stakeholders in the bone health community for the many informal conversations and opportunities we have had to learn from their expertise on this topic.

This research was conducted by The Economist Intelligence Unit Healthcare team from 2020 to 2021. The Economist Intelligence Unit bears sole responsibility for the content of this report. The findings and views expressed in the report do not necessarily reflect the views of the sponsor. The research was led by Dr Mary Bussell with input from The Economist Intelligence Unit team consisting of Amanda Stucke, Taylor Puhl, Marcela Casaca, Giulia Garcia and Lorena Perez. The report was written by Taylor Puhl with contributions from Mary Bussell and was edited by Janet Clapton.

Executive Summary

This report aims to provide a global scan of the current environment for bone health and present best practices of relevance for the creation of an integrated care pathway for bone health. Including an integrated care pathway for bone health in a country's health system enables a multidisciplinary response that allows the right health professionals to practise the right care at the right time, providing continuity of care for an individual throughout his or her life course. The policy scan was conducted in alignment with the World Health Organization (WHO) Decade of Healthy Ageing 2021-2030. This initiative is a global collaboration forging alliances between a wide array of stakeholders such as governments, academia, the private sector and civil society to improve the lives of older people, their families and the communities in which they live.

This work fits into the priorities of the Decade of Healthy Ageing by offering a platform for innovation and change. An integrated care pathway is an important tool for unifying the disparate aspects of care for bone health. To expand the co-ordination and comprehensiveness of services to improve health outcomes the pathway encompasses the integration of:

- primary and secondary care: a lifespan approach
- care delivery and service offerings
- pharmacological and non-pharmacological approaches
- social determinants of health

Throughout this report, the focus is on bringing together health professionals, policymakers and civil society among others to improve the care of bone health around the world. This report was written and published during the SARS-CoV-2 pandemic. Though health systems have had to focus almost exclusively on fighting this battle, we must not lose sight of other pressing health needs that will persist long after covid-19 has been defeated. Countries must build resilient health systems that are equipped to protect the most vulnerable populations, namely older adults. With populations rapidly ageing around the world, now, more than ever, the work of preparing and enabling health systems to better care for older adults is paramount. Rather than offer an in-depth analysis of any particular part of the care pathway, this report endeavours to offer an overview of the necessary components for constructing a fully integrated care pathway for bone health across a person's life.

The key findings are:

• Equipping primary care providers with the knowledge and tools to address bone health is critical. Though many care guidelines for bone health exist, few speak to the specific needs of primary care providers. An individual's first contact with the health system is usually through their primary care provider, and in some systems these general practitioners are the gateway into further care. Therefore, these professionals have a strong influence on treatment outcomes and their patients' behaviour.

- Building multidisciplinary teams in secondary care is crucial for bone health. There is no clinical specialty dedicated solely to bone health. This may make the delivery of care a challenge when it comes to this area of human health as providers with different types of expertise are called on to provide holistic and effective care. This means utilising professionals not only in the clinical environment, but also in fields such as public health and social services to care for patients throughout their life course.
- Investigating all fractures as a matter of bone health as opposed to trauma. The term 'fragility' can be stigmatising and may infer that nothing can be done for the individual who experiences a fragility fracture. In fact, all fractures must be properly investigated, particularly when they occur in older populations.
- Experiencing poor bone health later in life is not inevitable. Osteoporosis and fractures that result from this disease are not a routine part of ageing; there are measures that can be taken to prevent the onset of such outcomes. Improving health literacy in a population through education and increased awareness can increase engagement in preventive measures such as screening and treatment.

Integrated care pathways for bone health An overview of global policies

7

Background

The burden of poor bone health

As life expectancy around the world rises, the burden of poor bone health rises in unison. Poor bone health encompasses a broad spectrum of diseases, but it is most often quantified as the cumulative burden of osteoporosis and fragility fractures. In addition to the health burden placed on societies, bone health presents a growing financial strain as health systems struggle to manage these costly conditions when more can be done to prevent them from happening in the first place.

Osteoporosis is characterised by low bone mineral density (BMD) or the deterioration of bone tissue and it is the most widespread bone disease worldwide.¹ It is estimated that over 200 million people are affected by osteoporosis globally.² Old age is a significant risk factor for developing osteoporosis, as well as other non-modifiable factors such as gender and ethnicity.³ Modifiable risk factors are similar to those of other chronic conditions and include lack of weightbearing exercise, tobacco use, harmful use of alcohol, and a diet low in calcium and Vitamin D, among others.⁴ While not the only solution, minimising unnecessary risks and modifying behaviour to promote a healthy lifestyle can contribute to risk reduction for osteoporosis and other chronic diseases.

Fragility fractures are fractures resulting from an injury that would not typically break a normal, healthy bone.⁵ They are most commonly caused by osteoporosis and are also referred to as osteoporosis-related fractures or osteoporotic fractures. This report utilises the latter two terms, osteoporosis-related fractures and osteoporotic fractures, in an effort to avoid the stigma that often accompanies the term fragility. Rates of osteoporotic fractures have been increasing and are expected to continue rising in every region of the world, as illustrated in Figure 1. Health systems around the world must prepare for the surge of fractures they will continue to face.



Figure 1 Prevalence of osteoporotic hip fractures by region in 1990, 2025, and 2050⁶

Source: Friedman and Mendelson, 20146 originally published by Cooper et al. 1992.

Much of the expected increase in these fractures can be attributed to the anticipated rise in the population over age 60 worldwide. The number of people in this age group is expected to more than double by 2050 and more than triple by 2100, while the number of people over age 80 is anticipated to triple by 2050.8 This not only presents a unique strain on healthcare systems around the world, but also on other elder care services such as rehabilitation programmes and long-term care facilities. The growth in the number of older people will bring a new wave of care needs that must be addressed through tailored solutions that consider the varied demographic and health system contexts of countries. WHO has sought to address this global need through its Decade of Healthy Ageing 2021-2030. This initiative is a global collaboration of stakeholders including governments, academia, the media, the private sector and civil society to improve the lives of older people, their families and the communities in which they live. The ultimate aims of this programme are to achieve tangible outcomes including ensuring human resources for integrated care and defining the economic case for investment. A full list of the ten priorities for the Decade of Healthy Ageing is included in Appendix 1.

Gender is another key demographic consideration because it is a significant risk factor for osteoporosis. Post-menopausal women are disproportionately affected by osteoporosis and osteoporosis-related fractures, as shown in Figure 2. The International Osteoporosis Foundation (IOF) reports that 1 in 3 women over age 50 will experience a fracture caused by osteoporosis while 1 in 5 men will face the same outcome.9 Osteoporosis accounts for more days in a hospital for women than diabetes, heart attacks or breast cancer.9

Osteoporosis is often referred to as a silent disease, because individuals typically do not experience noticeable symptoms until a fracture occurs. Bone health is frequently overlooked precisely because it is silent in nature, contributing to the lack of attention given to prevention. Primary prevention refers to interventions that prevent the first fracture from occurring. Taking action following an initial fracture is paramount: a previous fracture is associated with up to 86% increase in risk of an additional fracture.¹¹ This effort to reduce the risk of an additional fracture is referred to as secondary prevention, where the initial fracture serves as a warning sign. Both primary and secondary prevention are critical to the creation of an integrated care pathway for bone health in which health professionals from primary and secondary care levels are involved.



Figure 2 Number of individuals with 10-year probability of a major osteoporotic fracture

Unfortunately, osteoporosis does not attract the same level of attention as other long-term conditions. While osteoporosis may not be perceived to be as deadly as other chronic diseases, the resulting fractures pose a serious risk to people with the condition. Individuals who have experienced a hip fracture are at an increased risk of mortality both in the short and long term compared with people who have not had a hip fracture.¹² The same is true for non-hip fractures, such as vertebral and femoral fractures,¹³ though a distinct lack of awareness of the mortality risk and management of risk continues to exist. However, metrics other than mortality data can be used to better demonstrate the true health burden of osteoporotic fractures in society. Not only do fractures increase the risk of death, but they also greatly contribute to a reduction in quality of life. Osteoporosis-related fractures frequently result in social isolation, depression, pain and loss of mobility and independence.¹⁴

Quality-adjusted life years (QALYs) measure the quality and quantity of life lived in order to understand disease burden: one QALY equates to one year in perfect health. QALYs lost due to osteoporotic fractures are expected to grow in the period from 2017 to 2030 in Europe's five largest countries (France, Germany, Italy, Spain, and the United Kingdom) plus Sweden.¹⁵ Disability-adjusted life years (DALYs) measure overall disease burden, expressed as the number of years lost due to morbidity (ill-health and disability) or premature mortality. The second greatest cause of global disability is due to musculoskeletal illness: it causes 6.8% of total DALYs worldwide.¹⁶ The DALY figure for musculoskeletal disease has grown by 45% since 1990, while the mean growth for other diseases has been 33%.¹⁰ With the growth of older age populations, the health risks and challenges associated with osteoporosis and osteoporosis-related fractures are only anticipated to increase in the coming years. Along with this rising health burden comes a rising economic burden placed on health systems and individuals.

The economic burden of poor bone health

In 2010, osteoporotic fractures cost the European Union (EU) €37.4 billion, and costs are expected to rise 25% to a total of €46.8 billion by 2025.¹⁷ Other high-income countries around the world are heading in the same direction: in 2018 osteoporotic fractures cost the United States \$52 billion, which is expected to climb 83% to \$95 billion by 2040.¹⁸ Not only are the direct costs of fractures a substantial burden, but the presence of osteoporosis is typically accompanied by one or more other major chronic conditions (defined as heart disease, depression, chronic obstructive pulmonary disease (COPD) and diabetes). Individuals with osteoporosis and at least one other major chronic disease face healthcare costs 13-23% higher than managing a chronic disease without osteoporosis.¹⁹ Osteoporosis compounds the impact of other health complications and in doing so increases overall costs to the health system.

While we recognise that people are living longer, we need to be able to differentiate between this basic observation and the requirement to promote healthy ageing. Individuals and their families bear some of the costs for osteoporosis, but it is the health system that suffers the greatest expense. As individuals live longer they typically spend a greater number of years in retirement which, in turn, reduces the amount they are able to contribute back to the health system. In the EU in 2016 there were 3.4 people of working age for every person aged 65 or older;²⁰ by 2050, it is predicted that there will be fewer than two people of working age for every person aged 65 or older;²¹ This phenomenon occurs worldwide and can be captured by old-age dependency ratios.



Figure 3 Old-age dependency ratios by region 1950-205022

These ratios (frequently expressed as percents) represent the number of people aged 65 years or over per 100 persons of working age (defined as people age 15-64 years). The ratio will increase in every region of the world by 2050 with some continents, like Europe and North America, rising more rapidly than others, as illustrated in Figure 3.

The metric is by no means perfect; it is meant to be a crude proxy to illustrate the pressure countries are likely to face in the coming decades. The increase in the number of older, nonworking people will place a greater strain on younger generations in terms of time and resources because they will assume some responsibilities as caregivers as well as financing the care of ageing populations through measures such as subsidising the increased cost of care with taxation. Without proper planning and allocation of regional and national resources to manage the rising tide of osteoporosis and related fractures, an avoidable health and economic burden is a likely outcome that will impact countries for decades to come.

In many countries, people are continuing to work longer and are retiring at older ages than in the past. This is due in part to improved health and wellbeing as well as reforms in pension and retirement programmes.²³ Though improvements in longevity have been brought about by advancements in nutrition, scientific understanding and improved medical care, older employees are at greater risk of fracture and fatal accidents in the workplace than their younger counterparts.²⁴ While policies to enact later retirement may help to alleviate the burden on pension systems and retirement programmes, it also means that rates of osteoporotic fractures will likely increase in working populations. Ultimately this could lead to productivity loss in the workplace and a corresponding increase in financial pressures on tax-funded health systems.

Poor bone health does not solely impact older individuals on the cusp of retirement. More than 7.6 million sick days were taken due to osteoporosis-related fractures in France, Germany, Italy, Spain, Sweden and the United Kingdom in 2017.²⁵ Not only are individuals with fractures missing work, but family members and friends often need to take leave from work to provide care. This invaluable input is referred to as informal care and is typically defined as a relative or friend providing unpaid care to an individual with whom they have a personal relationship.²⁶ Up to 56% of individuals with a hip fracture become dependent on an informal caregiver.²⁷ The informal provision of care is difficult to quantify yet is widely acknowledged to be a significant financial burden on both families and employers.²⁸

The data illustrate a lack of recognition of poor bone health which can be seen in the rising incidence of osteoporosis-related fractures. This is compounded by a lack of access to effective treatment due to under-diagnosis which further exacerbates the cost of poor bone health. Only 20% of patients with an osteoporotic fracture receive treatment in the year following their break.²⁹ This is often referred to as the treatment gap, which is the gap between the number of individuals receiving treatment compared with the number who require it. The treatment gap varies around the world, but the fact that it exists is a cause for concern and needs to be addressed.

A catastrophic rise in the health and economic toll due to osteoporosis and osteoporosis-related fractures does not need to be inevitable. While progress has been made in identifying and treating osteoporosis, these advances have not kept pace with the rate at which populations around the world are ageing. Mitigation of these daunting estimates is possible by understanding and quantifying a country's unique burden, building awareness of that burden, and adapting best practices to address it.

Components of the care pathway

Strengthening primary care

Risk assessment tools based on consistent data collection

Prevention is the most important action that can be taken to reduce the future burden of osteoporosis and osteoporotic fractures. Identification of individuals who are at the highest risk of a fracture is the first step in implementing primary prevention measures. Numerous tools and strategies exist for identifying these individuals.

Understanding an individual's risk allows for earlier action: lifestyle changes can be adopted and treatment can be initiated sooner. The FRAX[®] tool calculates a prediction for an individual's risk of fracture based on a series of inputs such as body mass index, prior fracture, age and family history of fracture. These inputs allow FRAX[®] to be easily implemented in primary care. The tool is available in 73 countries and covers more than 80% of the world's population.³⁰ Though BMD is a possible input, it is not required for the calculation of an individual's risk. This important aspect allows FRAX[®] models to be used in regions that do not have access to dual-energy X-ray absorptiometry (DXA), a test used to determine BMD. FRAX[®] is also particularly useful in cases where an individual does not have a BMD in the specified osteoporosis range (T score \leq -2.5), but is still at risk of fracture. Other effective and validated models exist such as Garvan, QFracture[®] and the Osteoporosis Risk Assessment Instrument (ORAI), but FRAX[®] has become the global gold standard for fracture risk assessment.³⁰

Critical to the FRAX[®] risk calculation is the epidemiology of fracture and mortality in a country. No two countries experience an identical burden, so FRAX[®] can be most effectively utilised by countries compiling the necessary epidemiological data to calculate their overall risk. The need for epidemiological data is not just important for FRAX[®]; robust data is needed to guide policy and determine resource allocation at national and regional levels. Without good data demonstrating the magnitude of the problem, efforts made to address the issue can be haphazard, if they happen at all.

Screening, which can include FRAX[®] estimates, is another potentially effective tool to use in primary prevention. Screening for osteoporosis offers the possibility of earlier diagnosis and initiation of steps to mitigate future complications through behaviour change and/or earlier treatment. A significant reduction in osteoporotic fractures has been found when screening is paired with a fracture risk assessment,³¹ though the use of risk assessments on their own can be an effective way to provide an initial determination of risk and support a clinical decision. Experts around the world have varying opinions on what an effective screening programme should comprise as the osteoporosis burden varies greatly among different populations. While screening using DXA is not a perfect tool, it has been found to be more effective when paired with an additional metric such as a bone strength test with quantitative computed tomography (QCT).^{32, 33} However screening is carried out, the underlying point remains: screening strategies must be tailored to meet a country's needs and flexibly adapted to technological availability.

Reliable epidemiologic data is not only necessary for demonstrating a country's burden, but also for scientific research such as intervention studies which require numerous participants to indicate efficacy.³⁴ The type of data that is most useful in this case comes from fracture registries. These registries are often initiated to gather data on hip fractures but can be expanded to include data on other osteoporotic fractures. The data contained in a fracture registry can be used to benchmark the performance of different health centres in creating standards for improving the quality of services delivered,³⁴ and ultimately changing clinical practice for the better. While the quality of registries varies by country, the evidence-based approach to data collection they espouse can enable a demonstration of the efficacy of prevention measures on both a regional and national scale. Therefore their use warrants further exploration.

Integrating guidelines into physicians' workflow

Screening, risk assessment tools and strong data collection are all meaningless if physicians are not able to include bone health assessments in routine patient care. Primary care providers can strongly influence their patients' behaviour by providing information that can impact decisionmaking.³⁵ When providers fail to discuss bone health, patients may not know that they should be thinking about their skeletal wellbeing or understand the importance of obtaining DXA screening or pursuing other risk assessments.³⁵ Improved clinical training complemented by a streamlined and consolidated approach to guidelines for primary care providers could help alleviate this problem by helping them to recognise the importance of bone health assessments, emphasising the importance of their communication with patients and demonstrating the efficient tools that can be used to assess fracture risk.

In 2020, a partnership network between hospitals for primary healthcare in Portugal created a guideline for the implementation of osteoporosis and fracture risk screening programmes in primary care settings.³⁶ The guideline is designed for nurses to implement FRAX[®] risk calculations in the routine care delivered to men and women who are not necessarily seeking care for their bone health. This is a useful way of reaching out to people to improve their understanding of risk factors for a disease that they may not have considered before their interaction with these nurses. The guideline also advises on how to develop an action plan. Based on the FRAX[®] results the recommendations include a range of options such as patient education on healthy habits, referral to a specialist and the initiation of treatment. The programme is a leading example of how to practically include screening programmes in routine primary care while educating health professionals about bone health. A diagram of the full pathway is available in Appendix 2.

Primary care must be embedded into bone health integrated care pathways for all age groups to ensure that care is delivered at the right time and as efficiently as possible, and opportunities for health promotion are maximised. While this burden falls solely on the shoulders of primary care providers, equipping them with educational resources and efficient tools (including support from secondary care specialists) can allow them to provide improved bone health care to their patients. One of the most important resources to provide to primary care physicians is locally-adapted guidelines. A gap exists for such guidelines: while globally there are over 200 guidelines for osteoporosis, few address the challenges and needs of primary care primary care into the

provision of comprehensive care for bone health throughout a person's life. We are keen to see care pathways that encompass a bone health approach incorporating osteoporosis prevention and care as key components. Health systems must find a balance between prioritising bone health diseases, developing, refining and utilising tools to integrate effective assessment into physician workflows, and managing bone health conditions in primary care.

Operationalising multidisciplinary care

Multidisciplinary teams for primary and secondary care are essential for the creation of an integrated care pathway for bone health. Health professionals including nurses, physiotherapists and pharmacists are necessary for a care pathway that meets an individual's needs throughout their life. The integrated clinical pathway should be complemented with targeted interventions from the social care and public health sector to address all of a patient's needs with relevance to bone health. Understanding an individual's functional competence, through measures such as ability to walk or assessment of fall frequency, is a way to ensure multidisciplinary awareness of an individual's needs. People with osteoporosis and osteoporotic fractures must frequently rely on services provided by social care and public health to address the non-clinical aspects of care. These may include participating in community-wide exercise programmes to improve muscle strength, securing transportation to and from an appointment, finding rehabilitation services and a host of other essential activities. An integrated care pathway across the life course must address the bone health needs of individuals before they enter the healthcare system as well as after they have left it.

The multifactorial nature of osteoporosis-related fractures requires the input of a variety of medical professionals to adequately care for the patient. The fact that no single clinical specialty focuses solely on bone health means the responsibility of care falls on multiple clinicians, and without clear lines of communication and agreed best practices, patients may not receive continuity of care or may miss out on necessary care entirely. The referral process is inherently complex for individuals with poor bone health who experience gaps in care and communication between GPs, orthopaedic surgeons, and endocrinologists or rheumatologists. A referral decision must be made that is followed by service identification and provider selection. The referral does not stop there: referral communication involving interactions between various providers then becomes increasingly important. Critical information about a patient must be made available to all providers, but the complexity and variation in this process frequently result in loss of quality and increasing cost. Therefore, it is important to improve decision-making and communication once the decision has been made to enhance the outcome for the patient. Innovative digital solutions can help to solve this challenge by enabling efficient communication and data sharing among providers when broader IT structures are in place to support them. Referral does not mean only the forward referrals from a primary care provider to a specialist. Equal importance should be given to the downward referrals as well, in which the patient is referred back to primary care from a specialist. Effective multidisciplinary care programmes start from the needs of patients and work to ensure clear communication between all participants, including family members.

Building on secondary care

Establishing and expanding successful care programmes

Awareness, prevention, diagnosis and treatment of poor bone health need to be prioritised for individuals throughout the life course to prevent a sharp rise in the burden of this disease later in life. It has been known for decades that individuals who have experienced a fracture are at twice the risk of incurring a second fracture.¹¹ Further, this fracture most often occurs within the first year of sustaining the initial fracture.³⁷ Using the first fracture as a warning sign, physicians must be able to recognise the immediate risks for the patient. All fractures should be investigated as individuals can be easily overlooked and dismissed with a passive approach to care.

Fracture liaison services (FLS) are the most widely utilised and supported multidisciplinary care programmes for bone health. They emerged from the IOF's 'Capture the Fracture' initiative, with the goal of implementing hospital-based co-ordinated multidisciplinary models of care for secondary fracture prevention. Today, registered FLS programmes exist in every WHO region³⁸ offering the global gold standard in secondary fracture prevention, addressing multiple causes. FLS programmes bring together multidisciplinary experts, with a dedicated care manager ensuring continuity and clarity for the patient. A diagram of the care pathway is included in Appendix 3. In addition to providing the most cost-effective method of secondary prevention,³⁹ they also provide benchmarks for care which have led to the creation of national fracture registries and the publication of clinical standards for healthcare providers.⁴⁰ The creation and implementation of a Best Practice Framework is the set of standards to which every FLS programme aspires. This patient-centric model allows a variety of clinical specialties and medical professionals to unite around the common goal of achieving the best possible outcome for patients. The widespread success of FLS is an example of the improvements in care that non-governmental organisations can inspire.

Japan has taken FLS one step further with the creation and implementation of Osteoporosis Liaison Service (OLS) in 2011. While FLS is focused on secondary fracture prevention in fracture patients, OLS expands this by incorporating primary fracture prevention services at clinics and in communities. An osteoporosis manager (OM) role was developed by the Japanese Osteoporosis Society as a designated co-ordinator for the OLS. The OM can be any health professional (physician, nurse, pharmacist, physical therapist, etc.) who completes an educational course and passes a certification exam. OMs serve in a variety of roles in the clinical setting such as managing a patient's treatment plan or screening a patient for risk factors, but they are also responsible for lifestyle guidance and assisting with public awareness campaigns. OLS has been effective for the same reasons that FLS is effective: a multidisciplinary team unites around the common goal of providing the most efficient and highest quality care to the patient.⁴¹ The programme faces its own challenges, but many benefits such as improved screening rates and medication adherence have been attributed to the OLS.⁴¹

Another example emerged in Sweden in 2020 as an effort to address the country's challenges and unmet needs. The National System for Knowledge Management in Healthcare (Nationellt System för Kunskapsstyrning Hälso - och Sjukvård) has developed a secondary care pathway specifically for osteoporosis, included in Appendix 4.⁴² Both inpatient and outpatient pathways

are available for providers once they identify individuals with a high fracture risk. The pathway officially begins when osteoporosis is suspected in a patient with a high fracture risk (supported by the Swedish Fracture Register). It includes investigative tests and treatment interventions, and ends when a follow-up plan has been developed together with the patient. Though the focus of our research is on bone health more generally, these osteoporosis care pathways are important tools for providing the highest quality of care for bone health.

The Fragility Fracture Network (FFN) is one prominent global organisation that supports a multidisciplinary approach to care by creating networks of experts to improve treatment and secondary prevention of fractures. FFN is committed to bringing together multidisciplinary experts to form national coalitions advancing policy change for bone health. They are focused on secondary prevention with a vision to achieve a world in which anyone who suffers from an osteoporosis-related fracture has the opportunity to reach optimal recovery of their independence and quality of life. FFN's work at the regional level is directed towards the needs of the countries to provide a tailored approach to policy change. FFN is also dedicated to crucial aspects of bone health such as education of non-physicians involved in care for osteoporotic fractures.⁴³

Leveraging the resources of three of the world's largest osteoporosis and osteoporosis-related fracture organisations, bone health experts around the world worked together to identify how to measure the delivery of care to patients through FLS and the corresponding impact of service interventions. From this they created the first ever patient-level key performance indicators (KPIs) in FLS programmes. FFN, IOF and the United States' National Osteoporosis Foundation (NOF) worked together to identify eleven KPIs designed to be recorded by FLS programmes around the world. These KPIs will be used to improve services for the patient as well as providing more accurate benchmarking of FLS programmes.⁴⁴ The full set of KPIs can be found in Appendix 5. Building consensus around the need for multidisciplinary partnerships, these three organisations are working to improve patient care. Further steps to improve FLS could involve introducing quality indicators such as quality of communication with providers to gain insight into the challenges and successes from the patient's viewpoint.

Improving guidelines to promote public health

Focus on gender

Good bone health should be considered across the life course for all, with certain targeted efforts made for populations at highest risk. One area of focus moving forward for both primary and secondary care must be addressing the burden of poor bone health in men. Unfortunately, men have often been neglected because women face higher risks for osteoporosis and osteoporotic fractures due to the hormonal changes occurring during menopause. Yet, men experience approximately one-third of hip fractures worldwide⁴⁵ and they are at higher risk of mortality following an osteoporotic fracture than women.⁴⁶ Given the focus on post-menopausal women, fewer guidelines exist for the care and treatment of osteoporosis in men.⁴⁷ Therefore, neglecting bone health in this population may limit progress in reducing the global burden.

Focus on multiple chronic conditions

Guidelines are also needed for individuals with certain conditions that pose an increased risk to developing poor bone health. Some diseases and their pharmacological treatments can significantly increase the risk of developing poor bone health. Progress has been made in addressing this issue with the creation of clinical guidelines for diseases such as COPD and celiac disease. However, a gap exists in the creation of bone health-informed guidelines for individuals with other diseases, for example diabetes and dementia. Evidence-based guidelines for the management of poor bone health in individuals with these conditions are needed.⁴⁸ Guideline creation for multiple chronic conditions is one example of how crucial multidisciplinary collaboration is for improving bone health.

Focus on adherence to treatment

The cost of non-adherence to prescribed osteoporosis treatments is much greater compared with other chronic diseases, as illustrated in Figure 4. Pharmaceutical treatment for osteoporosis and prevention of osteoporotic fractures is available, yet adherence rates remain persistently low. Research has sought to determine causes for poor adherence to treatment and to develop strategies for improvement. In creating a long-term management plan for patients that is integrated with primary care, studies indicate that FLS can be effective in promoting adherence.⁴⁹ The International Society for Pharmacoeconomics and Outcomes Research (ISPOR) has found that allowing providers to utilise electronic prescriptions so that a patient does not have to carry the prescription to the pharmacy can improve adherence.⁵⁰ Other beneficial practices include offering patients medications that can be taken less frequently and providing verbal counselling to patients.⁵⁰ Fear of the side effects of treatment could be another reason behind the low levels of adherence. Consistent and uniform messaging from reliable sources is vital to the delivery of health messages that inform and dispel misinformation.⁴⁸ Utilising these important findings in new and existing guidelines could benefit patients by allowing providers to understand the challenges they face and address those accordingly.

Figure 4

Annual medication non-adherence costs incurred by the patient



Stakeholder action

Public: population engagement through improved health literacy

The main hurdle to adequately addressing the rising burden of poor bone health around the world is the lack of understanding at the population and primary care provider level; many misconceptions around osteoporosis and osteoporotic fractures continue to exist. Most notably, individuals frequently believe that poor bone health is an inevitable part of ageing and that nothing can be done to prevent fractures later in life.⁵² This underscores the importance of educational initiatives conveying the message that maintaining independence and mobility is possible and osteoporosis-related fractures are avoidable. Education initiatives have largely centred on menopausal and post-menopausal women because of their increased risk of poor bone health due to hormonal changes later in life. While targeted efforts can be effective, there is need for a broader strategy to communicate messages about bone health to a broader audience. Public health communications must convey the reality that osteoporosis and osteoporotic fractures are avoidable: individuals can remain mobile and independent as they age.⁵³

Effective education and awareness campaigns should target anyone experiencing a fracture because it is vital to ascertain whether the break was due to underlying bone health issues or the result of an accident or trauma.⁴⁸ Both the public and clinicians must pay close attention to the distinction so that the default view of attributing all fractures to trauma can change. That shift in thought will require the synchronisation of communication from government agencies, departments of health and public health, physicians and advocacy organisations. This will only be possible with a concerted focus on health literacy. Moving beyond the ability to simply comprehend information, health literacy encompasses health education and an individuals' ability to use that information correctly and effectively.⁵⁴

Australia's 'Know Your Bones' programme has gained international recognition for the accomplishments made in bone health education and awareness. In 2016, Osteoporosis Australia and the Garvan Institute of Medical Research launched an initiative offering a self-assessment tool for individuals to understand their risk of osteoporosis and fractures. The tool is built on the world's longest running large-scale osteoporosis study, which has improved understanding of a combination of risk factors.⁵⁵ The tool empowers individuals to discuss their assessments with their physician, as well as make healthy decisions, such as modifying lifestyle factors. To further the efficacy of the initiative, Osteoporosis Australia created national ambassadors comprising famous sports people to spread the 'Know Your Bones' message. This was done in an effort to appeal to younger populations and demonstrate the importance of preventing poor bone health at an early age. Bone Health New Zealand was able to build on Osteoporosis Australia's 'Know Your Bones' initiative in creating a similar model for its citizens, demonstrating the transferability of such programmes from country to country.

In countries with low levels of civil society involvement a more effective strategy could be to start with general awareness of bone health at all levels of care. Kenya supports the annual World Osteoporosis Day on October 20th through activities led by the organisation Kenya Osteoporosis Prevention and Age Concern (OPAC). In addition to celebrating World Osteoporosis Day, OPAC works to spread awareness among health providers by partnering with nursing schools to develop

courses on osteoporosis.⁵⁶ The courses are virtual, thereby allowing nurses to remain in their regions and better serve their community with their new knowledge as opposed to congregating in large cities, where nursing schools are typically located. These knowledge sharing initiatives are one way to lay the foundations for an integrated care pathway for bone health.

Another strategy to create an environment conducive to bone health is to utilise the influence and breadth of medical societies. These societies are able to invigorate and strengthen patient societies through the formation of strong partnerships. The Argentine Society for Osteoporosis has helped organise an Association for Patients with Osteoporosis (SAPCO) which has become increasingly involved in awareness efforts throughout the country.⁵⁷ The transfer of knowledge can be effective regardless of who initiates the education; the important component of these programmes is that someone steps in as a champion for bone health.

The United States-based organisation, American Bone Health, implements cross-cutting education strategies to reach individuals through pre-established channels. It has partnered with the prominent breast cancer advocacy organisation Susan G. Komen to educate the public about the risks and dangers of osteoporosis and osteoporotic fractures. Partnerships with other chronic disease organisations can be creative and successful opportunities to conceptualise risks for a greater number of people, encouraging them to take action. When health literacy is improved through effective education campaigns like the ones discussed, the health system can reap the benefits for years to come.

The covid-19 pandemic has reinforced the critical importance of health literacy. The inability to use health information correctly and effectively risks a surge in poor bone health due to osteoporosis and osteoporotic fractures in the wake of the pandemic. As resources for chronic diseases have been reallocated to fight the pandemic, many individuals have lost access to routine care which is detrimental to bone health.⁵⁸ Since the onset of the pandemic FRAX[®] usage has dropped, FLS services have been scaled back or halted, and medications requiring injection have been limited.⁵⁸⁻⁶⁰ Covid-19 has been shown to be a significant risk factor for people who have recently undergone surgery for a fracture and people have had to manage poor bone health independently, which means they must be equipped to carry on with such things as their treatment regimen, exercises and healthy lifestyles without the routine input they received from healthcare professionals in a pre-pandemic world.^{61, 62}

Payors: reimbursement strategies built on robust data

The provision of quality care for bone health must be incentivised and adequately reimbursed or bone health will continue to be under-prioritised. Primary care providers are responsible for addressing so many aspects of life and health in their visits with patients that they seldom think about enquiring whether or not a patient is at risk of poor bone health.⁶³ Further exacerbating this time constraint is the reality that primary care providers are frequently not incentivised appropriately through the health system.

Countries using a reimbursement system where healthcare providers are paid for each service performed, defined as fee-for-service, frequently struggle with overuse and underuse of appropriate services. Overuse refers to care that consumes health resources without adding value to patients.⁶⁴ Underuse, conversely, is "the failure to use effective and affordable medical

interventions".⁶⁵ Both are dangerous to patient health, and a fee-for-service system fosters their growth by incentivising high quantity and low quality care. In a fee-for-service system unreimbursed services are frequently not provided to patients because there is little or no reward for delivering holistic and value-based care.⁶⁶ Reimbursement schemes should be in alignment with quality care by ensuring diagnostic procedures and treatments for bone health are part of a guaranteed benefits package.

Countries such as the United Kingdom have experienced great success with offering a Best Practice Tariff in which hospitals receive compensation if they meet defined quality standards.⁶⁷ In 2007, England published the Blue Book, a comprehensive guide to caring for patients with osteoporotic fractures. The Blue Book was created with input from an array of experts and societies from a range of specialisations.⁶⁸ Alongside this landmark publication the United Kingdom also launched the National Hip Fracture Database.⁴⁸ The effective data feedback allows policymakers to ensure hospitals are providing quality care while properly recognising physicians for their work through the remuneration they receive. Though fracture registries are important tools and should be a goal for all countries to work towards, utilising data from other countries to create and establish a benchmark can be an effective temporary solution. Brazil became the largest country in Latin America to implement a fracture risk assessment tool (FRAX®) in 2013 by using smaller epidemiologic studies in combination with Swedish data to estimate incidence rates of fractures.⁶⁹ The Swedish data was used as a proxy where Brazilian data was unavailable to produce more accurate assessment results. Though it has limitations, this adapted tool serves as an example of the benefits of sharing robust data worldwide to accelerate progress towards good bone health.

Standard national reimbursement practices are challenging if data are not collected consistently and uniformly. Experts note that any integrated care pathway for chronic disease must be clear, useable and flexible to enable modifications in response to evaluation and fostering improvement.⁷⁰ Several initiatives have emerged to address this issue. FFN has created a Minimum Common Dataset to serve as standard indicators that can foster international collaboration.⁷¹ Ultimately, the healthcare system determines which conditions are prioritised with the reimbursement structure for physicians based on collected data. These are fundamental decisions that can shape health policy for decades; therefore, it is vital that health systems are organised to deliver the highest quality of patient care.

Policymakers: levers supporting integrated care pathways

Raising awareness among decision-makers is critical to ensure they are better attuned to what clinicians need to provide the highest standards of care for their patients. Conveying an improved understanding of the health and economic consequences of poor bone health to policymakers is paramount. WHO's Framework on Integrated People-Centred Health Services (IPCHS) is a guide for the practices included in this report. The five strategies of IPCHS are: empowering and engaging people and communities; strengthening governance and accountability; re-orienting the model of care; co-ordinating services within and across sectors; and creating an enabling environment. These strategies are both interdependent and core building blocks of an integrated care pathway for bone health.⁷² The IPCHS goals of promoting equity in access, quality, responsiveness and participation, efficiency, and resilience

are the intended outcomes of creating such a care pathway.⁷² When applied to the creation of an integrated care pathway for bone health these policy levers include:

1. Re-orienting care

- Increase the emphasis on primary prevention to reduce the impact of poor bone health throughout the lifespan: address modifiable risk factors for osteoporosis.
- Establish multidisciplinary bone health teams to holistically address patient needs.
- Implement strategies to identify people at risk before the occurrence of a fracture.
- Equip primary care providers with the appropriate knowledge, guidelines and tools to improve care.
- Implement population health management including proactive outreach to the public to improve health literacy.

2. Co-ordinating services across primary and secondary care

- Develop a shared bone health pathway encompassing care delivered from primary and secondary providers, including guidance on referral pathways.
- Appoint a care co-ordinator to provide consistency throughout the care process.
- Integrate social and public health services into bone health, including rehabilitation services such as physical and occupational therapy.

3. Empowering and engaging the population

- Provide education on bone health to improve health literacy and engagement.
- Engage the public with targeted communications to promote the understanding that poor bone health is avoidable.

4. Strengthening governance and accountability

- Develop clinical leadership within bone health.
- Establish fracture registries to assess the impact of poor bone health at a national level.
- Define bone health outcomes for use in primary and secondary care to measure the quality of care delivered to patients.

5. Creating an enabling environment

- Provide improved training on bone health to health professionals, particularly primary care providers and nurses.
- Incentivise quality outcomes in bone health by ensuring reimbursement schemes are in alignment with quality care.
- Ensure diagnostic procedures and treatments for bone health are part of a guaranteed benefits package.
- Establish effective data collection strategies focused on comprehensiveness and quality.

The burden does not lie solely with policymakers to enact change. However, decision-makers have the unique opportunity to provide leadership on this issue. By deliberately implementing the policies outlined above, countries can foster an environment which allows for the creation and use of an integrated care pathway for bone health which will improve population health while limiting future costs.

Next steps – what can be done?

Call to action

Reducing the health and societal burden of poor bone health is possible through a co-ordinated effort by all stakeholders in the integrated care pathway. Several strategies to achieve such a pathway are described in Table 1, below. No strategy alone will be sufficient to solve this global issue, but each one provides a crucial building block for health systems in pursuit of good bone health.

Table 1

Analysis of the complex interventions used to implement integrated osteoporosis care (IOC): categorisation by means of strategies of the IPCHS Framework of the WHO⁷³

Strategy 1 Empowering and engaging people and communities	Strategy 2 Strengthening governance and accountability	Strategy 3 Re-orienting the model of care	Strategy 4 Co-ordinating services within and across sectors	Strategy 5 Creating an enabling environment	
Patient education	Patient-reported	Population	Introducing referral	Health workforce training by means of personal and	
Self-management	outcomes measures	management at primary care level	and counter-referral		
support	Development of treatment guidline for primary care physicians			postgraduate	
Outreach to the patient		defined roles and responsibilities	Alignment of education of family physicians, pharmacists,	education	
		Introduction of the osteoporosis nurse educator	nurses and physiotherapists		
		Patient follow-up by tele-medicine			

The three main stakeholders in the integrated care pathway each have a vital role to play in utilising the above strategies to create an environment where bone health is recognised as an urgent priority.

• Health professionals. A multidisciplinary approach centred on robust data collection is crucial for good bone health and the provision of care to those with poor bone health. An individual-centric approach (and following diagnosis a patient-centred approach) where providers work in collaboration to utilise available tools for diagnosis and treatment is a critical step in the care pathway. Consistency of design and structure of the health service contribute to optimal outcomes for the patient because these factors foster collaboration throughout the health system.⁷⁴ Successful models of secondary prevention can be applied to primary fracture prevention to help address unmet needs in this area. Case-finding tools to develop

such a model exist; therefore, it is a matter of putting evidence into practice.⁴⁸ Clear lines of communication throughout the referral process are invaluable to the quality of care provided to the patient.

- **Policymakers**. Policy creation to address bone health must consider the value of prevention and early detection. Not only can the health of populations be improved, but the overall cost savings to health systems by preventing poor bone health can dramatically increase. The growth in the number of older people in the coming decades will bring a new wave of care needs that must be addressed through tailored solutions that consider the varied demographic and health system contexts of countries. Cross-governmental partnership led by health professionals is a valuable method to establish well-rounded and holistic policies for improving public health. Various policy options are available to transform health systems into environments where good care for bone health is incentivised through appropriate reimbursement policies and enabled through consistent data collection standards. Doing so can help to establish resilient health systems that are able to meet the care needs of diverse populations for years to come.
- The public. Patient organisations and advocacy groups, in addition to other non-governmental organisations, have developed strategies to educate and engage the public about bone health. Improved health literacy among a population can lead to a better understanding of the risk factors for poor bone health and greater awareness of both pharmacological and non-pharmacological treatment options. When patients are given opportunities to improve their health literacy through successful education and awareness programmes, their ability to assess the risks and benefits of screening and treatment is improved and they can make informed decisions about their own health and wellbeing.⁷⁵ The goal of education and awareness-raising campaigns should be to empower individuals to take action based on knowledge and evidence. The most important message to convey is that osteoporotic fractures are not an inevitability of ageing; it is possible to live a mobile and independent life if preventive measures are started early.

The goal of developing a global integrated care pathway is to create a standard set of best practices for bone health that can be adapted to address the needs of each country within an overarching global approach. A co-ordinated effort to create such a path could improve population health by reducing the burden of poor health, thereby reducing costs for health systems and eventually serving as a model which other chronic conditions could follow for years to come.

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Appendix 1

World Health O	rganization '10	nriorities t	owards a F) acada of	Haalthy	Againg'76
vvoliu nearth O	igamzation io	priorities t	.0 wai us a L	vecaue or i	i i caitii y /	ng cillig

- 1 Establishing a platform for innovation and change
- 2 Supporting country planning and action
- 3 Collecting better global data on healthy ageing
- 4 Promoting research that addresses the current and future needs of older people
- 5 Aligning health systems to the needs of older people
- 6 Laying the foundations for a long-term care system in every country
- 7 Ensuring the human resources necessary for integrated care
- 8 Undertaking a global campaign to combat ageism
- 9 Defining the economic case for investment
- 10 Enhancing the global network for age-friendly cities and communities

Source: World Health Organization, 2017.

Appendix 2

Osteoporosis, risk of fractures and falls.³⁶

Full pathway for osteoporosis and fracture risk screening programmes in primary care settings.



Source: Unidade Coordenadora de Reumatologia do Centro, 2020.

Translated from the original Portuguese by The Economist Intelligence Unit

Appendix 3

S.C.

FLS care pathway⁴⁴



Appendix 4

Patient-centred and cohesive osteoporosis care pathway

Secondary prevention after fracture (inpatient and outpatient care) Osteoporosis care pathway for patients in inpatient care⁴²



Source: Nationellt System för Kunskapsstyrning Hälso - och Sjukvård, 2020.

Patient-centred and cohesive osteoporosis care pathway

Secondary prevention after fracture (inpatient and outpatient care) Osteoporosis care pathway for patients in outpatient patient care⁴²



Source: Nationellt System för Kunskapsstyrning Hälso - och Sjukvård, 2020.

Integrated care pathways for bone health An overview of global policies

32

Appendix 5

Patient-level KPIs for FLS programmes⁴⁴

	Indicator	Numerator	Denominator	
1.	Identification of patients with non- spine fragility fractures	Total number of patients with non- spine fragility fractures identified	Expected local non-spine fragility fracture caseload	
2.	Identification of patients with spine fractures	Number of patients with spine fractures identified	Number of hip fracture patients	
3.	Initial investigation (including fracture risk assessment) within 12 weeks of the sentinel fracture	Number of patients assessed within 12 weeks of the sentinel fracture	Total number of patients identified	
4.	DXA within 12 weeks of the sentinel fracture	Number of patients with date of DXA within 12 weeks of the sentinel fracture	Number of patients for whom DXA is recommended according to regional or national guidelines	
5.	Falls risk assessment	Number of patients with a falls assessment or screen performed, recommended, or referred to or already under a falls service	Total number of patients identified	
6.	Anti-osteoporosis medication (AOM) recommended as appropriate	Number of patients with a treatment recommendation as clinical decision to treat	Total number of patients identified	
7.	Recorded follow-up within 16 weeks post index fracture	Number of patients followed up post index fracture	Total number of patients referred or recommended AOM minus patients who have died	
8.	Commenced AOM by 16 weeks post index fracture	Number of patients commenced or continuing AOM within 16 weeks of date of fracture	Number of patients with a treatment recommendation to start AOM or referred to GP or referred to another clinician minus patients who have died	
9.	Strength and balance training commenced within 16 weeks of fracture	Number of patients initiating an evidence-based strength and balance class within 16 weeks of the date of fracture according to regional or national guidelines	Number of patients with a falls assessment performed, recommended, referred for less those already under falls service, minus patients who have died	
10.	Patients taking AOM 52 weeks after the sentinel fracture	Number of patients still taking AOM 52 weeks after the date of sentinel fracture	Number of patients with a treatment recommendation to start AOM or referred to GP or another clinician, minus patients who have died	
11.	Data completeness	Number of KPIs 1–10 with more than 80% complete data	10 KPIs	

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