DEXA Automatic Import, Report Generation and Format Options.

PenRad offers an integrated DEXA narrative report generation module. The DEXA module prepares statistical and analytical data, data mining capabilities, and patient recall compliance. Patients exam and reminder letters can be emailed and or mailed for patient retention.

Also available is our DEXA module import that imports current and prior scan region data directly from the modality, saving time and eliminating manual data input and errors.

With the combination of the DEXA narrative report generation module and the import module, report templates automatically perform comparison selection and calculate change. Then the narrative report is prepared for approval, offering the radiologist saved time.

Over the course of the years, various DEXA report formatting options have been developed.
Two general format styles exist for scanned region data; Sentence paragraph and Row Column.
This option is provided to hide various scan regions from the selection screen not used by the facility.

Paragraph sentence format:
Itemizes the selected comparisons in the sentence structure of the scan.
Current scan sentence typically shows percentage change between selected comparison (if exists), and/or with level of significance change, Z-Score, and variations of the WHO statement.
Format option offers sentence override for; risk level, change (by value or percentage), and overall risk.
Option offers suppression of T-Score value associated with scan.

Row column format:
Itemizes comparisons within the current scan with the percentage change calculation.
These options incorporate all like comparisons, by most current only or matching oldest, most with ascending or descending order options.

For demonstration of format and options:
Full report is initially displayed reflecting the sample of sentence structure and row column format.
To conserve "paper", samples focus on sentence options, and row column format differences, and standardized items are not repeated. For example; Clinical data section, Risk factors section, Disease section, Medications section, Study introduction sentence, Modality sentence, Z-score paragraph, Impression, recommendations, interpretation location, interpreting physician, imaging technologist, and letter sent.

Z-Score WHO statement override option available to both formats.

Impression options common to both formats:
Itemize scan data in impression with or without T-Score, and to suppress patient risk for fracture statement.

The following pages offer a full sample of the Paragraph Sentence format and the Row Column format.
Following each of the full format samples, customization options are presented for selection if desired.

Recommendation for product development?

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Solutions for productivity and revenue optimization in radiology workflow

Standard Stock Row and Column Format Sample
Autoselects all matching comparisons. Scan header single row. Scan order by A-Z. Comparisons ordered oldest to current. Includes Z-Score statement (optional automatic statements by patient age). Single row description header. Each scan referenced includes BMD, T-Score, % Reference, Z-score, % Age match, and Body part region. 8 optional formats available (following 2 pages).

BONE DENSITY EVALUATION: 11/20/2015

CLINICAL DATA: Post-menopausal, perimenopausal, and estrogen deficient.

RISK FACTORS: Caucasian race, advanced age, and early or surgical menopause.

CURRENT MEDICATIONS: Aromatase inhibitor, oral steroids, and Heparin.

DISEASE HISTORY: Rheumatoid arthritis, hyperparathyroidism, and hyperthyroidism.

FINDINGS:
On 11/20/2015 we performed bone density scans on your patient, Anita B. Joos. Any prior scans performed at this site are also listed chronologically for comparison by scan region. If comparison is being made to an outside study, a separate report will be included. Current studies were performed using a Hologic unit.

BONE DENSITY MEASUREMENTS

TEST DATE	BMD gm/cm2	T-SCORE	%REF	Z-SCORE	%AGE MATCH	BODY PART
09/01/2013	1.202	+1.20	0.0%	+1.20	0.0%	left femur neck
11/12/2014	1.120	+1.20	0.0%	+1.20	0.0%	left femur neck
11/20/2015	1.100	+1.20	0.0%	+1.21	0.0%	left femur neck
2.2 years	-8.5% change in BMD for left femur neck					
09/01/2013	1.210	+1.10	0.0%	+1.10	0.0%	AP L1-L4 region of spine
11/12/2014	1.100	+1.10	0.0%	+1.10	0.0%	AP L1-L4 region of spine
11/20/2015	1.130	+1.30	0.0%	+1.30	0.0%	AP L1-L4 region of spine
2.2 years	-6.6% change in BMD for AP L1-L4 region of spine					

FRAX 10 year probability of major osteoporotic fracture is 67.2% and hip fracture is 62.3%.

"Z-Scores" represent the Standard Deviations above and below the mean for age-matched BMD. Please note that T-Score values are important in determining increased risk for fractures. The T-Score represents the Standard Deviations above or below the mean BMD for young normals. With each "(-)1" Standard Deviation decrease in bone density, the risk for fracture doubles exponentially (i.e. T-Score of (-)1.0 will double the risk and (-)2.0 will be 4 times the risk). As a "rule of thumb", a T-Score of (-)1.0 to (-)2.5 indicates increasing degrees of OSTEOPENIA and less than (-)2.5 is consistent with OSTEOPOROSIS.

IMPRESSION: BONE DENSITY WITHIN NORMAL LIMITS
Patient is at normal risk for fracture. Compared to BMD of prior exam, there has been a decrease in bone density. Weight bearing exercises are recommended. A follow-up bone density study in 1 year is recommended. This exam was interpreted at 2344 Wayzata Blvd, Wayzata, MN 55391.

Dr. Christine Jade Anderson M.D.
cja/penrad:3/5/2017 10:47:21

Imaging Technologist(s): Sue T. Anderson RT(R)(M), Penrad Main Clinic
letter sent: Normal Exam Bone

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Standard Stock Row and Column Format Sample Options (applicable for other templates)
Hide scans and manufactures not used. Optional Z-Score statements by patient age. Suppress in Impression patient risk for fracture statement. Optional impression options, include summary of scan region with/without T-Score.

Alternate Impression options below to sample above:
IMPRESSION: BONE DENSITY WITHIN NORMAL LIMITS
Scan of left femur neck is within normal levels with a T-Score of 1.10.
Scan of AP L1-L4 region of spine is within normal levels with a T-Score of 1.30.
Compared to BMD of prior exam, there has been a decrease in bone density. Weight bearing exercises are recommended.
A follow-up bone density study in 1 year is recommended. This exam was interpreted at 2344 Wayzata Blvd, Wayzata, MN 55391.

Scan order A-Z, Current scan top, All matching comparisons.

Autoselects all matching comparisons. Presents current to oldest. Scans ordered by A-Z. Includes Z-Score statement. Single row description header. Change percentage with decimal. Each scan referenced includes BMD, T-Score, % Reference, Z-score, % Age match, and Body part region.

TEST DATE	BMD gm/cm2	T-SCORE	%REF	Z-SCORE	%AGE MATCH	BODY PART
11/20/2015	1.100	+1.20	0.0%	+1.21	0.0%	left femur neck
11/12/2014	1.120	+1.20	0.0%	+1.20	0.0%	left femur neck
09/01/2013	1.202	+1.20	0.0%	+1.20	0.0%	left femur neck
2.2 years	-8.5% change in BMD for left femur neck					

11/20/2015	1.130	+1.30	0.0%	+1.30	0.0%	AP L1-L4 region of spine
11/12/2014	1.100	+1.10	0.0%	+1.10	0.0%	AP L1-L4 region of spine
09/01/2013	1.210	+1.10	0.0%	+1.10	0.0%	AP L1-L4 region of spine
2.2 years	-6.6% change in BMD for AP L1-L4 region of spine					

Scan order A-Z, Current scan top, Most current comparison.

Autoselects only most current as comparison. Presents current to most current. Scans ordered by A-Z. Includes Z-Scores statement. Single row description header. Change percentage with decimal. Each scan includes BMD, T-Score, % Reference, Z-score, % Age match, and Body part region.

TEST DATE	BMD gm/cm2	T-SCORE	%REF	Z-SCORE	%AGE MATCH	BODY PART
11/20/2015	1.100	+1.20	0.0%	+1.21	0.0%	left femur neck
11/12/2014	1.120	+1.20	0.0%	+1.20	0.0%	left femur neck
1.0 years	-1.8% change in BMD for left femur neck					

11/20/2015	1.130	+1.30	0.0%	+1.30	0.0%	AP L1-L4 region of spine
11/12/2014	1.100	+1.10	0.0%	+1.10	0.0%	AP L1-L4 region of spine
1.0 years	2.7% change in BMD for AP L1-L4 region of spine					

Scan order A-Z, Current scan on top, Oldest comparison.

Autoselects only oldest as comparison. Presents current and oldest. Scans ordered by A-Z. No Z-Scores statement. Single row description header. Change percentage with decimal. Each scan includes BMD, T-Score, % Reference, Z-score, % Age match, and Body part region.

DATE	BMD	T-SCORE	%REF	Z-SCORE	AGE MATCH	BODY PART
11/20/2015	1.100	+1.20	0.0%	+1.21	0.0%	left femur neck
09/01/2013	1.202	+1.20	0.0%	+1.20	0.0%	left femur neck
2.2 years	-8.5% change in BMD for left femur neck					

11/20/2015	1.130	+1.30	0.0%	+1.30	0.0%	AP L1-L4 region of spine
09/01/2013	1.210	+1.10	0.0%	+1.10	0.0%	AP L1-L4 region of spine
2.2 years	-6.6% change in BMD for AP L1-L4 region of spine					

Scan order A-Z, Current scan bottom, Oldest comparison.

Autoselects only oldest as comparison. Presents oldest to current. Scans ordered by A-Z. Includes Z-Scores statement. Dual row description header. Change percentage with decimal. Each scan includes BMD, T-Score, % Reference, Z-score, % Age match, and Body part region.

Date	BMD gm/cm2	T-Score	%Young Ref	Z-Score	%Age Match	Body Part
09/01/2013	1.202	+1.20	0.0%	+1.20	0.0%	left femur neck
11/20/2015	1.100	+1.20	0.0%	+1.21	0.0%	left femur neck
2.2 years	-8.5% change in BMD for left femur neck					

09/01/2013	1.210	+1.10	0.0%	+1.10	0.0%	AP L1-L4 region of spine
11/20/2015	1.130	+1.30	0.0%	+1.30	0.0%	AP L1-L4 region of spine
2.2 years	-6.6% change in BMD for AP L1-L4 region of spine					

Scan order A-Z, Current scan bottom, All comparisons.

Autoselects all matching comparisons. Presents oldest to current. Scans ordered by A-Z. Includes Z-Scores statement. Dual row description header. Change percentage with decimal. Each scan includes BMD, T-Score, % Reference, Z-score, % Age match, and Body part region.

Date	BMD gm/cm2	T-Score	%Young Ref	Z-Score Match	%Age	Body Part
09/01/2013	1.202	+1.20	0.0%	+1.20	0.0%	left femur neck
11/12/2014	1.120	+1.20	0.0%	+1.20	0.0%	left femur neck
11/20/2015	1.100	+1.20	0.0%	+1.21	0.0%	left femur neck
2.2 years	-8.5% change in BMD for left femur neck					

09/01/2013	1.210	+1.10	0.0%	+1.10	0.0%	AP L1-L4 region of spine
11/12/2014	1.100	+1.10	0.0%	+1.10	0.0%	AP L1-L4 region of spine
11/20/2015	1.130	+1.30	0.0%	+1.30	0.0%	AP L1-L4 region of spine
2.2 years	-6.6% change in BMD for AP L1-L4 region of spine					

Scan order A-Z, Current scan top, Oldest comparison, Custom Who.
Autoselects oldest comparison. Presents current to oldest. Orders scans by A-Z. Scan description header replaced with scan region. Has custom "World Health Organization" statement. Each scan includes BMD, T-Score, % reference, Z-score, % age match. Change percentage rounded.

left femur neck:
11/20/2015 BMD: 1.100 T-Score: +1.20   % Ref: 0.0% Z-Score: +1.21 Age Match: 0.0%
09/01/2013 BMD: 1.202 T-Score: +1.20   % Ref: 0.0% Z-Score: +1.20 Age Match: 0.0%
    -8% change in BMD for left femur neck

AP L1-L4 region of spine:
11/20/2015 BMD: 1.130 T-Score: +1.30   % Ref: 0.0% Z-Score: +1.30 Age Match: 0.0%
09/01/2013 BMD: 1.210 T-Score: +1.10   % Ref: 0.0% Z-Score: +1.10 Age Match: 0.0%
    -7% change in BMD for AP L1-L4 region of spine

FRAX 10 year probability of major osteoporotic fracture is 67.2% and hip fracture is 62.3%.

World Health Organization Definitions Based on Bone Density Levels
Normal: Bone density is within 1 SD (+1 or -1) of the young adult mean. Low bone mass: Bone density is between 1 and 2.5 SD below the young adult mean (-2.5 SD or lower). Osteoporosis: Bone density is 2.5 SD or more below the young adult mean (-2.5 SD or lower). Severe (established) osteoporosis: Bone density is more than 2.5 SD below the young adult mean, and there have been one or more osteoporotic fractures.

Scan order A-Z, Current scan top, Oldest comparison, Custom Who, BMD and T-Score only
Autoselects oldest comparison. Presents current to oldest. Orders scans by A-Z. Scan description header replaced with scan region. Has custom "World Health Organization" statement. Each scan includes BMD, T-Score. Change percentage rounded.

left femur neck:
11/20/2015 BMD: 1.100 T-Score: +1.20
09/01/2013 BMD: 1.202 T-Score: +1.20
    -8% change in BMD for left femur neck

AP L1-L4 region of spine:
11/20/2015 BMD: 1.130 T-Score: +1.30
09/01/2013 BMD: 1.210 T-Score: +1.10
    -7% change in BMD for AP L1-L4 region of spine

FRAX 10 year probability of major osteoporotic fracture is 67.2% and hip fracture is 62.3%.

World Health Organization Definitions Based on Bone Density Levels
Normal: Bone density is within 1 SD (+1 or -1) of the young adult mean. Low bone mass: Bone density is between 1 and 2.5 SD below the young adult mean (-2.5 SD or lower). Osteoporosis: Bone density is 2.5 SD or more below the young adult mean (-2.5 SD or lower). Severe (established) osteoporosis: Bone density is more than 2.5 SD below the young adult mean, and there have been one or more osteoporotic fractures.

Row and column format options:
Option 1. Scan order A-Z, Current scan bottom, All comparisons. Shown in full as sample.
Option 2. Scan order A-Z, Current scan top, All comparisons.
Option 3. Scan order A-Z, Current scan top, Most current comparison.
Option 4. Scan order A-Z, Current scan top, Oldest comparison.
Option 5. Scan order A-Z, Current scan bottom, Oldest comparison.
Option 6. Scan order A-Z, Current scan bottom, All comparisons.
Option 7. Scan order A-Z, Current scan top, Oldest comparison, Custom WHO.
Option 8. Scan order A-Z, Current scan top, Oldest comparison, Custom WHO, BMD and T-Score only.

Options applicable to row and column format templates:
Hide scans and manufactures not used.
Optional Z-Score statement by patient age.
Suppress in Impression, patient risk for fracture statement.
Include in Impression, summary of scan region with T-Score.
Include in Impression, summary of scan region without T-Score.

Standard Stock Sentence Format Sample

Scans ordered automatically A-Z. AP scan has "region of spine". Standardized T-Score sentence included with value (separate option available to suppress). Scan interval change based on value difference. Who fracture sentence includes limits of fracture risk. User selects up to 3 individual comparisons, otherwise unlimited with DEXA interface. 5 optional formats available (following page).

BONE DENSITY EVALUATION: 11/20/2015

CLINICAL DATA: Post-menopausal, perimenopausal, and estrogen deficient.

RISK FACTORS: Caucasian race, advanced age, and early or surgical menopause.

CURRENT MEDICATIONS: Aromatase inhibitor, oral steroids, and Heparin.

DISEASE HISTORY: Rheumatoid arthritis, hyperparathyroidism, and hyperthyroidism.

COMPARISON:
09/01/2013 AP L1-L4 region of spine using a Hologic unit with reported normal fracture risk, BMD of 1.210g/cm2, T-score of 1.10, standardized T-score of 1.10, and Z-score of 1.10.
09/01/2013 Left femur neck using a Hologic unit with reported normal fracture risk, BMD of 1.202g/cm2, T-score of 1.20, standardized T-score of 1.24, and Z-score of 1.20.

FINDINGS:
Bone density evaluation was performed 11/20/2015 on the left femur neck using a Hologic unit. The BMD average for the exam is 1.100 g/cm2. The T-score is 1.20 and the Z-score is 1.21. The standardized T-score is 1.10. Since the previous similar exam of 09/01/2013, there has been a -0.102 or -8.5% change in the BMD value which represents a slight interval decrease in bone density. This matches the World Health Organization's criteria for normal bone density and places the patient within normal limits of fracture risk.

An additional bone density evaluation was performed 11/20/2015 on the AP L1-L4 region of spine using a Hologic unit. The BMD average for the exam is 1.130 g/cm2. The T-score is 1.30 and the Z-score is 1.30. The standardized T-score is 1.30. Since the previous similar exam of 09/01/2013, there has been a -0.080 or -6.6% change in the BMD value which represents no significant interval change in bone density. This matches the World Health Organization's criteria for normal bone density and places the patient within normal limits of fracture risk.

FRAX 10 year probability of major osteoporotic fracture is 67.2% and hip fracture is 62.3%.

IMPRESSION: BONE DENSITY WITHIN NORMAL LIMITS
Patient is at normal risk for fracture. Compared to BMD of prior exam, there has been a decrease in bone density. Weight bearing exercises are recommended. A follow-up bone density study in 1 year is recommended. This exam was interpreted at 2344 Wayzata Blvd, Wayzata, MN 55391.

Dr. Christine Jade Anderson M.D.
cja/penrad:3/5/2017 10:47:21

Imaging Technologist(s): Sue T. Anderson RT(R)(M), Penrad Main Clinic
letter sent: Normal Exam Bone

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Standard Sentence Format Options Sample (applicable for other templates)
Hide scans and manufactures not used. Suppress standardized T-Score sentence in itemized scan paragraphs.
Suppress in Impression patient risk for fracture statement. Include in Impression summary of scan region with T-Score.
Include in Impression summary of scan region without T-Score.

Alternate Impression options below to sample above:
IMPRESSION: BONE DENSITY WITHIN NORMAL LIMITS
Scan of left femur neck is within normal levels with a T-Score of 1.10.
Scan of AP L1-L4 region of spine is within normal levels with a T-Score of 1.30.
Compared to BMD of prior exam, there has been a decrease in bone density. Weight bearing exercises are recommended.
A follow-up bone density study in 1 year is recommended. This exam was interpreted at 2344 Wayzata Blvd, Wayzata, MN 55391.

DEXA Automatic Import, Report Generation and Format Options page 6 of 6.

Scan order A-Z, Interval change is based on percentage.
Scans ordered automatically A-Z. AP scan has "region of spine". Standardized T-Score sentence included with value (separate option available to suppress). Scan interval change is based on percentage versus value. Who statement includes limits of fracture risk. User selects up to 3 individual comparisons, otherwise unlimited with DEXA interface.

Bone density evaluation was performed 11/20/2015 on the left femur neck using a Hologic unit. The BMD average for the exam is 1.100 g/cm2. The T-score is 1.20 and the Z-score is 1.21. The standardized T-score is 1.10. Since the previous similar exam of 09/01/2013, there has been a -0.102 or -8.5% change in the BMD value which represents a significant interval decrease in bone density. This matches the World Health Organization's criteria for normal bone density and places the patient within normal limits of fracture risk.

An additional bone density evaluation was performed 11/20/2015 on the AP L1-L4 region of spine using a Hologic unit. The BMD average for the exam is 1.130 g/cm2. The T-score is 1.30 and the Z-score is 1.30. The standardized T-score is 1.30. Since the previous similar exam of 09/01/2013, there has been a -0.080 or -6.6% change in the BMD value which represents a significant interval change in bone density. This matches the World Health Organization's criteria for normal bone density and places the patient within normal limits of fracture risk.

Scan order A-Z, Interval change based on value, Bone regions format properized.
Scans ordered automatically A-Z. Bone scans region properized. AP scan has "region of spine" removed. Standardized T-Score sentence included with value (separate option available to suppress). Scan interval change on scan based on value. Who statement includes limits of fracture risk. User selects up to 3 individual comparisons, otherwise unlimited with DEXA interface.

Bone density evaluation was performed 11/20/2015 on the left Femoral Neck using a Hologic unit. The BMD average for the exam is 1.100 g/cm2. The T-score is 1.20 and the Z-score is 1.21. The standardized T-score is 1.10. Since the previous similar exam of 09/01/2013, there has been a -0.102 or -8.5% change in the BMD value which represents a slight interval decrease in bone density. This matches the World Health Organization's criteria for normal bone density and places the patient within normal limits of fracture risk.

An additional bone density evaluation was performed 11/20/2015 on the AP L1-L4 using a Hologic unit. The BMD average for the exam is 1.130 g/cm2. The T-score is 1.30 and the Z-score is 1.30. The standardized T-score is 1.30. Since the previous similar exam of 09/01/2013, there has been a -0.080 or -6.6% change in the BMD value which represents no significant interval change in bone density. This matches the World Health Organization's criteria for normal bone density and places the patient within normal limits of fracture risk.

Head to toe scan order, Interval change is based on value.
Scans ordered by head to toe. AP scan has "region of spine". Standardized T-Score sentence included with value (separate option available to suppress). Scan interval change is based on value. Who statement includes limits of fracture risk.

Bone density evaluation was performed 11/20/2015 on the AP L1-L4 region of spine using a Hologic unit. The BMD average for the exam is 1.130 g/cm2. The T-score is 1.30 and the Z-score is 1.30. The standardized T-score is 1.30. Since the previous similar exam of 09/01/2013, there has been a -0.080 or -6.6% change in the BMD value which represents no significant interval change in bone density. This matches the World Health Organization's criteria for normal bone density and places the patient within normal limits of fracture risk.

An additional bone density evaluation was performed 11/20/2015 on the left femur neck using a Hologic unit. The BMD average for the exam is 1.100 g/cm2. The T-score is 1.20 and the Z-score is 1.21. The standardized T-score is 1.10. Since the previous similar exam of 09/01/2013, there has been a -0.102 or -8.5% change in the BMD value which represents a slight interval decrease in bone density. This matches the World Health Organization's criteria for normal bone density and places the patient within normal limits of fracture risk.

Head to toe scan order, Interval change is based on value, Scan data automatically consolidated for region of spine.
Scans ordered by head to toe. AP scan has "region of spine". Standardized T-Score sentence is included with value (separate option available to suppress). Scan interval change is based on value. Who statement includes limits of fracture risk. When scans are automatically imported, scan data is automatically consolidated to suppress individual spine data (L1, L2, L3, L4) and only report largest collective area (L1-L4). Requires DEXA import.

Bone density evaluation was performed 11/20/2015 on the AP L1-L4 region of spine using a Hologic unit. The BMD average for the exam is 1.130 g/cm2. The T-score is 1.30 and the Z-score is 1.30. The standardized T-score is 1.30. Since the previous similar exam of 09/01/2013, there has been a -0.080 or -6.6% change in the BMD value which represents no significant interval change in bone density. This matches the World Health Organization's criteria for normal bone density and places the patient within normal limits of fracture risk.

An additional bone density evaluation was performed 11/20/2015 on the left femur neck using a Hologic unit. The BMD average for the exam is 1.100 g/cm2. The T-score is 1.20 and the Z-score is 1.21. The standardized T-score is 1.10. Since the previous similar exam of 09/01/2013, there has been a -0.102 or -8.5% change in the BMD value which represents a slight interval decrease in bone density. This matches the World Health Organization's criteria for normal bone density and places the patient within normal limits of fracture risk.

Sentence format options
Option 1. Scan order A-Z, Interval change based on value. Shown in full as sample.
Option 2. Scan order A-Z, Interval change based on percentage.
Option 3. Scan order A-Z, Interval change based on value, Bone regions format properized.
Option 4. Head to toe scan order, Interval change based on value.
Option 5. Head to toe scan order, Interval change based on value, Scan data automatically consolidated for region of spine.

Options applicable to sentence format templates
Hide scans and manufactures not used.
Suppress standardized T-Score sentence in itemized scan paragraphs.
Suppress in Impression, patient risk for fracture statement.
Include in Impression, summary of scan region with T-Score.
Include in Impression, summary of scan region without T-Score.