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.

	Appropri	ateness	GOT			n 1 nn-		3.5.11			F	inal	Tabu	latio	ns		
Procedure	Catego	ory	SOE	Adults RR	L	Peds RRL	Rating	Median	1	2	3	4	5	6	7	8	9
DXA lumbar spine and hip(s)	Usual appropi	lly riate	Limited	≎ <0.1 mS	Sv		9	9	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		_		1			1			
DXA distal forearm	May appropri	be riate	Limited	≎ <0.1 mS	Sv		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)	1		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
		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	 		3	3	2	0	7	2	3	0	0	0	0
		References		Study	Quality										
		45 (24443324)			4										
		52 (23341489)			4										

		48 (28988401)			4										
		46 (27900426)			4										
		54 (30093271)			3										
		47 (31628810)			3										
		53 (31525243)			3										
		51 (29416218)			3										
		18 (31400968)			4										
		43 (28276598)			4										
		44 (22749406)			3										
		49 (-3194796)			3										
		50 (26498132)		(Good										
QUS calcaneus	Usually not appropriate	Limited	O 0 mSv	O 0 mSv [ped]	1	1	10	1	0	1	0	0	1	0	0
		References		Study	Quality										
		38 (18442758)			4										
		37 (11256897)			3										
		39 (29541626)			4										
Radiography axial skeleton	Usually not appropriate	Limited	Varies	Varies	1	1	11	2	0	0	0	0	0	0	0
		References		Study	Quality										
		41 (16534696)			3										
		42 (31959378)			3										
Radiography appendicular skeleton	Usually not appropriate	Limited	�� 0.1-1mS	Sv	1	1	12	1	0	0	0	0	0	0	0
		References		Study	Quality										
		40 (1627412)			3										
SXA distal forearm	Usually not appropriate	Expert Consensus	� <0.1 mSv	,	1	1	11	1	0	0	0	0	0	0	1

Variant 2: Follow-up imaging of patients demonstrated to have risk for fracture or surveillance of established low bone mineral density.

	Appropriateness	207							F	inal	Tabu	latior	ıs		
Procedure	Category	SOE	Adults RRL	Peds RRL	Rating	Median	1	2	3	4				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		_		1						
DXA distal forearm	May be appropriate	Limited	≎ <0.1 mSv		6	6	0	0	0	0	3	4	3	2	1
		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)		1	4			_	1						
QCT lumbar spine and hip	May be appropriate	Strong	��� 1-10 mSv		5	5	0	1	1	1	9	2	0	0	0
		References		Study	Quality										
		23 (26277847)			4										

			61 (24898537)				2										
			62 (24038152)				1										
			63 (23871852)				1										
TBS lumbar spine	May approp	be riate	Strong	≎ <0.1 mS	Sv		4	4	0	0	1	8	4	1	0	0	0
			References			Study	Quality										
			66 (23769698)				3										
			65 (27554425)				4										
			64 (21887701)				2										
			67 (26092650)				3										
			68 (26378772)				4										
			69 (29167971)				1										
			70 (32258965)				2										
			71 (27111239)				2										
			72 (28624340)				1										
			73 (28734710)				4										
DXA VFA	Usually approp		Limited	≎ <0.1 mS	Sv		3	3	4	3	1	4	2	0	0	0	0
			References			Study	Quality										
			18 (31400968)				4										
QUS calcaneus	Usually approp	y not riate	Expert Consensus	O 0 mSv	′	O 0 mSv [ped]	1	1	11	0	0	1	0	0	0	1	0
SXA distal forearm	Usually approp	y not riate	Expert Consensus	≎ <0.1 mS	Sv		1	1	12	0	0	0	0	0	0	0	1

Variant 3: Follow-up imaging. Patients with T-scores less than 1.0 (by DXA) and one or more of the following: 1) Females equal to or greater than 70 years of age or males equal to or greater than 80 years of age; 2) Historical height loss greater than 4 cm (greater than 1.5 inches); 3) Self-reported but undocumented prior vertebral fracture; 4) Glucocorticoid therapy equivalent to equal to or greater than 5 mg of prednisone or equivalent per day for equal to or greater than 3 months.

The Approximation of the Appro	priateness	000	A I II DDI	D I DDI	D 41	3.5 11			F	inal	Tabu	ılatio	ns		
Procedure	tegory	SOE	Adults RRL	Peds RRL	Rating	Median	1	2	3	4	5	6	7	8	9

	Appropriateness	907		D. 1											
Procedure	Category	SOE	Adults RRL	Peds RRL	Rating	Median	1	2						8	9
DXA VFA	Usually appropriate	Strong	⊕ <0.1 mSv		9	9	0	0	0	0	0	3	2	0	8
		References		Study	y Quality										
		78 (8237484)		4 4											
		92 (20571773)			4										
		93 (24599272)			4										
		94 (23769657)			4										
		79 (17245546)			4										
		95 (32095943)													
		96 (31352490)													
		18 (31400968)			4										
		76 (32268210)		(
		77 (12054160)													
		80 (17563237)													
		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)													
		90 (12377802)													
		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	13
		References		Study	y Quality										

		56 (22256806)				4										
DXA distal forearm	May approp	Limited	≎ <0.1 mS	Sv		6	6	1	0	0	0	4	3	2	2	1
		References			Study	Quality										
		56 (22256806)				4										
QCT lumbar spine and hip	May approp	Expert Consensus	��� 1-10 mSv	0		6	6	0	0	0	2	5	7	0	0	0
Radiography axial skeleton	May approp	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 approp	Limited	≎ <0.1 mS	Sv		3	3	2	2	6	3	1	0	0	0	0
		References			Study	Quality										
		48 (28988401)				4										
QUS calcaneus	Usually approp	Expert Consensus	O 0 mSv	,	O 0 mSv [ped]	1	1	11	0	1	0	0	0	1	0	0
Radiography appendicular skeleton	Usually approp	Expert Consensus	�� 0.1-1m	ıSv		1	1	10	3	0	0	0	0	0	0	0
SXA distal forearm	Usually approp	Expert Consensus	≎ <0.1 mS	Sv		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.

	Appropriateness	COF	A L L DDI	D I DDI	D (1	3.5 31			F	inal '	Гаbи	latio	ns		
Procedure	Category	SOE	Adults RRL	Peds RRL	Rating	Median	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 mS	Sv		5	5	0	0	0	0	7	2	1	1	2
		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))	1		4				1	1					
QCT lumbar spine and hip	Usually not appropriate	Limited	��� 1-10 mSv)		3	3	5	0	7	1	0	0	0	0	0
		References		•	Study	Quality										
		107 (22962425))			3										
		108 (19455271))			3										
QUS calcaneus	Usually not appropriate	Limited	O 0 mSv		O 0 mSv [ped]	1	1	11	0	0	1	1	0	0	0	0

			References			Study	Quality										
			109 (18645695))			3										
Radiography axial skeleton	Usually appropr		Expert Consensus	Varies		Varies	1	1	12	0	0	1	0	0	0	0	0
Radiography appendicular skeleton	Usually appropr	not riate	Expert Consensus	�� 0.1-1m	ıSv		1	1	12	1	0	0	0	0	0	0	0
TBS lumbar spine	Usually appropr		Expert Consensus	≎ <0.1 mS	Sv		1	1	11	0	0	0	1	0	0	0	1
SXA distal forearm	Usually appropr	not riate	Expert Consensus	↔ <0.1 mS	Sv		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.

D 1	Appropri	iateness	COE	4 1 14 DD		n i nnr	D 41	3.7. 11			F	'inal '	Гаbu	latio	ns		
Procedure	Categ		SOE	Adults RR	KL	Peds RRL	Rating	Median	1	2	3	4	5	6	7	8	9
DXA lumbar spine and hip(s)	Usua approp		Limited	 <0.1 mS	Sv		9	9	0	0	0	0	1	0	0	0	12
	•		References			Study	Quality										
			25 (25182228)				4					_					
DXA distal forearm	May approp	be oriate	Limited	� <0.1 mS	Sv		6	6	0	0	0	0	4	3	2	3	1
			References			Study	Quality										
			25 (25182228)				4		_								
QCT lumbar spine and hip	May approp		Expert Consensus	��� 1-10 mSv	0		5	5	1	0	1	5	7	1	0	0	0
QUS calcaneus	Usuall approp		Expert Consensus	O 0 mSv	/	O 0 mSv [ped]	1	1	11	0	0	1	1	0	0	0	0
TBS lumbar spine	Usuall approp		Expert Consensus	≎ <0.1 mS	Sv		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.

Donas James	Appropriateness	COF	A L L DDI	D 1 DD1	D (1	3.6.11	Final Tabulations								
Procedure	Category	SOE	Adults RRL	Peds RRL	Rating	Median	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											
		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
		References		Study	Quality		_		-						
		33 (24880494)			4										
		115 (27327251))												
		114 (15981723))		2										
DXA distal forearm	Usually appropriate	Limited	⊕ <0.1 mSv		7	7	0	0	0	0	4	1	6	1	2
		References		Study											
		13 (20559834)													
		111 (27162010))	2											
		12 (-3194791)		4											
		110 (33655400))		4		1	1			1				
QUS calcaneus	Usually not appropriate	Expert Consensus	O 0 mSv	O 0 mSv [ped]	1	1	13	0	1	0	0	0	0	0	0

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.