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Osteoporosis in Men: Update of a European Perspective

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Evidence-based guidelines

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Evidence-Based Guideline for the management of osteoporosis in men

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Age- and sex-specific incidence of radiographic vertebral, hip and distal forearm fractures



Sambrook et al Lancet 2006



A systematic review of hip fracture incidence and probability of fracture worldwide

Ten-year probability of a major fracture (in percent) in men and women aged 65 years with a prior fragility fracture (and no other clinical risk factors) at the threshold of osteoporosis as judged by BMD at the femoral neck (i.e. a T- score of -2.5 SD). The body mass index was set at 24 kg/m2



Kanis et al Osteoporos Int 2012

10 year probability (%)



Trabecular Bone – Age Related Loss Differs Between Men and Women



Aaron et al Clin Orthop Rel Res 1987

Adapted from Seeman E., J Appl Physiol 2003



Mortality Risk Associated With Low-Trauma Osteoporotic Fracture and Subsequent Fracture in Men and Women

Figure 2. Mortality Rates for the General Population and Fracture Participants According to Age





Age ≥75 Years







Bliuc et al JAMA 2009



A Prospective Study on Socioeconomic Aspects of Fracture of the Proximal Femur

	Odds ratio	
Patients returned to private housing 1 year after fracture ^d		
age (per 10 years)	0.37	(0.25-0.55)
male gender	0.39	(0.17-0.91)
living circumstances (alone vs. couple or family)	0.47	(0.25 - 0.90)
general health condition (bad vs. good)	0.22	(0.10-0.49)



Factors which influence vertebral fracture detection on X-ray





Vertebral fractures predict subsequent fractures



Fig. 1. Cumulative incidence of any subsequent fracture following the initial vertebral fracture among Rochester, Minnesota, women and men in 1985–94.



Effect of gender on the evolution of pain and quality of life after treatment of symptomatic vertebral fragility fractures





Algorithm for the management of patients at low, high and very high risk of osteoporotic fractures



Kanis et al Osteoporos Int 2020



BMD and Fracture in Women and Men

Age-adjusted incidence of hip fracture in men and women according to the T-score for femoral neck BMD

Incidence (rate/100,000) 1000 🔶 Men 800 --- Women 600 400 200 0 -2.0 -4.0 0.0 2.0 4.0 T-score (SD)

Kanis et al Osteoporos Int 2011



Evidence-Based Guideline for the management of osteoporosis in men

Recommendation:

- A female reference database should be used for the densitometric diagnosis of **Strong** osteoporosis in men.
- FRAX is the appropriate tool for the assessment of fracture risk and as the basis for Strong setting intervention thresholds in men with osteoporosis.
- FRAX-based intervention thresholds should be age dependent in men with osteoporosis. **Strong**
- All men with a prior fragility fracture should be considered for treatment with anti- Strong osteoporosis medications.



Analysis of daily teriparatide treatment for osteoporosis in men



Osteoporos Int 2015



Osteoporosis treatment prevents hip fracture similarly in both sexes: the FOCUS observational study

Healthcare system to compare the reduction in hip fractures associated with standard-of-care osteoporosis treatment in men versus women. n=271'389 patients aged ≥ 65 yrs

Table 3. Odds ratio (adjusted and crude) of hip fracture associated with osteoporosis treatment (treated vs not-treated patients; and partially-treated vs not-treated patients) for each sex at two-year follow-up.

		Adjuste	d odds ratio (95% CI)	Crude odds ratio (95% CI)		
Treated vs not-treated	Women					
	Women	0.26	0.21-0.33	0.25	0.19-0.31	
	Men	0.21	0.13-0.34	0.25	0.16-0.39	
	Men:Women ^a	0.81	0.47-1.37	1.00	0.60-1.66	
Partially-treated vs not-treated						
•	Women	0.90	0.69-1.18	0.99	0.77-1.27	
	Men	0.69	0.40-1.21	0.85	0.51-1.42	
	Men:Women ^a	0.77	0.41-1.42	0.86	0.49-1.52	
	Wien: women	0.77	0.41-1.42	0.00	0.4/-1.52	



Efficacy of osteoporosis pharmacological treatments in men: a systematic review and meta-analysis

Study

95%-CI Weight

MD

Experimental

Total Mean

SD Total Mean

Control

SD

Mean Difference

-5

0

Bisphosphonates

and BMD in men

5

MD

1.90

5.40 [2.63; 8.17]

2.00 [0.19; 3.81]

2.60 [1.35; 3.85]

3.30 [-0.21; 6.81]

[0.48; 3.32]

2.53 [1.76; 3.31] 44.9%

1.25 [0.13; 2.37] 18.6%

2.60 [1.59, 3.61] 21.2% 1.95 [0.62; 3.27] 39.8%

3.80 [1.07; 6.53] 4.3%

1.44 [-0.15; 3.03] 11.0%

2.26 [1.67; 2.85] 100.0%

95%-CI Weight

4.2%

8.9%

13.2%

15.9%

2.7%

Lumbar spine

Total hip

Bisphosphonate = Alen														Rienhoanha	moto = Alas	NICONOTA -					
Gonnelli 2003	39	8 80 6	2400	38	120.6	1600				- 10.00	17 23	12 771	87%	Connolli 200	nate – Aler	30 4	20	6 2400	30	1 20	6 1600
Hwang 2010	23	5 50 3	3600	23	2 00 3	3600		25	-	3.50	[1.56	5 4 41	10.8%	Gorment, 200.	5	39 4	20	0.2400	20	0.70	2 280/
Miller 2004	109	4 28 4	5000	58	1 45 4	1000		-		283	1 48	4 181	12 4%	Hwang, 2010		100 2	10	2.0000	23	0.70	3.3000
Orwoll 2000	146	7 10 3	6200	95	1.80 4	8700				5 30	14 16	6 441	12 9%	Onvoll 2004		109 2	50	4.7100	05	0.17	4.3300
Shimon 2005	11	840 6	6300	11	3 30 3	3200		_		5.10	10.72	9 491	5.5%	Chiman 2000		140 2	.00	4.0300	95	-0.10	4.0700
Pandom effects model	328	0.40 0	.0000	225	0.00 0.	0200			-	5 20	12 7E.	7 641	50 2%	Shimon, 2005		200	.90	5.3100	11	-1.40	2.0000
deterogeneity: $l^2 = 83\%$ τ^2	= 6.304	3 p < 0	01	220						0.20	[2.70,	7.04]	00.2%	Heteroneneity	$l^2 = 26\% = 2$	328	1.84	- 0.25	225		
inter og en en er	0.001								3					There is generally.	$1 = E U 10^{1/2}$	0.000	NP.	-0.20			
Bisphosphonate = Rise	dronat	e											1020.000	Bisphospho	nate = Rise	edronate					
Boonen, 2009	191	5.70 5	.5300	93	1.20 5.	7900			-	4.50	[3.09;	5.91]	12.2%	Boonen, 2009)	191 1	.60	4.8400	93	0.35	4,3400
Ringe, 2009	158	6.50 5	5300	158	2.20 5.	5300				4.30	[3.08;	5.52]	12.7%	Ringe 2009		158 3	20	4 8400	158	0.60	4 3400
Random effects model	349			251					*	4.39	[3.46:	5.311	24.9%	Random effe	cts model	349			251		
leterogeneity: $I^2 = 0\%$, $\tau^2 =$	0, p =	0.83									1000	INCOME.	100000000000	Heterogeneity:	$l^2 = 67\%, \tau^3$	= 0.6149,	p = 0	80.0	A \$285		
lanhaanhanata r 7-i	draul-	Anid												Disalian							
sisphosphonate = Zolei	Eeo	7 70 0	7000	811	1 80 0	0000				8 10	14.00	7.241	12.0%	Bisphospho	nate = Zole	aronic A	20	45 7000	200	2.50	45 7000
Joonen, 2012	200	1.70 9	.7000	011	1.00 9.	9000				0.10	[4.99,	1.21]	12.9%	Boonen, 2011		248 1	.30	15.7000	260	-2.50	15.7000
Bisphosphonate = Iban	dronat	e												Bisphospho	nate = Iban	dronate					
Drwoll, 2010	85	3.52 4	.5000	47	0.95 4	1000		1	-	2.57	[1.06:	4.081	12.0%	Orwoll, 2010	110.02 10201	85 1	.21	4,7100	47	-0.23	4.3300
969994 67865	1999) 	2010/02/02	2885UD/58	1255	910300013	0000000				1000						5555 5	0.000	111/12/14/00	20.525	13307058	
Random effects model	1350		9	1134			32 - 32		٠	4.75	[3.45;	6.05]	100.0%	Random effe	cts model	1010			783		
Heterogeneity: $I^2 = 79\%$, τ^2	= 3.092	6, p < 0.	.01				1 1	2				-		Heterogeneity:	$l^2 = 31\%, \tau^2$	= 0.1592,	p = (0.17			
Test for overall effect: $z = 7$.	15 (p <	0.01)					-10 -5	0	5 10					Test for overal	effect z = i	7.53 (p < 0.	.01)				
Test for subgroup difference	ac 2 -	14 33 4	f = 3 (p	< 0.01)										Test for subgro	oup difference	es: $\chi_{2}^{2} = 2$.	90, d	if = 3 (p =	0.41)		
A)	τ. ₂₃ -	Experi	mental	Tatal		Control							Weinha	(B)							
A) Study	Total	Experi Mean	mental SD	Total	Mean	Control SD	M	ean Dif	ference	MD	9	5%-CI	Weight	(B)							
A) Study Bisphosphonate = Alen	Total I	Experi Mean	mental SD	Total	Mean	Control SD	M	ean Dif	ference	MD	9	15%-CI	Weight	(B)							
A) Study Bisphosphonate = Alen Gonnelli, 2003	Total I idronat	Experi Mean 3.90	mental SD 6.2400	Total 38	Mean -0.30	Control SD 6.1600	м	ean Dif	ference	MD 	9	15%-Cl 3: 6.971	Weight	(B)							
A) Study Bisphosphonate = Alen Gonnelli, 2003 Hwana, 2010	Total I Idronat 39 23	Experi Mean 3.90 2.70	mental SD 6.2400 5.2700	Total	Mean -0.30 0.30	6.1600	м	ean Dif	ference	MD 	9 (1.43	5%-CI 3; 6.97]	Weight 4.7% 4.0%	(B)							
A) Study Bisphosphonate = Alen Gonnelli, 2003 Hwang, 2010 Miller, 2004	Total idronal 39 23 109	Experi Mean 3.90 2.70 2.35	mental SD 6.2400 5.2700 3.0900	Total 38 23 58	Mean -0.30 0.30 0.34	6.1600 5.2700 2.8900	м	ean Dif	ference	MD - 4.20 - 2.40 2.01	9 (1.43) [-0.65 [1.07	9 5%-Cl 3; 6.97] 5; 5.45] 7: 2.951	Weight 4.7% 4.0% 18.9%	(B)							
A) Study Bisphosphonate = Alen Gonnelli, 2003 Hwang, 2010 Miller, 2004 Orwell 2000	Total idronal 39 23 109 146	Experi Mean 2.70 2.35 3.10	6.2400 5.2700 3.0900 3.6200	Total 38 23 58 95	-0.30 0.30 0.34 0.60	6.1600 5.2700 2.8900 4.8700	м	ean Dif	ference	MD 	9 9 (1.43) (-0.65 (1.07	5%-CI 3; 6.97] 5; 5.45] 7; 2.95] 5; 3.64]	Weight 4.7% 4.0% 18.9% 16.0%	(B)							
Study Bisphosphonate = Alen Gomelli, 2003 Hwang, 2010 Miller, 2004 Drwoil, 2000 Bandom effects model	Total adronat 39 23 109 146 317	Experi Mean 3.90 2.70 2.35 3.10	mental SD 6.2400 5.2700 3.0900 3.6200	Total 38 23 58 95 214	Mean -0.30 0.30 0.34 0.60	6.1600 5.2700 2.8900 4.8700	M	ean Dif	ference	MD 	9 9 [1.43] [-0.65 [1.07 [1.36	5%-Cl 3; 6.97] 5; 5.45] 7; 2.95] 5; 3.64] ; 3.031	Weight 4.7% 4.0% 18.9% 16.0% 43.7%	(B)							
Study Bisphosphonate = Alen Gonnelli, 2003 Hwang, 2010 Miller, 2004 Orwoll, 2000 Random effects model Heterogenety. / ² = 0%, z ² .	Total adronat 39 23 109 146 317 = 0, p =	Experi Mean 3.90 2.70 2.35 3.10 0.52	mental SD 6.2400 5.2700 3.0900 3.6200	Total 38 23 58 95 214	Mean -0.30 0.30 0.34 0.60	6.1600 5.2700 2.8900 4.8700	M	ean Dif	ference	MD - 4.20 - 2.40 2.01 2.50 2.34	9 (1.43 -0.65 (1.07 (1.36 (1.66	5%-Cl 3; 6.97] 5; 5.45] 7; 2.95] 3; 3.64] 3; 3.03]	Weight 4.7% 4.0% 18.9% 16.0% 43.7%	(B)							
A) Study Bisphosphonate = Alen Gonnelli, 2003 Hwang, 2010 Miller, 2004 Orwoll, 2000 Random effects model Heterogeneity. / ² = 0%, z ² =	Total idronal 39 23 109 146 317 = 0, p =	Experi Mean 2.70 2.35 3.10 0.52	mental SD 6.2400 5.2700 3.0900 3.6200	Total 38 23 58 95 214	-0.30 0.30 0.34 0.60	6.1600 5.2700 2.8900 4.8700	M	ean Dif	ference	MD - 4.20 - 2.40 2.01 2.50 2.34	9 [1.43 [-0.65 [1.07 [1.36 [1.66	5%-Cl 3; 6.97] 5; 5.45] 7; 2.95] 3; 3.64] 3; 3.03]	Weight 4.7% 4.0% 18.9% 16.0% 43.7%	(B)					ſ		
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Study Bisphosphonate = Alen Gonnelli, 2003 Hwang, 2010 Miller, 2004 Orwoll, 2000 Random effects model Heterogeneity, /² = 0%, τ² - Bisphosphonate = Rise Boonen, 2009 Random effects model	Total 39 109 146 317 -0, p = 191 158 349	Experi Mean 2,70 2,35 3,10 0.62 e 2,75 4,40	mental SD 6.2400 5.2700 3.0900 3.6200 4.8400 4.8400	Total 38 23 58 95 214 93 158 251	Mean 0.30 0.34 0.60 0.45 0.40	Control SD 6.1600 5.2700 2.8900 4.8700 4.8700 4.3400 4.3400	M	ean Dif	ference	MD - 2.40 - 2.40 2.50 2.34 2.30 4.00 3.17	9 9 9 [1.43 9 [-0.65 9 [1.07 9 [1.36 9 [1.18 9 [2.99 7 [1.50	5%-Cl 3; 6.97] 5; 5.45] 7; 2.95] 5; 3.64] 5; 3.63] 3; 3.42] 9; 5.01] 1; 4.83]	Weight 4.7% 4.0% 18.9% 16.0% 43.7% 16.3% 17.8% 34.2%	(B)						В	isp
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A) Study Bisphosphonate = Alen Gonnelli, 2003 Hwang, 2010 Miller, 2004 Orwoll, 2000 Random effects model Heterogeneity. <i>I</i> ² = 0%, τ ² - Bisphosphonate = Rise Boonen, 2009 Ringe, 2009 Random effects model Heterogeneity. <i>I</i> ² = 78%, τ ² Bisphosphonate = 7-12	Total 39 23 109 146 317 = 0, <i>p</i> = 317 158 349 = 1,140 dronal	Experi Mean e 3.90 2.70 2.35 3.10 0.62 e 2.75 4.40 7, p = 0	mental SD 6.2400 5.2700 3.0900 3.6200 4.8400 4.8400 03	Total 38 23 55 214 95 214 93 158 251	Mean 0.30 0.34 0.60 0.45 0.40	Control SD 6.1600 5.2700 2.8900 4.8700 4.8700 4.3400 4.3400	м	ean Dif	ference	MD - 2.40 2.50 2.30 2.30 4.00 3.17	9 (1.43) (-0.5) (1.07) (1.36) (1.	5%-Cl 5, 5.45] 7, 2.95] 3, 3.64] 5, 3.03] 3, 3.42] 5, 5.01] 5, 5.01] 5, 5.01]	Weight 4.7% 4.0% 18.9% 43.7% 43.7% 10.3% 17.8% 34.2%	(B)					[B	isp nd
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A) Study Bisphosphonate = Alen Gonnell, 2003 Hwang, 2010 Miller, 2004 Orwoll, 2000 Random effects model Heterogeneity. <i>I</i> ² = 0%, τ ² = Bisphosphonate = Rise Boonen, 2009 Ringe, 2009 Random effects model Heterogeneity. <i>I</i> ² = 79%, τ ² Bisphosphonate = Zole Boonen, 2011 Bisphosphonate = Iban Orwoll, 2010 Random effects model Heterogeneity. <i>I</i> ² = 41%, τ ² Test for norgeneity. <i>I</i> ² = 41%, τ ²	Total I idronal 39 23 109 23 146 317 58 349 51 248 349 51 248 349 51 248 349 51 248 349 51 248 349 51 248 349 51 248 349 51 248 349 51 248 349 51 248 349 51 248 349 51 248 349 51 248 349 51 248 349 51 248 349 51 248 349 51 248 349 51 248 349 51 248 347 51 248 349 51 248 347 51 248 349 51 248 347 51 248 347 51 248 349 51 248 347 51 248 347 51 248 349 51 349 51 349 51 349 51 349 51 349 51 349 51 349 51 349 51 349 51 349 51 51 51 51 51 51 51 51 51 51 51 51 51	Experi Mean e 3.90 2.70 2.35 3.10 0.52 e 2.75 4.40 7, p = 0 Acid 3.50 1 e 1.82 9, p = 0 0,011	mental SD 6.2400 5.2700 3.6200 4.8400 03 5.7000 3.0900 .11	Total 38 23 58 95 214 93 158 251 260 47 772	Mean -0.30 0.34 0.60 0.45 0.40 -0.30 -0.31	Control SD 6.1600 5.2700 2.8900 4.3400 4.3400 4.3400 2.8900	M		ference	4.20 - 2.40 2.50 2.34 2.30 4.00 3.17 - 3.80 2.13 2.13 2.72 6	9) [1.43 [1.07) [1.36) [1.186) [2.99 [1.50] [1.50) [1.07 ; [1.07 ; [2.06	5%-Cl 5,545 7,295 3,364 3,342 3,342 3,342 3,342 7,653 7,653 7,319 1,337 1,337	Weight 4.7% 4.0% 18.9% 43.7% 16.3% 17.8% 34.2% 4.9% 17.2% 100.0%	(B)						B aı	isp nd

Experimental

Total Mean

Control

SD

Mean Difference

SD Total Mean

Femoral neck

(C)

Study



ALENDRONATE FOR THE TREATMENT OF OSTEOPOROSIS IN MEN

Lumbar Spine







Orwoll et al NEJM 2000



Efficacy of osteoporosis pharmacological treatments in men: a systematic review and meta-analysis

Denosumab

044.	T	Exper	imental	Tetel		Control		D:#		MD	050/ 01	18/
study	lotal	Mean	SD	Iotal	mean	SD	Mea	n Differ	ence	MD	95%-CI	weight
Nakamura, 2014	23	7.35	3.3800	24	0.17	3.7020		1	+ 10	- 7.18	[5.15; 9.21]	42.1%
Orwoll, 2012	121	5.70	3.0900	121	0.90	3.3700			-	4.80	[3.99; 5.61]	57.9%
Random effects model	144			145			_			5.80	[3.50; 8.11]	100.0%
Heterogeneity: I ² = 78%, τ [*]	= 2.21	119, p =	0.03						Sec.			
Fest for overall effect: z = 4	1.94 (p	< 0.01)					-5	0	5			

		Exper	imental		(Control							
Study	Total	Mean	SD	Total	Mean	SD	Mean	Diffe	rence	1	٨D	95%-CI	Weight
Nakamura, 2014	23	2.07	3.5400	24	0.24	5.8500		-	r)	1	83	[-0.92, 4.58]	9.4%
Drwoll, 2012	121	2.10	3.6500	121	0.00	3.3800			-	2	10	[1.21; 2.99]	90.69
Random effects model	144			145			 		-	2	07	[1.23; 2.92]	100.0%

(B)

		Experi	imental		1	Control								
Study	Total	Mean	SD	Total	Mean	SD		Mean	Diffe	rence		MD	95%-CI	Weight
Nakamura, 2014	23	2.49	2.9800	24	-0.65	3.1900			1		n -	- 3.14	[1.38; 4.90]	16.9%
Orwoll, 2012	121	2.40	2.5200	121	0.30	2.2400				+		2.10	[1.50; 2.70]	83.1%
Random effects model	144			145						-	а 	2.28	[1.51; 3.04]	100.0%
Heterogeneity: $I^2 = 16\%$, τ^2	= 0.08	88. p =	0.27						1.5		1			
Test for overall effect $z = 5$.84 (p	< 0.01)					-4	-2	0	2	4			

(C)

Teriparatide



(A)

(B)

Study



BMD (A) Lumbar spine (B) Femoral neck (C) Total hip

Abaloparatide

Study	Total	Exper Mean	imental SD	Total	Mean	Control SD		Mean	Difference	MD	95%-CI	Weight
Czerwinski, 2022	149	8.48	6.5900	79	1.17	10.4000			=	7.31	[4.78; 9.84]	59.7%
maisumoto, 2022	14	19.90	12.8900	0	2.10	3.0000				17.10	[0.30, 20.00]	40.376
Random effects model	163			85						11.29	[1.80; 20.78]	100.0%
Heterogeneity: $I^2 = 77\%$, τ^2	= 37.6	061, p =	0.04				. 5				53 DA DA	
Test for overall effect: z = 2	.33 (p	= 0.02)					-20	-10	0 10 20			
0												
-)												
		Expe	rimental			Control						
Study	Tota	Mean	SD	Total	Mea	n SD		Mea	n Difference	MD	95%-CI	Weight
21									W.			3.5
Czerwinski, 2022	149	2.98	4.1500	79	0.1	5 3.9900				2.83	[1.73; 3.93]	62.1%
Matsumoto, 2022	14	6.46	5.6400	6	0.6	1 1.2100			- 10	- 5.85	[2.74; 8.96]	37.9%
Dan dam affects madel	405			0.5						2.00	14 40. 0 051	400.00/
Hatereageneity (2 = 80% =	2 - 24	126	0.07	00				-		3.90	[1.10, 0.00]	100.0%
Test for overall effect: z =	271 (0	430, p = < 0.01	- 0.07					5	0 5			
rootion oronali onoot. e		0.01	/					~	0 5			
- 2007												
3)												
		Expe	rimenta	a		Control						
Study	Tota	al Mea	n SI	D Tota	l Mea	in SD		Mea	n Difference	MD	95%-CI	Weight
Czonwinski 2022	14	9 21	4 3 290	0 79	3 00	01 3 1100			-88- 1	2 13	[1 26: 3 00]	51.1%
AND AND THIS COULD AND AND AND AND AND AND AND AND AND AN												

85

(C)

Random effects model 163

Heterogeneity: $I^2 = 95\%$, $\tau^2 = 6.3197$. p < 0.01Test for overall effect: z = 2.15 (p = 0.03)

Beaudart et al ACER 2023

-6 -4 -2 0 2 4 6

- 3.91 [0.34; 7.49] 100.0%



A Phase III Randomized Placebo-Controlled Trial to Evaluate Efficacy and Safety of Romosozumab in Men With Osteoporosis



Table 2.	Summary of Subject Incidence of
Treatmen	t-Emergent Adverse Events Through
Month 12	2

Adverse event, n (%)	Romosozumab 210 mg QM (N = 163)	Placebo (N = 81)
Any adverse event	123 (75.5)	65 (80.2)
Serious adverse event	21 (12.9)	10 (12.3)
Adjudicated cardiovascular serious adverse event ^a	8 ^b (4.9)	2 (2.5)
Cardiac ischemic event	3 (1.8)	0 (0.0)
Cerebrovascular event	3 (1.8)	1 (1.2)
Death ^{c,d}	2" (1.2)	1 (1.2)
Heart failure	1 (0.6)	0 (0.0)
Death	1 (0.6)	1 (1.2)
Leading to discontinuation of investigational product	5 (3.1)	1 (1.2)

12

77

144

Lewiecki et al JCEM 2018



Efficacy of osteoporosis pharmacological treatments in men: a systematic review and meta-analysis

Summary of the incidence of fractures

First Author	Participants (n) and Treatment/comparator	Study duration	Primary/secondary endpoint	Type of fractures reported	Number of fractures treatment group	Number of fracture con	trol group
Boonen, 2009[19]	Risedronate (n=191)/ Placebo (n=93)	24 months	Secondary endpoint	VF+ all clinical fractures	All clinical fractures: 7 VF: 2	NVF: 6 VF: 0	
Boonen, 2011[6]	Zoledronic acid (n=248) / Placebo (n=260)	24 months	Primary endpoint	All fractures	Incident fractures: 16	Incident fractures: 20	
Boonen, 2012[20]	Zoledronic acid (n=588) / Placebo (n=611)	24 months	Primary endpoint	VF	VF: 9	VF: 28	
Czerwinski, 2022[18]	Abaloparatide (n=174)/ Placebo (n=64)	12 months	Secondary endpoint	VF+NVF	NVF: 1 VF: 0	NVF: 2 VF: 1	-
Kurland, 2000[21]	Teriparatide (n=13) / Control (n=10)	18 months*	Secondary endpoint	VF	VF: 1	VF: 2	
Lewiecki, 2018[5]	Romosozumab (n=163)/ Placebo (n=82)	12 months	Safety	All fractures	Incident fractures: 3	Incident fractures: 2	
Miller, 2004[8]	Alendronate (n=109)/ Placebo (n=58)	12 months	Safety	VF+NVF	NVF: 6 Morphometric VF: 6 Clinical VF: 5	NVF: 1 Morphometric VF: 3 Clinical VF: 3	
Nakamura, 2014[7]	Denosumab (n=23)/ Placebo (n=24)	24 months	Primary endpoint	VF	VF: 0	VF: 2	
Orwoll, 2000[10]	Alendronate (n=146)/ Placebo (n=95)	24 months	Secondary endpoint	VF+NVF	NVF: 6 VF: 1	NVF: 5 VF: 7	
Orwoll, 2003[13]	Teriparatide (n=151) / Placebo (n=147)	12 months	Safety	NVF	NVF: 2	NVF: 3	
Orwoll, 2010[11]	Zoledronic acid (n=154) / Alendronate (n=148)	24 months	Secondary endpoint	VF	VF: 4	VF: 6	
Orwoll, 2010[9]	Ibandronate (n=85) / Placebo (n=47)	12 months	Safety	VF + Clinical fractures	VF: 1 Clinical fracture: 3	VF: 2 Clinical fracture: 0	
Orwoll, 2012[14]	Denosumab (n=111)/ Placebo (n=117)	12 months	Secondary endpoint	VF+NVF	NVF: 1 VF: 0	NVF: 1 VF: 1	
Ringe, 2009[15]	Risedronate (n=158) / Control (n=158)	24 months	Primary endpoint	VF+NVF	NVF: 18 VF: 14	NVF: 33 VF: 35	
Shimon, 2005[16]	Alendronate (n=11) / Placebo (n=13)	12 months	Safety	VF+NVF	NVF:0 VF:0	NVF:1 VF:1	
Walker, 2013[17]	Bisedronate (n=10) / Teriparatide (n=9) / Combined (n=10)	18 months	VF: Secondary endpoint Clinical F: safety	VF + Clinical fractures	VF: 1 Clinical fracture (12 months): 0	Teriparatide: VF: 0; Clin Combined: VF:1; Clinica	ical fracture (12 months) : 0 al fractures (12 months): 1

*fractures assessed at 12 months

VF= Vertebral fracture, NVF= Non vertebral fractures, F= fractures

Beaudart et al ACER 2023

Fracture Risk and Zoledronic Acid Therapy in Men with Osteoporosis



Boonen et al NEJM 2012





Evidence-Based Guideline for the management of osteoporosis in men





Evidence-Based Guideline for the management of osteoporosis in men Recommendation:

- Vitamin D and calcium repletion should be ensured in all men ≥ 65 years.
- Oral bisphosphonates (alendronate or risedronate) are first-line treatments for men at a high risk of fracture
- Denosumab or zoledronate are **second-line** treatments for men at a high risk of fracture. **Strong**
- A sequential therapy starting with a bone-forming agent followed by an anti-resorptive Strong agent should be considered for men at a very high risk of fracture.
- Bone-forming agents should be used in accordance with the recommendations of the regulatory authorities.
- Physical exercise and a balanced diet should be recommended to all men with osteoporosis.

Strong: \geq 75% voters (n=28)

Fuggle et al Nature Rev Rheumatol 2024

Strong

Strong

Strong



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