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**A Cost-effectiveness Analysis  
of the Medications for Osteoporosis**

**2001 8**

-

**A Cost-effectiveness Analysis  
of the Medications for Osteoporosis**

**2001 4**

**2001 6**

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\_\_\_\_\_

HRT (conjugated equine estrogen 0.625mg 25 +  
 medroxyprogesterone acetate 5mg 12 ), Alendronate 5mg,  
 Alendronate 10mg, D(Calcitriol), Calcium -

가 , , ,  
 ,  
 HRT mammography(  
 )  
 (L2-L4)

(Bone Mineral Density, BMD)  
 DEXA (Dual Energy X-ray Absorptiometry)  
 BMD (percent change)

MEDLINE  
 mixed linear model 1  
 50

1 ,  
 Calcium 489,816 가 , HRT  
 558,685 , D Calcitriol 822,316 , Alendronate  
 5mg 836,356 Alendronate 10mg 가 1,010,236  
 가  
 가 (50

)  
, 가 HRT>Alendronate  
10mg>Alendronate 5mg HRT가 가 -  
, 가  
. , 가  
BMD HRT>Alendronate 5mg>Alendronate 10mg  
- . D Calcium

BMD 가

: , - ,  
: 99902-530

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---

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3.		.....	3
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5.		.....	26
6.		.....	27
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9.	1	.....	31
10.	BMD	.....	34
11.	BMD	.....	35
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---

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3.	1	.....	31
4.	BMD	- .....	37
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6.	BMD	BMD .....	40
7.	BMD	BMD .....	40
8.	BMD	- .....	41
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# I.

## 1.

12,000,000  
250,000 , 80%가 가  
40%가 80  
, 80 3 1 6 1  
25% 50%  
가 ,  
2040 2 4  
가 (O'Connell et al, 1996). WHO  
guideline(1998) 1990 130 -160  
, 가  
. 1990 2025 50  
150%, 200% 가  
, 131- 140%, 183%, 200%  
, 가가 2025  
6 가 가  
.  
(1999) 50  
58.8%가 ,

(2001) 40 , 50

42%가

‘OECD 가

(2000)’

50

51.3%

Rowe (1997) 1, 2 50-59 ,  
 60-69 , 70-79 1.5% , 12.5% , 27.3%  
 , (L2-L4) 14.3% , 25% , 33.3% .  
 50-59 , 60-69 , 70-79  
 17.6% , 35.8% , 84.4% , (L2-L4) 32.8% , 62.2% ,  
 88.9% .

1. BMD\*

Age (years)	Men			Women		
	Normal	Osteopenia	Osteoporosis	Normal	Osteopenia	Osteoporosis
20-49	82.5	17.5	0	84.8	14.3	0.9
50-59	54.8	31.0	14.3	26.2	41.0	32.8
60-69	53.1	21.9	25	13.3	24.4	62.2
70-79	33.3	33.3	33.3	0	11.1	88.9

\* Normal, < - 1 SD ; osteopenia, - 1 SD - 2.5 SD ; osteoporosis, - 2.5 SD

2. BMD\*

Age (years)	Men			Women		
	Normal	Osteopenia	Osteoporosis	Normal	Osteopenia	Osteoporosis
20-49	84.2	15.8	0	84.9	15.2	0
50-59	47.7	50.8	1.5	35.3	47.1	17.6
60-69	31.2	56.3	12.5	11.9	52.2	35.8
70-79	13.6	59.1	27.3	0	15.6	81.1

\*Normal, < -1 SD ; osteopenia, -1 SD -2.5 SD ; osteoporosis, > -2.5 SD

(1997) 50  
 552 3  
 50-54 , 55-59 2.9%,  
 7.1%

3.

Age(yrs)	50-54	55-59	60-64	65-69	70-74	75
Osteopenia(%)	11.5	25.0	42.3	47.1	50.9	36.2
Osteoporosis(%)	2.9	7.1	7.7	11.5	23.6	40.4

75 90%가  
 45 50%가  
 가 가 가 가 가  
 가 가  
 가

(Barrett-Connor, 1998).

20                      30                      가                      가                      가

,

.

,

가                      가

가 .

**2.**

.

,

,

monitoring

.

,

(meta analysis)

.

,

.

,

-

## II.

가

### 1. (osteoporosis)

가 가  
(resorption) (formation)  
(bone remodeling) (Marcus, 1989).

10% 가  
(Mundy, 1991).

가 , (porous)  
(Rubin, 1993).

1993 Consensus Development  
Conference 가 가

[骨量]

가

(Conference report. 1993).

## 1.1.

### 1.1.1.

I  
가  
(Rubin, 1993), (vertebral crush  
fracture) Colles' I 가  
(Rubin, 1993). 가  
3 7 가  
II  
65  
II  
가  
(Mundy, 1991).  
(Riggs, 1987).

1.1.2.

가 . 가 . , , I , , cyclosporine, , methotrexate, thyroid hormone( ) ( , 1998).

1.2.

, . . . , , , . SD(Standard Deviation, T score) . 1SD 10-20% . WHO , T score > -1, (Low Bone Mass, Osteopenia) -1 < T score < -2.5, T score < -2.5 . 가 , 가 . 가

가 (QCT, Qunatitative Computerized Tomography), (DEXA, Dual Energy X-ray Absorptiometry), (Single Photon Absorptiometry), (Dual Photon Absorptiometry) . DEXA가 가 가 . ( , 1996).

가 . osteocalcine , alkaline pyridinoline , alkaline phosphatase, creatinine, 1,25(OH)<sub>2</sub> - vitamin D, testosterone, (T SH) ( , 1998).

가 DEXA

## 2.

(antiresorptive) 가 (bone formation stimulator) .

## 2.1. (antiresorptive)

, (bone turnover rate)  
,  
가 . 가가  
( , 1995).

### 2.1.1.

,  
가  
estrogen  
(  
, 1995). NIH Consensus  
Conference on Osteoporosis  
estrogen 1,000mg ,  
1,500mg .

### 2.1.2. Estrogen

가 estrogen  
가 .  
Estrogen  
inter-leukin-6  
,  
1,25(OH)<sub>2</sub>D 가  
. Estrogen 가

5- 15

. Estrogen

5- 10 , estrogen

가 progesterone , estrogen

가 .

conjugated estrogen 0.625mg , 17 -estradiol

1-2mg , 21-25 estrogen

progesterone 10- 14

.

### 2.1.3. Bisphosphonate

Pyrophosphate P- O- P P- C- P

가 .

Bisphosphonate가 pinocytosis 가

apoptosis 가 ,

가 가 가 가 ( , 1998).

Etidronate가 , Clodronate, Pamidronate, Alendronate

가

Alendronate 2-3

가 . 5- 10mg

70mg .

Alendronate 10%

30 - 1

, ,

.

#### 2.1.4. Calcitonin

Calcitonin 32 peptide C  
,  
가 ( ,  
1995). , , FDA  
, I II  
200IU/day가 . remodeling cycle  
2 1  
, 3 3 ( ,  
1998).

#### 2.1.5.

D  
D 가 D  
D  
D 가  
가 ,  
( , 1995). D 1,25(OH)<sub>2</sub> Vit D(calcitriol),  
1(OH) Vit D(alphacalcidol) 가 가 . Calcitriol 0.5µg  
/day가 .

### 2.2. (Bone Formation Stimulator)

가

가 .

가 가 , 가 가 .

,

.

sodium fluoride, parathyroid hormone,  
coherence therapy, growth hormone, growth factors ( ,  
1995).

### 3. 가

#### 3.1. 가

가(economic evaluation)

,

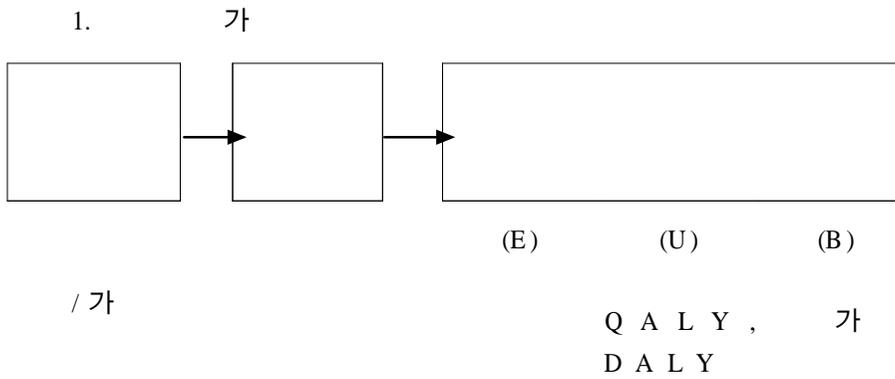
가

( , 1999).

.

가

.



가 .

가 ( ) 가

(Drummond, 1980).

가 가 ,

가 . 가 가 가 가

가 가 ,

가 가

(Drummond, 1980).

3.1.1. - (Cost-Effectiveness Analysis)  
 가 -  
 - . -  
 가  
 가 가  
 Piachaud Weddell  
 가 ,  
 3 4

(Piachaud and Weddell, 1972).

CEA 가  
 .  
 (Culyer et al, 1981)  
 (Russell, 1977)  
 .  
 가  
 가

3.1.2. - (Cost-Utility Analysis)  
 CEA - ,  
 (Quality Adjusted Life-Years : QALYs) ,  
 (Healthy Years Equivalent : HYE) .  
 가  
 가 ‘ QALYs ’  
 가 (utility)

Klareman

4

3

5

. 1 2,600\$ 가 가 , QALY  
2,600\$ x 4/5 = 2,080\$가 (Klareman et al, 1968).

- 가

가

,

,

.

,

가

- 가

(Drummond et al, 1997).

### 3.1.3. - (Cost-Benefit Analysis)

CEA

가

가

. 3가

가 ,

57 4

가

. 500 , 1000 , 1500

500 가

가 가 가

- ( , 1999). - (CBA)

가 가

.

가

가

, spill-over . CBA CEA

가 가가  
( , 1999).

### 3.2.

-

#### 3.2.1. (Decision Analysis)

(game theory)  
( , 1996).

가 ( , 2000).

가 (transition state)  
(Markov model)  
(Petitti, 1994).  
가 (Markov chain model)

(Markov process model)

QALY DALY 가 ( , 2000).

### 3.2.2. (Meta Analysis)

가 . , , 가 . 가 . , 가 가 . 가 가 ( , 1998). 가 , 가 , ( , 1998).

### 3.3.

#### 3.3.1.

가, ( , , )  
) 가 ,  
, 가,  
( , ),  
, 가 , ,  
(direct cost)  
(indirect cost),  
(intangible cost)  
, ( , , )  
가 가 ,  
, ,  
( , 1999). 가  
가 (tangible cost)  
(intangible cost) 가  
가 , ,  
, .



### III.

#### 1.

가 50  
가

가

가

#### 2.

HRT

(conjugated equine estrogen 25 + medroxyprogesterone acetate 12 )

bisphosphonate Alendronate

Calcium

D (Calcitriol)

### 3.

, ,  
, 50 (KRS)  
가 .  
DEXA (Dual Energy X-ray Absorptiometry) .

### 4.

(1)

,

가

50

(2) 가  
1 가 50 가  
가 1)

(3)  
가 BMD(bone mineral  
density)

5. -  
(HRT, Alendronate, Calcitriol, Calcium)  
가

---

1) Rowe (1997)  
50-59

2.

-

( )
_____
( , , )
_____
( , , )
_____
( )

HRT
Alendronate
Calcium
D

( )
_____
(Bone Mineral Density, BMD)

$$- = ( ) / ( )$$

6.

가

BMD

# IV.

## 1.

### 1.1.

#### 1.1.1.

1  
가 , 가 가 가  
2001.1.1 2) 가 3)  
. 4가 가  
30 가 .

---

2) 8 2 4 24 2 가  
(2000.12.8) ( 2000-67 ).  
3) 가 ,  
가 가 가 가  
가 가 , 가 가 가  
가 가 ,  
2001.1.1 가 1 가 55.4 .



5.

(2001.4.1 ) ( : )

가			
HRT	52,872	110,400	<b>163,272</b>
Alendronate	521,280	110,400	<b>631,680</b>
Calcitriol	333,360	110,400	<b>443,760</b>
Calcium	39,600	110,400	<b>150,000</b>

: Pharm Manager 2000 v2.1,

1.1.2.

$$= [ ( ) + ( 가 4) ) + ( 가 ) ] \times 55.4$$

, 1 50

(Bone Mineral Density, BMD) (Dual energy x-ray absorbtiomerty, DEXA) 1 (DEXA)

4) 가 ( 2000-67 )  
 -30%, -25%, -20%,  
 -15% 가 가  
 , 가  
 가

1 가 , ,  
가 .

6. (2001. 4. 1 )

	( )
( )	5,300 x 12
(30 )	8,390 x 12
(DEXA, 2 )	38,740 x 1
	<b>203,020</b>

: 2001.

1

.

7. (2001. 4. 1 )

HRT	163,272	203,020	<b>366,292</b>
Alendronate	631,680	203,020	<b>834,700</b>
Calcitriol	443,760	203,020	<b>646,780</b>
Calcium*	150,000	164,280	<b>314,280</b>

\* 가

Calcium

Calcium

1.2.

가 가

가

1.2.1.

1995 5) 2001 4 가  
 1 4,550 . 2001 4 가  
 (1995 = 100, 2001 4 = 149.5) 2001.4.  
 6,802 .

1.2.2.

가

, , , , ,  
 ,  
 .  
 50 가 , 가  
 1999 ( ) .  
 50-59 54.5  
 , 790,088 , 218.2  
 54.5 3,651 (1999 ) .

---

5) , , 1995

8. 1

	1)	60	3,651
	2)	34	2,069
/	3)	10	609
	4)	24.6	1,497
		<b>2 8 36</b>	<b>7,826</b>

1) 95

2) 4368

3) 2001.3.15

4) 2000.12.30

1.2.3.

( )

가 3-8 가

가

10

, 가

HRT

Alendronate

bisphosphonate etidronate

가 .

D

D

Alendronate

D

HRT

mammography ( )

HRT

HRT

mammography

가)가 5,490

4

15,097

1,760

16,857

1.2.4.

1

1

Alendronate 10mg

1

가

Calcium

가

HRT

366,292 ,

175,536 ,

16,857

1

558,685 , Alendronate 10mg

834,700 ,

175,536

1,010,236

, Calcitriol

646,780 ,

175,536

822,316

, Calcium

314,280

175,536

489,816

6)

(2001.1.)

9. 1

( : )

HRT*	163,272	203,020	175,536	16,857	<b>558,685</b>
Alendronate 10	631,680	203,020	175,536		<b>1,010,236</b>
Alendronate 5	457,800	203,020	175,536		<b>836,356</b>
Calcitriol	443,760	203,020	175,536		<b>822,316</b>
Calcium**	150,000	164,280	175,536		<b>489,816</b>

\* conjugated equine estrogen 0.625mg 25  
+ medroxyprogesterone acetate 5mg 12

\*\* 1900mg/day

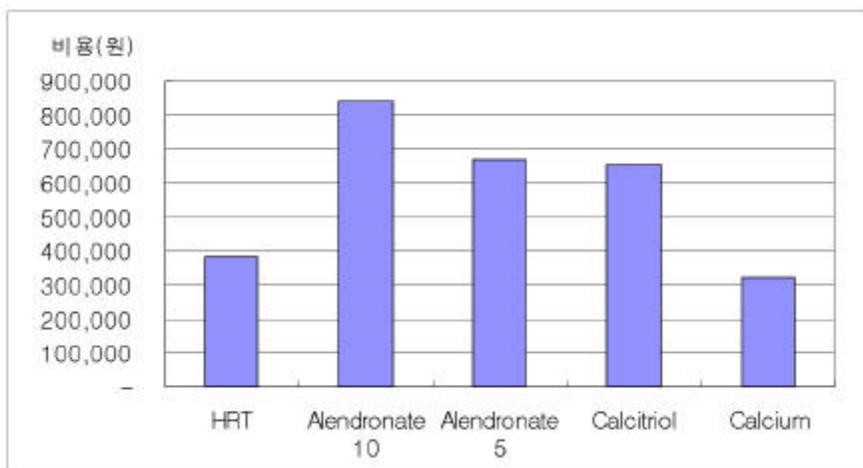
가

가

Calcium Alendronate 10mg

, 가

3. 1



2.

(L2-L4) BMD  
 BMD  
 가  
 1990 1 2000 12  
 MEDLINE  
 , 50  
 , 가  
 ,  
 , BMD 가  
 , BMD DEXA  
 HRT  
 21 (1938 ), Alendronate 9 (1,404  
 ), D 11 (1003  
 ), Calcium 9 (273 )  
 가  
 가  
 mixed linear model<sup>7)</sup> BMD

7) mixed linear model GLM procedure standard linear model  
 fixed effects parameter random effects parameter가

the SAS®  
 system v8.1 proc mixed procedure

MEDLINE

가

(extrapolation)

가

mixed linear model

1

, BMD

## 2.1. BMD

### 2.1.1. BMD

BMD

(p<0.05)

( 3 ).

HRT

$$Y = + \text{Age} + \text{Initial BMD}$$

Alendronate

$$Y = + \text{Age} + \text{Log(Dose)} + \text{Initial BMD}$$

$$Y = + \text{Age} + \text{Initial BMD}$$

Calcium

$$Y = + \text{Age} + \text{Log(Dose)} + \text{Initial BMD}$$

Y : BMD

Age : , year

Dose : , mg/day

Initial BMD : BMD , g/cm<sup>2</sup>

가 54.5 (L2-L4) 0.99

18)

10. \* BMD

HRT	3.24
Alendronate 10	2.92
Alendronate 5	2.21
D	-1.57
Calcium **	-7.78

\*L2-L4

\*\*1900mg/ day

2.1.2. BMD

BMD

(p<0.05) ( 3 ).

HRT	
Y =	+ Age + Initial BMD
Alendronate	
Y =	+ Age + Log(Dose) + Initial BMD
D	
Y =	+ Age + Initial BMD
Calcium	
Y =	+ Age + Log(Dose) + Initial BMD

8) Rowe (1997)

Y : BMD

Age : , year

Dose : , mg/day

Initial BMD : BMD , g/cm<sup>2</sup>

50-59 ( 54.5 ) BMD

0.8349)

11. BMD

HRT	0.99
Alendronate 10	0.76
Alendronate 5	0.57
D	-2.1
Calcium*	-2.92

\*1900mg/day

가 BMD

, HRT	BMD	3.24%, Alendronate 10mg
BMD	2.92%, Alendronate 5mg	BMD
2.21%,	D	BMD -1.57%, Calcium
(1900mg/day)	BMD	-7.78% . Calcium

, D

9) Rowe (1997)

가 BMD  
HRT 0.99%, Alendronate(10mg/ day)  
0.76%, D -2.1%, Calcium (1900mg/ day)  
-2.92% 가 D  
Calcium BMD  
HRT  
Alendronate HRT  
BMD Alendronate

**3. -**

**3.1. BMD -**

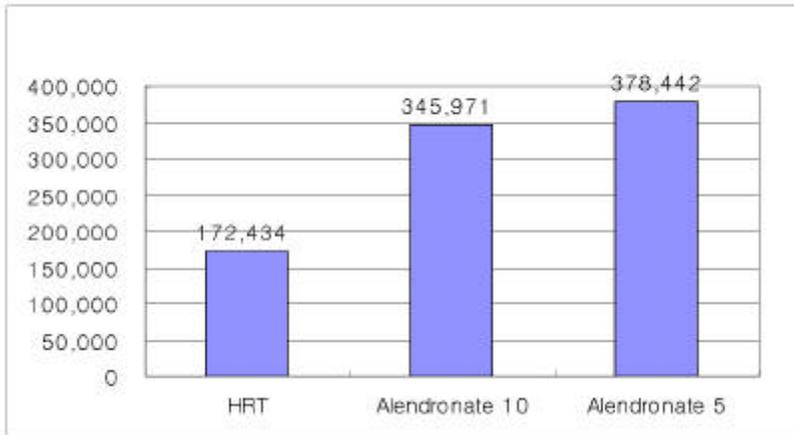
3.1.1. BMD -  
BMD 1

12. BMD -

	1	(C) BMD	(E)	/ (C/E)
HRT *	558,685	3.24	172,433.64	
Alendronate 10	1,010,236	2.92	345,971.23	
Alendronate 5	836,356	2.21	378,441.63	

\* HRT conjugated equine estrogen 0.625mg 25  
medroxyprogesterone acetate 5mg 12

4. BMD -



3.1.2. BMD -

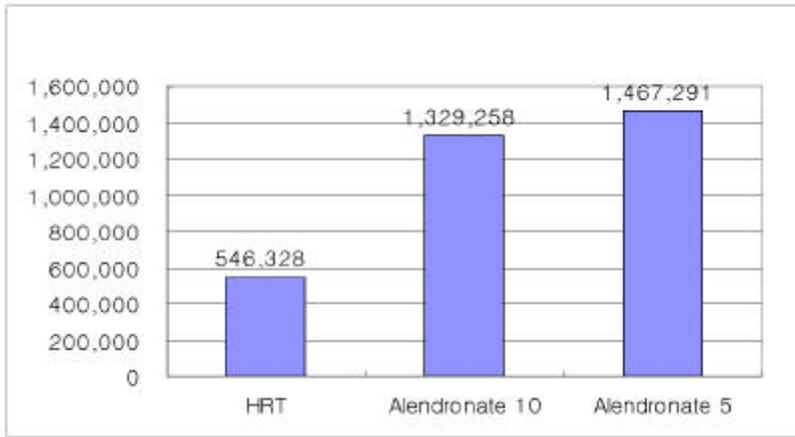
BMD 1

- .

13. BMD -

	1	(C) BMD	(E)	/	(C/E)
HRT	558,685	0.99			546,328.28
Alendronate 10	1,010,236	0.76			1,329,257.89
Alendronate 5	836,356	0.57			1,467,291.23

5. BMD -



BMD HRT > Alendronate 10mg > Alendronate 5mg  
 5mg , - , HRT > Alendronate 10mg > Alendronate 5mg - .

4.

- 1  
 , 가 ,  
 BMD , 가  
 1 가  
 가  
 BMD .  
 BMD 0.891 가 가 BMD  
 0.734 가 가 BMD -

14. BMD 0.891 -				
	1	(C)	BMD	(E) / (C/E)
HRT	558,685		4.00	139,671.25
Alendronate 10	1,010,236		2.55	396,170.98
Alendronate 5	836,356		1.85	452,084.32

15. BMD 0.734 -				
	1	(C)	BMD	(E) / (C/E)
HRT	558,685		1.43	390,688.81
Alendronate 10	1,010,236		1.24	814,706.45
Alendronate 5	836,356		1.05	796,529.52

가 0.1g/cm<sup>2</sup> BMD

HRT 가 4.00%, Alendronate 10mg 2.55%,  
 Alendronate 5mg 1.85% 가 HRT가 1.43%,  
 Alendronate 10mg 1.24%, Alendronate 5mg 1.05% 가

HRT BMD Alendronate  
 가 . HRT BMD 가

,  
 BMD 가 BMD

(0.991:3.24%→0.891:4.00%) .

Alendronate 10mg BMD 0.891 g/cm<sup>2</sup>  
 가 (2.55%)가 0.991 g/cm<sup>2</sup>

가

(2.92%)

BMD

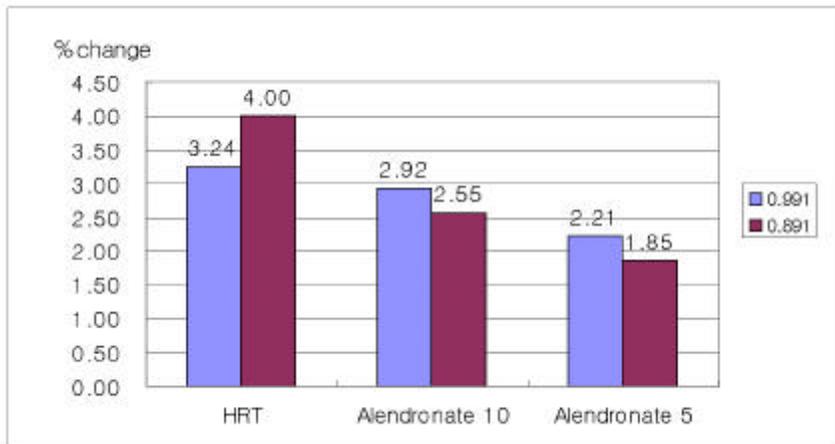
Alendronate

BMD

6.

BMD

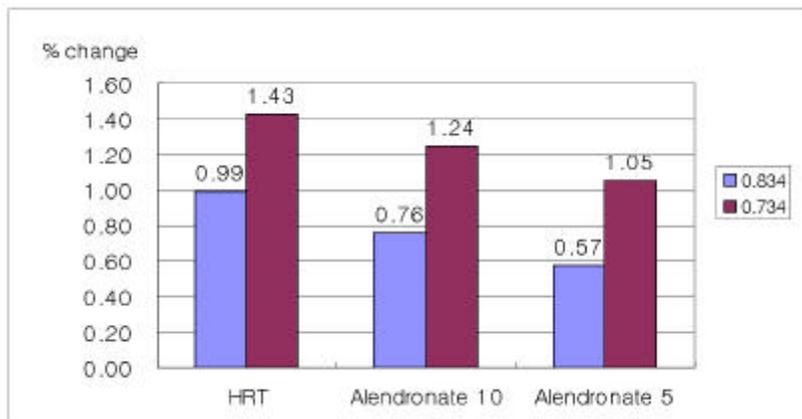
BMD



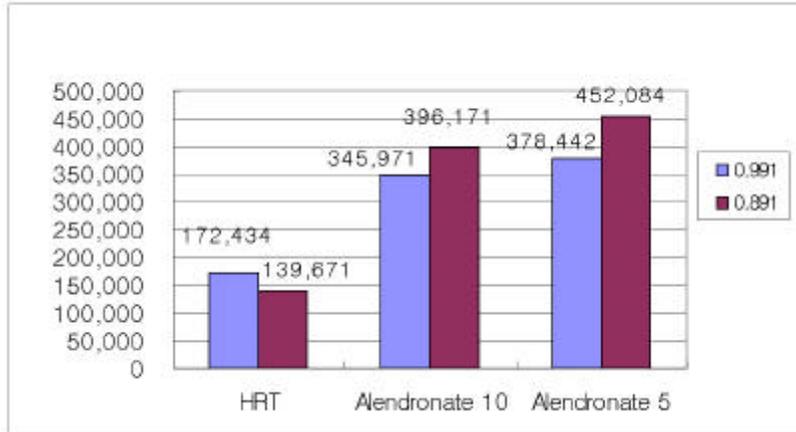
7.

BMD

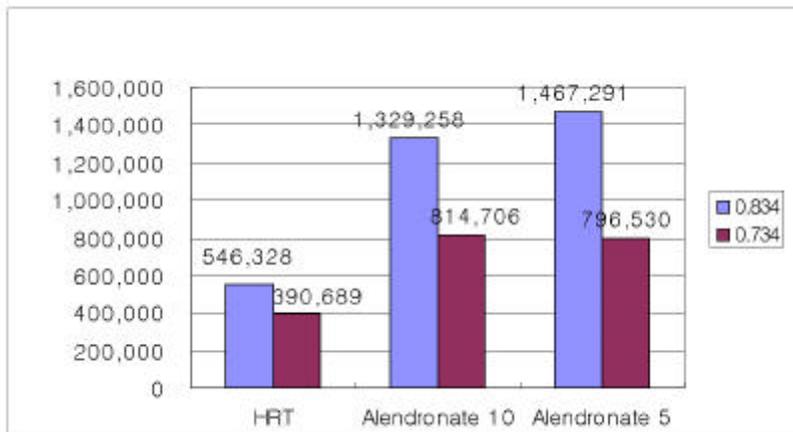
BMD



8. BMD



9. BMD



		, BMD 가			
HRT		BMD 1%		97,743.75	273,409.09
가	-			.	
		BMD 가			Alendronate
5mg	Alendronate 10mg		-		.

# V.

가  
 , , , .  
 가 5-20% 가  
 1 , 50%  
 .  
 가 가 가 .  
 , 50 40% ,  
 13%가

## (National Osteoporosis Foundation)

1995 45  
 가 138 80.4% , 19.6% .  
 62.4% , 28.2% , 9.4%  
 , 가 63.1% ,  
 36.9%가 가  
 ,  
 가  
 Alendronate, D, Calcium 4가 HRT ,  
 .  
 I . 가

가 가 가 가  
 가 가  
 . 가 corticosteroid  
 , 가 , , ,  
 가 .  
 1

MEDLINE

가 .  
 'publication bias'  
 가 가 .  
 osteocalcine  
 pyridinoline, , Alkaline phosphatase, creatinine,  
 1,25(OH)<sub>2</sub> - Vitamin D BMD(Bone  
 Mineral Density) , DEXA  
 mixed linear model  
 , 가 1 50  
 BMD . 가

BMD 가 HRT , Alendronate  
10mg/day, Alendronate 5mg/day , D Calcium

. 가

,

가 가 .

BMD

. BMD 가 HRT , Alendronate  
10mg/day, Alendronate 5mg/day .

,

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,

가

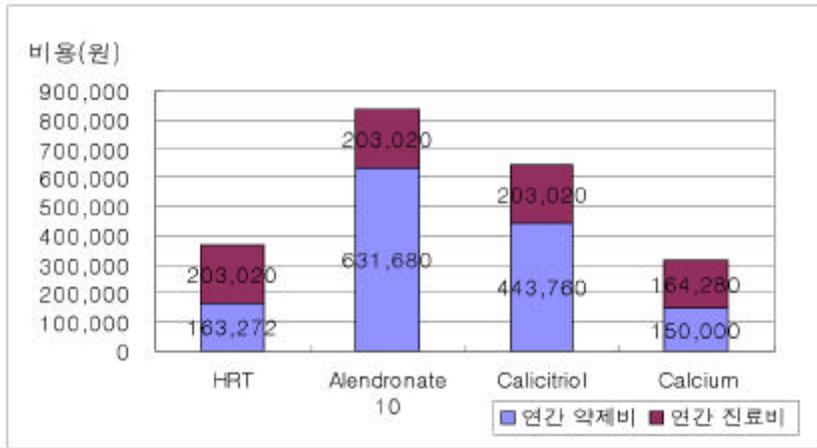
Alendronate 10mg Calcitriol 가

가

. Alendronate 10mg 가

, Calcitriol, HRT, Calcium

10.



HRT 가 172,433.64( / % ) 가  
 Alendronate 10mg 345,971.23( / % ) ,  
 Alendronate 5mg 378,441.63( / % ) . 가  
 BMD  
 가 HRT ,  
 BMD 1% BMD 0.991 172,433.64  
 BMD 0.891 139,671.25 가 .  
 가 HRT -  
 . , Alendronate BMD  
 1% BMD 0.991 10mg 345,971.23  
 5mg 378,441.63 , BMD 0.891  
 10mg 396,170.98 5mg 452,084.32 .  
 BMD 0.734 가 가

Alendronate 5mg 796,529.52( /% ) Alendronate 10mg  
814,706.45( /% ) - .  
Alendronate 10mg 834,700  
Alendronate 5mg 660,820 -  
Alendronate 70mg  
10mg/day  
가 2001.4.1 가 10,136  
10mg/day 가 가  
가 가 - .  
Alendronate 10mg - 1,329,257.89(BMD  
: 0.834) 814,706.45(BMD : 0.734) 가  
가 가 .  
가 가 .  
가 가  
가 가  
(Visentin et al, 1997) Conjugated estrogen 0.625mg,  
Salcatonin(intranasal) 100IU, Alendronate 5mg, Calcitriol 0.5µg  
- 가  
가 C<sub>PAHF</sub>(The Cost per Avoided Hip Fracture)<sup>10)</sup>

10)  $C_{PAHF} = C_{Rx} \times N - C_{Morb} + C_{SE} + C_{RxLE}$

C<sub>Rx</sub> : All direct medical and health-care costs

C<sub>SE</sub> : All health-care costs associated with the adverse side effects of treatment

C<sub>Morb</sub> : savings in health-care, rehabilitation and custodial costs due to the

Conjugated estrogen 0.625mg  
 \$55,736, Salcatonin (intranasal) 100IU \$838,120, Alendronate 5mg  
 \$317,244, Calcitriol 0.5µg \$110,520 HRT가 가  
 . (Ankjaer-Jensen et al,  
 1996) Hip Fracture -  
 Etidronate가 가 HRT, Calcium  
 , Calcitonin 가 .  
 , (Jonsson et al, 1995) -1 SD BMD  
 62 5 hip fracture -  
 cost per QALY \$13,375 , cost per life-year saved  
 \$27,500 , cost per hip fracture avoided \$43,750 .  
 cost per  
 life-year gained 220,000 SEK , 128,000 SEK  
 QALY 105,000 SEK 103,000  
 SEK .  
 Eddy (1990) 가 50  
 (T score -2.375) HRT 5  
 0.84% , 0.55%  
 1.13% 1.11%  
 .  
 가 가 .

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preventing or alleviation of disease

$C_{R\&L\&E}$  : costs of treating diseases that would not have occurred if the patient  
 had not lived longer as a result of the original treatment



## VI.

HRT ,

Alendronate, D, Calcium -

BMD

mixed linear model 가

(BMD 0.991) -

HRT 가 172,433.64( /% ), Alendronate 10mg 345,971.23( /% ), Alendronate 5mg 378,441.63( /% ), (BMD 0.834) - HRT 가 546,328.28( /% ), Alendronate 10mg 1,329,257.89( /% ), Alendronate 5mg 1,467,291.23( /% ) . BMD 가 HRT , -

HRT 가 가 .

## VII.

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[ 1]

1. HRT

	(year)		BMI				BMD				BMD % change						
			(year)	(kg)	(g/cm <sup>2</sup> )	(year)	(g/cm <sup>2</sup> )										
							L2-L4	FN		L2-L4	FN	L2-L4	FN	L2-L4	FN		
Tiras et al	1	31	52.7 ± 5.6		24.2 ± 3.6	4.9 ± 4.6	0.798 ± 0.08	0.742 ± 0.07	0.5	1.88	1.75	1	3.01	3.1			
Eiken et al	10	100					0.962		10	13.2							
Mosekilde et al	5	448	49.5 ± 2.7	68.3 ± 11.9	25.3 ± 4.3	0.7 ± 0.6	1.041 ± 0.141	0.807 ± 0.114	2	0.48		5	0.19				
	5	205	50.1 ± 2.6	64.9 ± 10.1	23.9 ± 3.6	0.7 ± 0.6	1.019 ± 0.143	0.786 ± 0.117	2	2.65		5	2.36				
Komulainen et al*	5	105	52.9		26.4	1.1	1.132	0.938	5	6.71	-0.96						
Komulainen et al**	2.5	83	52.9	70.1	26.4	1.2	1.139	0.937	2.5	1.67	-0.32						
Komulainen et al***	5	112	52.9	70.5	26.9	1.1	1.135	0.940	5	0.2	-1.4						
Genant et al	2	57	51.8 ± 0.3	67.1 ± 0.9	25.3 ± 0.4		1.030 ± 0.0		2	2.81	1.54						
	2	32	53.2 ± 1.0	57.6 ± 1.3	24.6 ± 0.5	12.5 ± 1.8	0.9 ± 0.0	0.7 ± 0.0	0.5	4.2	1.5	1	5	1.97	2	7.2	2.5
	2	67	54.8 ± 0.7	56.7 ± 0.7	23.5 ± 0.3	6.8 ± 0.9	0.9 ± 0.0	0.7 ± 0.0	0.5	4.2	1.5	1	5	1.97	2	7.2	2.5
	2	22	67.2 ± 1.6	58.5 ± 1.9	25.5 ± 0.8	17.2 ± 1.8	0.8 ± 0.0	0.6 ± 0.0	0.5	4.2	1.5	1	5	1.97	2	7.2	2.5

HRT

(year)	(year)	(kg)	BMI (g/cm <sup>2</sup> )	(year)	BMD (g/cm <sup>2</sup> )				BMD % change					
					L2-L4	FN	L2-L4	FN	L2-L4	FN	L2-L4	FN		
2	107	51.78 ± 5.35		5.78 ± 3.43	0.95 ± 0.14	0.77 ± 0.11	1	0	0	2	4.21	0		
1	48	54.8 ± 4.5	56.69 ± 7.8	23.4 ± 3.1	6.5 ± 5.9	1.8983 ± 0.11	0.7597 ± 0.1	1	3.27	-0.07				
1	236	52.5 ± 6.74	57.8 ± 7.46			0.987 ± 0.1714		1	3.34					
1	29	54.8 ± 9.2				0.987 ± 0.1745		1	3.34					
1	19	54.53 ± 4.06				0.749 ± 0.105	0.671 ± 0.133	1	5.34	2.53				
*	1	53.1 ± 0.9	54.5 ± 1.3	23.8 ± 0.5		0.789 ± 0.01		1	5.32					
**	1	54.5 ± 5.2	55.8 ± 7.1	23.9 ± 2.9		0.785 ± 0.052		1	5.48					
1	107	54.8 ± 5.6			6.23		0.793 ± 0.103	1		3.15				
2	52	55 ± 0.67		22.74 ± 0.44	6.94 ± 0.8	0.737 ± 0.089	0.648 ± 0.0096	1	5.7	-3.6	2	6.2	-2.6	
Wimalawansa et al	4	15	52.7 ± 0.84		24.5 ± 0.93	3.13 ± 0.35	0.89 ± 0.01	0.72 ± 0.01	2	3.67	2.35	4	6.78	4.01

## 2. Alendronate

	(year)	(mg)	(year)	(kg)	BMI (g/cm <sup>2</sup> )	(year)	BMD (g/cm <sup>2</sup> )		BMD % change									
							L2-L4	FN	L2-L4	FN	L2-L4	FN	L2-L4	FN				
Tiras et al	1	32	10	53.8 ± 6.8	23.8 ± 4.1	6.5 ± 5.6	0.746 ± 0.07	0.729 ± 0.06	0.5	4.155	1.78	1	7.11	3.02				
Kung et al	1	35	10	64 ± 5	52.9 ± 7.6	23.2 ± 3.3	15 ± 4	0.668 ± 0.62	0.544 ± 0.097	1	4.79	2.9						
Pols et al	1	863	10	62.8 ± 7.5	63.8 ± 9.6		15.8 ± 8.5	0.84 ± 0.08	0.75 ± 0.1	1	5 ± 3.2	2.3 ± 4.5						
Lieberman et al	3	175	5	64		24.2		0.81	0.72	1	4.15	1.4	2	4.6	1.98	3	5.15	2.75
	3	174	10							1	5.2	2.9	2	6.9	3.05	3	8.2	4.7
Rossini et al	0.5	15	20	63 ± 3	25.6 ± 3.9	12 ± 4	0.738 ± 0.08	0.703 ± 0.106	0.5	3.7 ± 1.7	0.5 ± 4.2							
Chesnut et al	2	32	5	62.9 ± 6.1	63.7 ± 9.4		15.0 ± 6.9	0.75 ± 0.08	0.73 ± 0.06	2	7.067	3.56						
	2	30	10	62.9 ± 6.1	63.7 ± 9.4		15.0 ± 6.9	0.75 ± 0.08	0.73 ± 0.06	2	7.2	4.93						
Gonnelli et al	2	48	10	59.9 ± 5.2	60.1 ± 7.4		8.5 ± 4.7	0.693 ± 0.077		1	3.7		2	5				

### 3. Calcium

	(year)	(mg)	(year)	(kg)	BMI (g/cm <sup>2</sup> )	(year)	BMD (g/cm <sup>2</sup> )		BMD % change					
							L2-L4	FN	L2-L4	FN	L2-L4	FN		
Chevalley et al	1.5	26	800	72.4 ± 1.0	25.4 ± 0.8	23.9 ± 1.6	0.976 ± 0.044	0.751 ± 0.026	1.5	1.9 ± 1.3	1.3 ± 1.0			
	1.5	22	800	79.0 ± 1.2	23.7 ± 0.6	31.2 ± 1.4	0.926 ± 0.042	0.606 ± 0.019	1.5	1.2 ± 1.7	-0.9 ± 1.8			
Lau et al	0.83	12	800	75			0.7	0.54	0.83	-0.08	-3.5			
	0.83	15	800	76			0.7	0.53	0.83	-1.1	5.0			
Dawson-Hughes et al*	2	24	500	54.5 ± 3.4	26.5 ± 4.3	3.2 ± 1.4	1.13 ± 0.02	0.82 ± 0.01	1	-1.32 ± 0.56	-0.48 ± 0.78	2	-3.11 ± 0.77	-0.24 ± 0.96
	2	23	500	54.5 ± 3.4	26.5 ± 4.3	3.2 ± 1.4	1.13 ± 0.02	0.82 ± 0.01	1	-1.93 ± 0.53	0.32 ± 0.79	2	-2.66 ± 0.74	-1.11 ± 0.97
	2	53	500	59.9 ± 5.4	26.0 ± 4.2	13.0 ± 5.6	1.06 ± 0.01	0.78 ± 0.01	1	-0.26 ± 0.39	0.60 ± 0.56	2	-0.92 ± 0.5	0.41 ± 0.69
	2	52	500	59.9 ± 5.4	26.0 ± 4.2	13.0 ± 5.6	1.06 ± 0.01	0.78 ± 0.01	1	-0.76 ± 0.39	0.28 ± 0.56	2	-1.90 ± 0.51	-0.07 ± 0.69
Gonnelli et al	2	46	1000	59.1 ± 4.3	60.0 ± 7.9	7.2 ± 3.3	0.702 ± 0.093		2	-1.6				

#### 4. Vitamin D

			(year)	(kg)	BMI (g/cm <sup>2</sup> )	(year)	BMD (g/cm <sup>2</sup> )		BMD % change					
	(year)	(year)					L2-L4	FN	L2-L4	FN	L2-L4	FN		
Komulainen et al**	2.5	102	52.9	70.9	26.8	1.1	1.155 ±0.026	0.937 ±0.028	2.5	0 2597	-2.134			
Komulainen et al***	5	112	52.9 ±0.4	70.7 ±2.1			1.147 ±0.027	0.937 ±0.021	5	-4.621	-4.269			
Komulainen et al*	5	113	52.8				1.140	0.932	5	-4.386	-4.269			
Aloia et al	1	12	64.1 ±1.5			2.2 ±0.4	0.878 ±0.055		1	0.228				
Gallagher et al	2	18	69.1 ±1.5	57.8 ±8.8		2.2 ±0.4	0.852 ±0.124		2	1.94 ± 1 .19				
Dawson-Hughes et al**	1	110	61.4 ±0.5	68.5 ±1.1		13.5 ±0.6	1.05 ±0.02		1	0.85				
Dawson-Hughes et al**	0.5	110	61.4 ±0.5	68.5 ±1.1		13.5 ±0.6	1.05 ±0.02		0.5	1.4				
Dawson-Hughes et al***	2	110	64.0 ±5.3	68.3 ±11.5	26.3 ±3.8	15.3 ±7.0	1.03 ±0.15	0.82 ±0.10	1	2.20 ±0.29	-0.38 ±0.32	2	-2.21 ±0.29	-2.14 ±0.29
	2	105	63.0 ±5.1	68.6 ±12.5	26.6 ±4.4	15.4 ±6.5	1.05 ±0.16	0.83 ±0.11	1	1.86 ±0.27	0.6 ±0.28	2	-2.09 ±0.31	-1.6 ± 0.34
Sambrook et al	1	34	49	66 ±15		17 ±13	1.18 ±0.19	0.87 ±0.19	1	-1.3 ±5.6	-2.8 ±10.3			
Ooms et al	2	177	80.1 ±5.6	70.6 ±10.9	28.1 ±4.1	32.9 ±7.5		0.697 ±0.111			1.6			

[ 2 ]

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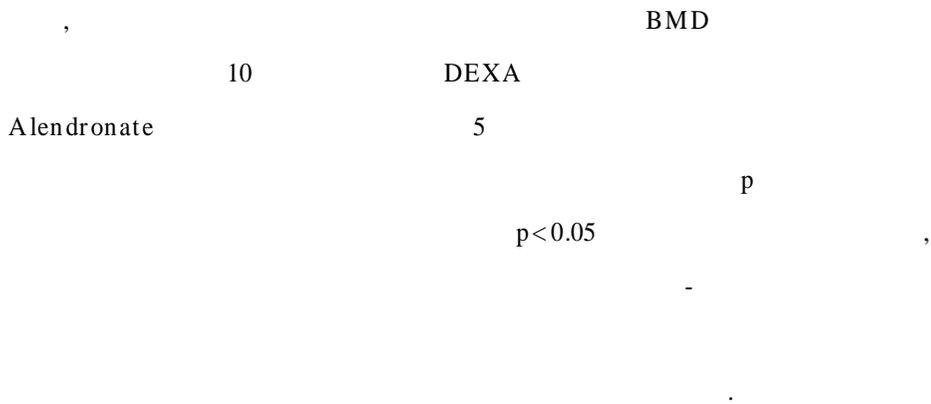
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1998;19:86-93.



HRT	4.9828	-0.0061	-	-4.3895
Alendronate	0.4427	0.06702	0.6318	-4.7516
D	3.7858	0.0074	-	-11.8963
Calcium	-6.3951	0.002208	1.0268	-0.0140



# ABSTRACT

## **A Cost-effectiveness Analysis of the Medications for Osteoporosis**

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Directed by Prof. Soonman Kwon

This study has been performed for the purpose of analysing cost-effectiveness of four medications - HRT therapy (conjugated equine estrogen 0.625mg for 25 days and medroxyprogesterone acetate 5mg for 01112 days), Alendronate (10mg and 5mg), Active Vitamin D (Calcitriol), and Calcium - for treating and preventing osteoporosis.

The total costs included direct medical cost in the health care sectors - examination fee, consultant fee, prescription fee, fee for preparing medications, and the price of pharmaceuticals - and indirect costs paid by patients such as traffic expenses and time loss. In addition, it was added the costs of monitoring in adverse reaction as derived costs. The effect of four medications was expressed as BMD (Bone Mineral Density) percent change measured by DEXA (Dual Energy X-ray Absorptiometry) in lumbar spine (L2-L4) and femoral neck site. Total estimates of effectiveness were obtained by mixed model from the meta-analysis results then applied to the hypothetical cohort which was

composed of 50's postmenopausal women.

The result of this study is as follows. HRT therapy is the most cost-effective medication at 172,433.64 won (lumbar spine site) and 564,328.28 won (femoral neck site) per BMD percent change for osteoporosis. Alendronate 10mg is more cost-effective medication than Alendronate 5mg as respectively 345,971.23 won and 378,441.63 won per lumbar BMD percent change at  $0.991\text{g}/\text{cm}^2$ . Also Alendronate 10mg is more cost-effective medication than Alendronate 5mg as respectively 1,329,257.89 won and 1,467,291.23 won per femoral neck BMD percent change at  $0.834\text{g}/\text{cm}^2$ . In short, this analysis could be useful for reasonable decision making concerning the allocation of health care resources for alternative medication to treating and preventing osteoporosis.

Key Word : Osteoporosis, Cost-effectiveness analysis, Postmenopause

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