Bending the Curve with Patient Identification and Treatment in Osteoporosis

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Background

- Two million Americans suffer an osteoporotic fracture every year, often causing significant morbidity, reductions in quality of life, loss of independence, and mortality.[1]
- Such fractures contribute to high costs to payers ($22 billion) and result in substantial indirect costs (e.g., informal caregiving).[1]
- This economic and clinical burden is driven by inadequate diagnosis and treatment of high-risk individuals.
- Given an aging population and recent decrease in utilization of preventive measures, this burden is expected to rise.[2]
- Policy-driven expansion of case-finding [e.g. dual-energy X-ray absorptiometry (DXA)] and treatment (e.g. pharmacologic therapies) of high-risk women could lower this burden.
- While previous analyses have projected the future economic and clinical burden of osteoporotic fractures, they have not considered how interventions may impact projections.[2-6]

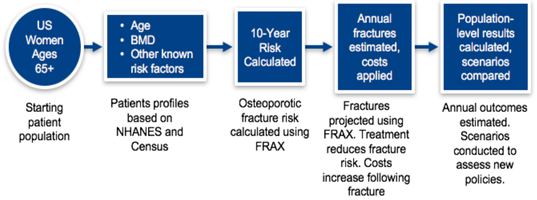
Objective

- We aimed to project the fracture burden in US women 65+ years old given policy changes and various interventions.

Methods

- A microsimulation forecasting model was developed to project the burden of osteoporosis from 2018 to 2040 **(Figure 1)**.
- We assessed hypothetical cohorts of 10 million US women ages 65 years and older annually, and estimated total fractures and direct and indirect costs with or without potential hypothetical policy changes.

FIGURE 1: PATIENT FLOW THROUGH THE MODEL



BMD, bone mineral density; FRAX, Fracture Risk Assessment Tool; NHANES, National Health and Nutrition Examination Survey.

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- Risk factor prevalence was estimated from analyzing NHANES,[7] a nationally-representative population-based survey conducted every 2 years **(Table 1)**.

TABLE 1. POPULATION CHARACTERISTICS FROM NHANES

Variable	2014 Value
Mean Femoral Neck T-score	-1.57
Previous Fracture (Rate of Event)	14%
Parent History of Hip Fracture (Rate of Event)	12%
Long-term Glucocorticoid Therapy (Utilization Rate)	9%
Rheumatoid Arthritis (Prevalence)	9%
Cigarette Smoking (Utilization Rate)	8%
Excessive Alcohol Use (Utilization Rate)	3%

- Fracture risks for individual women in the model was estimated using FRAX simplified tables.[8]
- Model inputs, including costs and healthcare utilization rates, were based on published literature and pricing databases **(Table 2)**.
- Treatment was assumed to be a market basket of available branded and generic therapies, and simplifying assumptions were made related to included products, changes in pricing, and loss of exclusivity.

TABLE 2. COST INPUTS

Model Input	Value	Source
Costs		
Preventive Costs		
DXA Screening	$40.00	(2018 Physicians' Fee & Coding Guide, 2018)[9]
Weighted Average Wholesale Acquisition Costs	$27.80	(Wolters Kluwer, 2018)[10]
Direct Medical Costs (Per Fracture)		
Without Subsequent Fracture	$20,474.00	(Weaver, Sajjan, Lewiecki, Harris, & Marvos, 2017)[11]
With Subsequent Fracture	$34,899.00	(Weaver, Sajjan, Lewiecki, Harris, & Marvos, 2017)[11]
Indirect Medical Costs (Per Fracture)		
Productivity Losses	$1,956.00	(Pike et al., 2010)[12]
Caregiver Costs	$1,770.60	(Vanness & Tosteson, 2005);[13] (Wiktorowicz et al., 2001);[14] (Bureau of Labor Statistics, 2018)[15]
Screening and Treatment Utilization		
DXA (% of Population by Year)	11.3%	(Lewiecki et al., 2016)[16]
Any Treatment (% of Population by Year)	8.6%	Amgen Data on File
Weighted Average Medication Effectiveness (RR: Hip)	0.837	(Freemantle et al., 2013)[17]
Weighted Average Medication Effectiveness (RR: Non-Hip)	0.849	(Freemantle et al., 2013)[17]
Probability of Treatment Following DXA	44%	(King et al., 2005)[18]

DXA, dual-energy X-ray absorptiometry; RR, risk ratio.

- Scenarios, varying by policies aiming to increase diagnosis and treatment, were compared to the status quo to estimate the potential benefits of encouraging and improving methods of case finding, and incentivizing the appropriate use of treatment among high-risk women.

Results

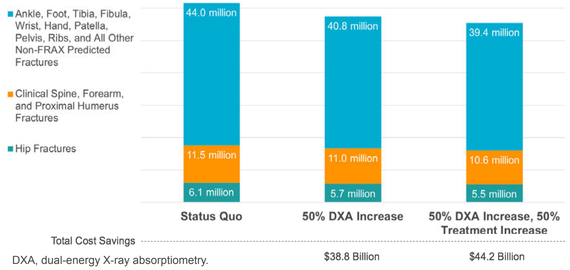
- Given anticipated population aging and growth, annual osteoporotic fractures were projected to increase from just under 2 million to over 3.2 million from 2018 to 2040, an increase of 68%.
- Societal costs related to fracture prevention and treatment are expected to rise from $52 billion in 2018 to over $87 billion in 2040, however some of these are preventable.
- If interventions that increase case finding were implemented, the economic and clinical burden could be reduced.
- Policy-driven increases in case finding of high-risk women could substantially decrease the clinical burden, preventing up to 4.2 million fractures over the next 22 years compared to status quo **(Table 3, Figure 2)**.
- Even with increases in costs associated with additional case finding and treatment, preventive services would represent less than 6% of total costs of osteoporosis **(Figure 3)**.

TABLE 3. COMPARISON OF COSTS AND FRACTURES WITH AND WITHOUT ADDITIONAL PREVENTIVE SERVICES

Variable	2018-2023	2018-2025	2018-2028	2018-2033	2018-2040
Total Fractures					
Varying Age and Population Size (Rate of DXA: 11.3%)	10,339,728	17,437,985	22,558,073	36,598,591	61,603,120
50% DXA Increase[a]	9,701,568	16,342,149	21,125,280	34,199,520	57,449,128
50% DXA Increase, 88% Treated	9,371,342	15,785,017	20,403,148	33,026,495	55,457,460
Total Costs (Billions)					
Varying Age and Population Size (Rate of DXA: 11.3%)	$281.8	$475.0	$614.3	$995.8	$1,674.6
50% DXA Increase[a]	$276.8	$466.1	$602.5	$974.7	$1,635.9
50% DXA Increase, 88% Treated	$276.3	$465.2	$601.1	$972.2	$1,630.4

DXA, dual-energy X-ray absorptiometry.
[a] Assumes total proportion of women scanned increases to 61.3%, and 44% are subsequently treated.

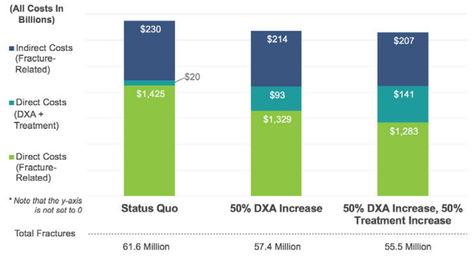
FIGURE 2. COMPARISON OF FRACTURES BY SITE FROM 2018 TO 2040 WITH INCREASED CASE FINDING AND TREATMENT



DXA, dual-energy X-ray absorptiometry.

- Increases in case finding and treatment could reduce payer costs by $21 billion and total societal costs by $44 billion over the next 22 years through the prevention of 6.1 million fractures **(Table 3, Figure 3)**.

FIGURE 3. COMPARISON OF DIRECT AND INDIRECT COSTS FROM 2018 TO 2040 WITH INCREASED CASE FINDING AND TREATMENT



DXA, dual-energy X-ray absorptiometry.

Conclusions

- Given a growing population of postmenopausal women in the US and increasing longevity, there is an expected rise in the economic and clinical burden of osteoporotic fractures.
- To prevent this rapid growth in fractures, emphasis must be placed on identifying and treating high-risk individuals.
- Our analysis found that such measures would simultaneously reduce the clinical burden while reducing costs, unlike many other disease areas where improving outcomes requires higher spending.

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