

**American College of Radiology  
ACR Appropriateness Criteria®**

**Osteoporosis and Bone Mineral Density**

**Variant 1: Osteoporosis screening or initial imaging of clinically suspected low bone mineral density.**

Procedure	Appropriateness Category	SOE	Adults RRL	Peds RRL	Rating	Median	Final Tabulations									
							1	2	3	4	5	6	7	8	9	
DXA lumbar spine and hip(s)	Usually appropriate	Limited	☼ <0.1 mSv		9	9	0	0	0	0	0	0	0	0	0	13
			References	Study Quality												
			20 (15616758)	4												
			21 (15268886)	M												
			28 (20464374)	4												
			29 (21779818)	4												
			25 (25182228)	4												
			22 (11846333)	4												
			23 (26277847)	4												
			30 (30142455)	4												
			7 (30456571)	4												
			18 (31400968)	4												
			19 (29946735)	4												
			24 (32427525)	4												
			26 (-3194793)	4												
			27 (30575489)	1												
			31 (27486526)	4												
DXA distal forearm	May be appropriate	Limited	☼ <0.1 mSv		6	6	0	0	0	0	6	4	2	1	0	

References	Study Quality
20 (15616758)	4
21 (15268886)	M
28 (20464374)	4
29 (21779818)	4
25 (25182228)	4
22 (11846333)	4
23 (26277847)	4
30 (30142455)	4
7 (30456571)	4
18 (31400968)	4
19 (29946735)	4
24 (32427525)	4
26 (-3194793)	4
27 (30575489)	1
31 (27486526)	4

QCT lumbar spine and hip	May be appropriate	Limited	☹☹☹ 1-10 mSv		5	5	2	0	1	1	9	2	0	0	0
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References	Study Quality
33 (24880494)	4
36 (30790025)	3
12 (-3194791)	4
26 (-3194793)	4
32 (26277851)	4
34 (24637515)	3
35 (-3194795)	4

TBS lumbar spine	Usually not appropriate	Strong	☹ <0.1 mSv		3	3	2	0	7	2	3	0	0	0	0
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References	Study Quality
45 (24443324)	4
52 (23341489)	4



Procedure	Appropriateness Category	SOE	Adults RRL	Peds RRL	Rating	Median	Final Tabulations								
							1	2	3	4	5	6	7	8	9
DXA lumbar spine and hip(s)	Usually appropriate	Limited	⊕ <0.1 mSv		9	9	0	0	0	0	0	0	0	1	12

References	Study Quality
13 (20559834)	4
60 (19193908)	4
25 (25182228)	4
57 (15292281)	4
59 (30693381)	4
24 (32427525)	4
55 (28554549)	4
56 (22256806)	4
58 (31378452)	4

DXA distal forearm	May be appropriate	Limited	⊕ <0.1 mSv		6	6	0	0	0	0	3	4	3	2	1
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References	Study Quality
13 (20559834)	4
60 (19193908)	4
25 (25182228)	4
57 (15292281)	4
59 (30693381)	4
24 (32427525)	4
55 (28554549)	4
56 (22256806)	4
58 (31378452)	4

QCT lumbar spine and hip	May be appropriate	Strong	⊕⊕⊕ 1-10 mSv		5	5	0	1	1	1	9	2	0	0	0
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References	Study Quality
23 (26277847)	4



Procedure	Appropriateness Category	SOE	Adults RRL	Peds RRL	Rating	Median	Final Tabulations								
							1	2	3	4	5	6	7	8	9
DXA VFA	Usually appropriate	Strong	☼ <0.1 mSv		9	9	0	0	0	0	0	3	2	0	8

References	Study Quality
78 (8237484)	4
92 (20571773)	4
93 (24599272)	4
94 (23769657)	4
79 (17245546)	4
95 (32095943)	3
96 (31352490)	3
18 (31400968)	4
76 (32268210)	Good
77 (12054160)	4
80 (17563237)	4
82 (15940375)	3
81 (14555255)	3
83 (18584111)	4
84 (21732219)	4
85 (24582085)	4
86 (23959594)	4
87 (23097259)	4
88 (23818208)	4
89 (16574519)	4
90 (12377802)	4
91 (12181624)	3
97 (31375350)	4

DXA lumbar spine and hip(s)	Usually appropriate	Limited	☼ <0.1 mSv		9	9	0	0	0	0	0	0	0	0	0	13
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References	Study Quality
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		56 (22256806)			4													
DXA distal forearm	May be appropriate	Limited	☼ <0.1 mSv		6	6	1	0	0	0	4	3	2	2	1			
		References			Study Quality													
		56 (22256806)			4													
QCT lumbar spine and hip	May be appropriate	Expert Consensus	☼☼☼ 1-10 mSv		6	6	0	0	0	2	5	7	0	0	0			
Radiography axial skeleton	May be appropriate	Limited	Varies	Varies	4	4	2	1	0	6	3	2	0	0	0			
		References			Study Quality													
		78 (8237484)			4													
		18 (31400968)			4													
		98 (33145043)			3													
TBS lumbar spine	Usually not appropriate	Limited	☼ <0.1 mSv		3	3	2	2	6	3	1	0	0	0	0			
		References			Study Quality													
		48 (28988401)			4													
QUS calcaneus	Usually not appropriate	Expert Consensus	○ 0 mSv	○ 0 mSv [ped]	1	1	11	0	1	0	0	0	1	0	0			
Radiography appendicular skeleton	Usually not appropriate	Expert Consensus	☼☼ 0.1-1mSv		1	1	10	3	0	0	0	0	0	0	0			
SXA distal forearm	Usually not appropriate	Expert Consensus	☼ <0.1 mSv		1	1	11	1	0	0	0	0	0	0	1			

**Variant 4: Initial imaging for premenopausal females or males less than 50 years of age. Individual with risk factors that could alter bone mineral density.**

Procedure	Appropriateness Category	SOE	Adults RRL	Peds RRL	Rating	Median	Final Tabulations											
							1	2	3	4	5	6	7	8	9			
DXA lumbar spine and hip(s)	Usually appropriate	Limited	☼ <0.1 mSv		9	9	0	0	0	0	0	0	1	0	12			

References	Study Quality
57 (15292281)	4
18 (31400968)	4
99 (24091896)	4
100 (28131128)	4
101 (32453819)	4
102 (29657446)	4
103 (28585410)	4
104 (31318068)	4
105 (16189261)	1
106 (16731428)	4

DXA distal forearm	May be appropriate	Limited	☼ <0.1 mSv		5	5	0	0	0	0	7	2	1	1	2
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References	Study Quality
57 (15292281)	4
18 (31400968)	4
99 (24091896)	4
100 (28131128)	4
101 (32453819)	4
102 (29657446)	4
103 (28585410)	4
104 (31318068)	4
105 (16189261)	1
106 (16731428)	4

QCT lumbar spine and hip	Usually not appropriate	Limited	☼☼☼ 1-10 mSv		3	3	5	0	7	1	0	0	0	0	0
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References	Study Quality
107 (22962425)	3
108 (19455271)	3

QUS calcaneus	Usually not appropriate	Limited	○ 0 mSv	○ 0 mSv [ped]	1	1	11	0	0	1	1	0	0	0	0
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		References	Study Quality												
		109 (18645695)	3												
Radiography axial skeleton	Usually not appropriate	Expert Consensus	Varies	Varies	1	1	12	0	0	1	0	0	0	0	0
Radiography appendicular skeleton	Usually not appropriate	Expert Consensus	☼☼ 0.1-1mSv		1	1	12	1	0	0	0	0	0	0	
TBS lumbar spine	Usually not appropriate	Expert Consensus	☼ <0.1 mSv		1	1	11	0	0	0	1	0	0	0	1
SXA distal forearm	Usually not appropriate	Expert Consensus	☼ <0.1 mSv		1	1	12	0	0	0	0	0	0	0	1

**Variant 5: Premenopausal females with risk factors. Males less than 50 years of age with risk factors. Follow-up to low bone mineral density.**

Procedure	Appropriateness Category	SOE	Adults RRL	Peds RRL	Rating	Median	Final Tabulations								
							1	2	3	4	5	6	7	8	9
DXA lumbar spine and hip(s)	Usually appropriate	Limited	☼ <0.1 mSv		9	9	0	0	0	0	1	0	0	0	12
		References	Study Quality												
		25 (25182228)	4												
DXA distal forearm	May be appropriate	Limited	☼ <0.1 mSv		6	6	0	0	0	0	4	3	2	3	1
		References	Study Quality												
		25 (25182228)	4												
QCT lumbar spine and hip	May be appropriate	Expert Consensus	☼☼☼ 1-10 mSv		5	5	1	0	1	5	7	1	0	0	0
QUS calcaneus	Usually not appropriate	Expert Consensus	○ 0 mSv	○ 0 mSv [ped]	1	1	11	0	0	1	1	0	0	0	0
TBS lumbar spine	Usually not appropriate	Expert Consensus	☼ <0.1 mSv		1	1	11	0	0	1	0	0	0	0	1

SXA distal forearm	Usually not appropriate	Expert Consensus	⊕ <0.1 mSv		1	1	12	0	0	0	0	0	1	0	0
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**Variant 6: Males and females greater than or equal to 50 years of age. Suspected osteoporosis. Advanced degenerative changes of the spine with or without scoliosis, or other conditions that may spuriously elevate BMD. Initial imaging.**

Procedure	Appropriateness Category	SOE	Adults RRL	Peds RRL	Rating	Median	Final Tabulations								
							1	2	3	4	5	6	7	8	9
DXA lumbar spine and hip(s)	Usually appropriate	Limited	⊕ <0.1 mSv		8	8	0	0	0	0	1	0	2	6	5

References	Study Quality
111 (27162010)	2
112 (30122533)	3
110 (33655400)	4
113 (30766896)	4

QCT lumbar spine and hip(s)	Usually appropriate	Limited	⊕⊕⊕ 1-10 mSv		8	8	0	0	0	1	0	0	3	5	5
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References	Study Quality
33 (24880494)	4
115 (27327251)	3
114 (15981723)	2

DXA distal forearm	Usually appropriate	Limited	⊕ <0.1 mSv		7	7	0	0	0	0	4	1	6	1	2
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References	Study Quality
13 (20559834)	4
111 (27162010)	2
12 (-3194791)	4
110 (33655400)	4

QUS calcaneus	Usually not appropriate	Expert Consensus	○ 0 mSv	○ 0 mSv [ped]	1	1	13	0	1	0	0	0	0	0	0
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Radiography axial skeleton	Usually not appropriate	Expert Consensus	Varies	Varies	1	1	12	2	0	0	0	0	0	0	0
Radiography appendicular skeleton	Usually not appropriate	Expert Consensus	☼☼ 0.1-1mSv		1	1	12	2	0	0	0	0	0	0	0
SXA distal forearm	Usually not appropriate	Expert Consensus	☼ <0.1 mSv		1	1	13	0	0	1	0	0	0	0	0

## **Appendix Key**

A more complete discussion of the items presented below can be found by accessing the supporting documents at the designated hyperlinks.

**Appropriateness Category:** The panel's recommendation for a procedure based on the assessment of the risks and benefits of performing the procedure for the specified clinical scenario.

**SOE:** Strength of Evidence. The assessment of the amount and quality of evidence found in the peer reviewed medical literature for an appropriateness recommendation.

- **References:** The citation number and PMID for the reference(s) associated with the recommendation.
- **Study Quality:** The assessment of the quality of an individual reference based on the number of study quality elements described in the reference.

**RRL:** Relative Radiation Level. A population based assessment of the amount of radiation a typical patient may be exposed to during the specified procedure.

**Rating:** The final rating (1-9 scale) for the procedure as determined by the panel during rating rounds.

**Median:** The median rating (1-9 scale) for the procedure as determined by the panel during rating rounds.

**Final tabulations:** A histogram showing the number of panel members who rated the procedure as noted in the column heading (ie, 1, 2, 3, etc.).

Additional supporting documents about the AC methodology and processes can be found at [www.acr.org/ac](http://www.acr.org/ac).