2023 ISCD Current Positions (Adult)
These are the Official Positions of the ISCD as updated in 2023. The Official Positions that are new or revised since 2019 are in **bold type**.

Indications for Bone Mineral Density (BMD) Testing

- Women aged 65 and older
- For post-menopausal women younger than age 65 a bone density test is indicated if they have a risk factor for low bone mass such as;
    - Low body weight
    - Prior fracture
    - High risk medication use
    - Disease or condition associated with bone loss.
- Women during the menopausal transition with clinical risk factors for fracture, such as low body weight, prior fracture, or high-risk medication use.
- Men aged 70 and older.
- For men < 70 years of age a bone density test is indicated if they have a risk factor for low bone mass such as;
    - Low body weight
    - Prior fracture
    - High risk medication use
    - Disease or condition associated with bone loss.
- Adults with a fragility fracture.
- Adults with a disease or condition associated with low bone mass or bone loss.
- Adults taking medications associated with low bone mass or bone loss.
- Anyone being considered for pharmacologic therapy.
- Anyone being treated, to monitor treatment effect.
- Anyone not receiving therapy in whom evidence of bone loss would lead to treatment.

Women discontinuing estrogen should be

2023 國際臨床骨密檢測學會目前立場 (成人)
以下是國際臨床骨密檢測學會在 2023 年更新的官方立場。新的或自 2019 年修正的官方立場標以**粗體字**。

骨密度(BMD)檢測的適應症

- 65 歲以上的婦女
- 對於小於 65 歲的停經婦女，骨密度檢測是必要的，假使她有低骨量的危險因子，例如；
    - 低體重
    - 曾經骨折
    - 使用高風險性藥物
    - 與骨流失相關的疾病或情況
- 正處於停經階段且具有骨折危險因子如低體重、曾經骨折或使用高風險性藥物之婦女
- 70 歲以上男性
- 對於小於 70 歲的男性，骨密度檢測是必要的，假使他有低骨量的危險因子，例如；
    - 低體重
    - 曾經骨折
    - 使用高風險性藥物
    - 與骨流失相關的疾病或情況
- 脆弱性骨折者
- 罹患可能導致低骨量或骨流失之相關疾病者。
- 所服用藥物和低骨量或骨流失有相關者。
- 任何被認為需要用藥物治療者。
- 任何接受治療中，用以監測治療效果者。
- 未曾接受治療者卻有骨流失的證據足以導致接受治療者

參照上列各項適應症，停止使用雌激素的女性應

considered for bone density testing according to the indications listed above.

Reference Database for T-Scores

- Use a uniform **white** (non-race **/ethnicity** adjusted) female normative database for women of all ethnic groups.*
- Use a uniform **white** (non-race **/ethnicity** adjusted) female reference for men of all ethnic groups *
- Manufacturers should continue to use NHANES III data as the reference standard for femoral neck and total hip T-scores.
- Manufacturers should continue to use their own databases for the lumbar spine as the reference standard for T-scores
- If local reference data are available they should be used to calculate only Z-scores but not T-scores.

*Note: Application of recommendation may vary according to local requirements.

Central DXA for Diagnosis

- The WHO international reference standard for osteoporosis diagnosis is a T-score of -2.5 or less at the femoral neck.
    - The reference standard from which the T-score is calculated is the female, white, age 20-29 years, NHANES III database
- Osteoporosis may be diagnosed in postmenopausal women and in men age 50 and older if the T-score of the lumbar spine, total hip, or femoral neck is -2.5 or less:*
    - In certain circumstances the 33% radius (also called 1/3 radius) may be utilized

*Note: Other hip regions of interest, including Ward's area and the greater trochanter, should not be used for diagnosis. Application of recommendation may vary according to local requirements.

- Skeletal sites to measure
    - Measure BMD at both the PA spine and hip in all patients
    - Forearm BMD should be measured under the following circumstances:
        - Hip and/or spine cannot be measured or interpreted.
        - Hyperparathyroidism
        - Very obese patients (over

考慮接受骨密度檢測。

T 值的參考資料庫

- 統一使用白種人(未經種族**/族群**校正)女性的正常資料庫於所有種族的女性。
- 統一使用白種人(未經種族**/族群**校正)女性參考資料於所有種族的男性。
- 製造商應繼續使用第三次全 國健康與營養檢驗調查(NHANE III)的資料作為女性股骨頸及全髖骨的 T 值參考標準。
- 製造商應繼續使用他們自己的腰椎資料庫作為 T 值參考標準。
- 假如可以得到當地的參考資料，應該僅使用於計算 Z 值而非 T 值。

*備註:使用本建議仍需視當地的要求而異。

以中軸型雙能量 X 光吸收儀(DXA)作診斷

- 世界衛生組織的國際參考標準為股骨頸 T 值等於或小於-2.5 時可診斷為骨質疏鬆症。
    - 此 T 值計算的參考標準為女性、白種人、年齡介於 20-29 歲之 NHANES III 資料庫。
- 當停經後婦女或 50 歲以上男性腰椎、全髖骨或股骨頸的 T 值等於或小於-2.5 時可診斷為骨質疏鬆症*。
    - 在某些情形可採用橈骨 33%長度處(亦稱為 1/3 橈骨)。

*備註:髖骨其他判讀區間如華德氏區(Ward's area)及大轉子(greater trochanter)不應用來作為診斷依據。使用本建議仍需視當地的要求而異。

- 骨骼測量位置
    - 所有的病人應同時檢測後前位脊椎及髖骨的骨密度。
    - 當以下情形時應測量前臂骨密度
        - 當無法測量或判讀髖骨和/或脊椎時

the weight limit for DXA table)
 	
• Spine Region of Interest (ROI)
  • Use PA L1-L4 for spine BMD measurement
  • Use all evaluable vertebrae and only exclude vertebrae that are affected by local structural change or artifact. Use three vertebrae if four cannot be used and two if three cannot be used
  • BMD based diagnostic classification should not be made using a single vertebra.
  • If only one evaluable vertebra remains after excluding other vertebrae, diagnosis should be based on a different valid skeletal site
  • Anatomically abnormal vertebrae may be excluded from analysis if:
  • They are clearly abnormal and non-assessable within the resolution of the system; or
  • There is more than a 1.0 T-score difference between the vertebra in question and adjacent vertebrae
  • When vertebrae are excluded, the BMD of the remaining vertebrae is used to derive the T-score
  • The lateral spine should not be used for diagnosis, but may have a role in monitoring
• Hip ROI
  • Use femoral neck, or total proximal femur whichever is lowest.
  • BMD may be measured at either hip.
 	
• Forearm ROI
  • Use 33% radius (sometimes called one-third radius) of the non-dominant forearm for diagnosis. Other forearm ROI are not recommended
	● 副甲狀腺機能亢進
	● 過度肥胖者(超過 DXA 檢查台體重限制)
	
	● 脊椎判讀區間
	  ● 應採用後前位第一至第四腰椎作為脊椎骨密度測量
	  ● 應計算所有可評估的腰椎，僅排除受到局部結構變化或假影影響之脊椎。如果不能四節全用，就用三節；不能使用三節，就用兩節。
	  ● 不應採用單一節脊椎骨密度來作診斷分類
	  ● 當排除異常脊椎體僅剩一節可評估的腰椎時，應考慮其他可用骨骼部位作診斷
	
	  ● 當出現下列之解剖異常腰椎，判讀時可能被排除:
	  ◆ 在系統解析度下有明確異常或無法評估者；或
	  ◆ 有疑慮的脊椎體之間以及和相鄰椎體的 T 值差距超過 1.0 時
	
	  ● 當某節脊椎被排除後，應以剩餘節數之脊椎骨密度來計算 T 值。
	  ● 側位脊椎影像不應作為診斷使用，但可作為監測使用。
	
	● 髖骨判讀區間
	  ● 採用股骨頸或全髖骨兩者任一最低值
	  ● 可測量任何一側髖骨之骨密度
	
	● 前臂判讀區間
	  ● 使用非慣用手的橈骨 33%長度處(有時候稱為 1/3 橈骨)作為診斷，其他前臂區間均不建議使用。

Fracture Risk Assessment • A distinction is made between diagnostic classification and the use of BMD for fracture risk assessment. • For fracture risk assessment, any well-validated technique can be used, including measurements of more than one site where this has been shown to improve the assessment of risk.	骨折風險評估 ● 診斷分類與以骨密度進行骨折風險評估明顯不同。 ● 任何被驗證過的技術都可以用來作為骨折風險評估，包含測量一個部位以上也有助於改善風險評估。
Use of the Term “Osteopenia” • The term “osteopenia” is retained, but “low bone mass” or “low bone density” is preferred. • People with low bone mass or density are not necessarily at high fracture risk.	骨缺乏的用詞 ● 骨缺乏(osteopenia) 一詞仍保留使用，但是建議改用低骨量(low bone mass)或低骨密度(low bone density) ● 低骨量或低骨密度患者非必然具有高骨折風險
BMD Reporting in Postmenopausal Women and in Men Age 50 and Older • T-scores are preferred. • The WHO densitometric classification is applicable.	停經後婦女和 50 歲以上男性之骨密度報告 ● 建議採用 T 值 ● 使用世界衛生組織的密度測量分類標準
BMD Reporting in Females Prior to Menopause and in Males Younger Than Age 50 • Z-scores, not T-scores, are preferred. This is particularly important in children. • A Z-score of -2.0 or lower is defined as “below the expected range for age”, and a Z-score above -2.0 is “within the expected range for age.” • Osteoporosis cannot be diagnosed in men under age 50 on the basis of BMD alone. • The WHO diagnostic criteria may be applied to women in the menopausal transition.	停經前婦女和 50 歲以下男性之骨密度報告 ● 建議採用 Z 值，而非 T 值；尤其在兒童特別重要。 ● 當 Z 值等於或小於-2.0 時稱之為低於同齡的預期值(below the expected range for age)，當 Z 值大於-2.0 時稱之為介於同齡的預期值(within the expected range for age)。 ● 50 歲以下男性僅靠骨密度不可診斷為骨質疏鬆症。 ● WHO 的診斷標準可以用於停經過渡期的女性
Z-Score Reference Database • Z-scores should be population specific where adequate reference data exist. For the purpose of Z-score calculation, the patient’s self-reported ethnicity should be used.	Z 值參考資料庫 ● Z 值應該以有適當參考資料存在的特定族群為參考值。為了 Z 值的計算，病患自述種族資料應被採用。
Follow-up BMD Measurements • Serial BMD testing, in combination with	**追蹤性**骨密度測量

clinical assessment of fracture risk, bone turnover markers, and other factors including height loss and trabecular bone score, can be used to determine whether treatment should be initiated in untreated patients, according to locally applicable guidelines. • **Follow-up BMD testing can aid in monitoring response to therapy.** • **Follow-up BMD testing should be undertaken with clearly defined objectives and when the results are likely to influence patient management.** • **Follow-up BMD testing should be performed if a fracture has occurred or new risk factors have developed, but should not delay treatment for secondary fracture prevention.** • **Repeat BMD testing should be used to monitor individuals prior to a temporary cessation of bisphosphonate therapy and during the period of planned interruption of treatment.** • **Repeat BMD testing intervals must be individualized considering an individual's age, baseline BMD, the type of pharmacological treatment, and the presence of clinical factors which are associated with bone loss.** • **Shorter intervals between BMD testing may be indicated in the presence of factors associated with rapid change in bone mineral density. Examples include the use of certain medications such as glucocorticoids, aromatase inhibitors, androgen deprivation therapy, and osteoanabolic therapies, medical disorders such as malabsorption and severe systemic inflammatory diseases, and other conditions such as prolonged immobilization, bariatric surgery, and surgical menopause.** • **If changes in BMD are outside the expected range for an individual patient and adequate scan quality has been confirmed, this should prompt consideration for a re-evaluation of the patient and plan of care.** •	● 根據該地區適用之指引，系列骨密度檢測與臨床骨折風險評估、骨代謝指標、身高流失及骨小樑指數等合併考量，可用來決定未治療的病患是否應該開始治療。 ● **追蹤性骨密度檢測可以協助監測治療的反應。** ● **當有明確定義目標、或檢測結果可能會影響病人處置時 ，應安排 追蹤骨密度檢測。** ● **當發生新的骨折或新的風險因子時，應 追蹤骨密度檢測，但不應該延遲次發性骨折預防的治療。** ● **當預計暫時性停止雙磷酸鹽類藥物治療前，以及計劃性暫停治療的期間，應重複進行追蹤骨密度檢測來監測個案。** ● **重複進行骨密度檢測的時間間隔應該有個人化考量，包括：個案年齡、基準骨密度、藥物治療的種類、及臨床上可能與骨質流失相關的因子。** ● **當有造成骨密度快速改變因子出現時，可考慮縮短骨密度檢測的時間間隔。舉例包括：使用特定藥物如糖皮質激素、芳香環酶抑制劑、雄性激素剝奪療法、及促骨質生成藥物；醫療狀況如吸收不良、嚴重系統性發炎疾病；其他狀況如長期的不活動、減重手術及手術引起之停經。** ● **當骨密度的變化已超出個案的預期區間值，且掃瞄檢測品質也經過確認，就應即時地考慮重新評估個案及治療計畫。**
Phantom Scanning and Calibration	假體掃描和校準

The Quality Control (QC) program at a DXA facility should include adherence to manufacturer guidelines for system maintenance. In addition, if not recommended in the manufacturer protocol, the following QC procedures are advised: • Perform periodic (at least once per week) phantom scans for any DXA system as an independent assessment of system calibration. • Plot and review data from calibration and phantom scans. • Verify the phantom mean BMD after any service performed on the densitometer. • Establish and enforce corrective action thresholds that trigger a call for service. • Maintain service logs. • Comply with government inspections, radiation surveys and regulatory requirements. Precision Assessment • Each DXA facility should determine its precision error and calculate the LSC. • The precision error supplied by the manufacturer should not be used. • If a DXA facility has more than one technologist, an average precision error combining data from all technologists should be used to establish precision error and LSC for the facility, provided the precision error for each technologist is within a pre-established range of acceptable performance. • Every technologist should perform an in vivo precision assessment using patients representative of the clinic's patient population. • Each technologist should do one complete precision assessment after basic scanning skills have been learned (e.g., manufacturer training) and after having performed approximately 100 patient-scans. • A repeat precision assessment should be done if a new DXA system is installed. • A repeat precision assessment should be done if a technologist's skill level has changed.	DXA 設備的品質管制程序應包括遵循製造商系統維護的指引。此外，若製造商的指引未有建議，則建議採取以下品質管控程序： ● 對任何雙能量 X 光吸收儀系統執行週期性(每週至少一次)的假體掃描，作為系統校準的獨立評估。 ● 繪製及回顧校準和假體掃描的資料。 ● 在執行任何骨密儀檢查後，驗證假體平均骨密度。 ● 建立和執行會觸發呼叫服務的校正措施之閾值。 ● 維護服務紀錄。 ● 遵守政府審查，輻射檢測和法規要求。 精確度評估 ● 每台雙能量 X 光吸收儀設備應確定其精確度誤差和計算 最小顯著變化值 。 ● 不應使用製造商提供的精確度誤差。 ● 假使雙能量 X 光吸收儀設備具有一個以上的技術員，應該使用來自所有技術人員的平均精確度誤差的合併數據，去建立設備的精確度誤差和 最小顯著變化值 ，每個技術員提供的精確度誤差是在一個預先建立可接受的技能範圍內。 ● 每個技術員應使用可代表院所病患族群的患者進行活體精確度評估。 ● 每個技術員在學到基本掃描技能(例如，製造商培訓)，並已完成約 100 例患者掃描後，都應該做一個完整的精確度評估。 ● 如果安裝了新的雙能量 X 光吸收儀系統，應該重複作精確度評估。 ● 如果技術員的技術水準有變，應該做重複的精確度評估。

- To perform a precision analysis:
  - Measure 15 patients 3 times, or 30 patients 2 times, repositioning the patient after each scan
  - Calculate the root mean square standard deviation (RMS-SD) for the group
  - Calculate LSC for the group at 95% confidence interval

- The minimum acceptable precision for an individual technologist is:
  - Lumbar Spine: 1.9% (LSC=5.3%)
  - Total Hip: 1.8% (LSC=5.0%)
  - Femoral Neck: 2.5% (LSC=6.9%)
  - Retraining is required if a technologist's precision is worse than these values

- Precision assessment should be standard clinical practice. Precision assessment is not research and may potentially benefit patients. It should not require approval of an institutional review board. Adherence to local radiologic safety regulations is necessary. Performance of a precision assessment requires the consent of participating patients.

Cross-Calibration of DXA Systems

- When changing hardware, but not the entire system, or when replacing a system with the same technology (manufacturer and model), cross-calibration should be performed by having one technologist do 10 phantom scans, with repositioning, before and after hardware change.
  - If a greater than 1% difference in mean BMD is observed, contact the manufacturer for service/correction.

- When changing an entire system to one made by the same manufacturer using a different technology, or when changing to a system made by a different manufacturer, one approach to cross-calibration is:
  - Scan 30 patients representative of the facility's patient population once on the initial system and then twice on the new system within 60

- 執行精確度分析
  - 測量 15 個病患 3 次或 30 個病患 2 次，每次掃描後須重新定位病患。
  - 計算群體平方根標準差(RMS-SD)
  - 計算群體在 95%的信賴區間之 最小顯著變化值(LSC)。

- 個別技術員的最低可接受精確度為：
  - 腰椎：1.9％ (LSC=5.3％)
  - 全髖骨：1.8％ (LSC= 5.0％)
  - 股骨頸：2.5％ (LSC=6.9％)
  - 如果一個技術員的精確度比這些值還差的話，則需要再培訓。
- 精確度評估應該是標準的臨床工作。精確度評估不是研究，且可能對患者有益。它不應該需要人體試驗委員會的核准。但遵守當地的輻射安全法規是必要的。執行精確度評估需要參與患者的同意。

DXA 系統的交叉校準

- 當更換硬體，而不是整個系統，或用相同技術(製造商和型號)更換系統時，交叉校準應當由一位技術員在硬體變化前後執行做 10 次有重新定位的假體掃描。
  - 如果在平均骨密度有大於 1％的差異，應聯繫製造商維修/校正。

- 當變動使用不同技術但相同製造商的整個系統，或由不同製造商的系統時，一種交叉校準的方法是：
  - 在 60 天內掃描代表該設備的病患族群的 30 例患者，一次在最初系統，然後兩

days
- Measure those anatomic sites commonly measured in clinical practice, typically spine and proximal femur
- Facilities must comply with locally applicable regulations regarding DXA
- Calculate the average BMD relationship and LSC between the initial and new machine using the ISCD DXA Machine Cross-Calibration Tool (www.ISCD.org)
- Use this LSC for comparison between the previous and new system. Inter-system quantitative comparisons can only be made if cross-calibration is performed on each skeletal site commonly measured
- Once a new precision assessment has been performed on the new system, all future scans should be compared to scans performed on the new system using the newly established intra-system LSC

Cross-Calibration of DXA: Adding Hardware or Systems

- When adding a DXA scanner with the same technology (manufacturer and model) of the original (index) scanner, for the purpose of allowing patients to be scanned across devices, cross-calibration should be performed by scanning one spine phantom on both the index scanner, and on the additional scanner(s) on 20 different days to establish the respective mean BMD values. If a greater than 0.5% difference in mean BMD is observed between devices, contact the manufacturer for service/correction to return the additional machines to match the index scanner calibration and verify the new calibration with the same process
    - Certain additional conditions that may apply are:
        - When the DXA scanners are

次在新系統上。

- 測量臨床工作常用的測量解剖部位，一般是脊椎和近端股骨。
- 設備必須按照當地有關雙能量 X 光吸收儀的適用法規
- 使用 ISCD DXA 交叉校準工具計算初始和新機之間的平均骨密度關係和 最小顯著變化值 (www.ISCD.org)
- 使用此最小顯著變化值作新舊系統的比較。如果每個常用的骨骼測量部位可以進行交叉校準，則系統間的定量比較就可以進行。
- 一旦新的精確度評估已在新系統上執行，今後所有掃描應與使用新建立的系統內的最小顯著變化值所作的新系統掃描作比較。

DXA 系統的交叉校準-加上硬體或軟體系統

- 當在原有(指標) DXA 掃描儀加上相同技術的 DXA 掃描儀(製造商和型號)，為了讓病人可以在不同設備交互掃描，應在指標及新增掃描儀對同一個脊椎假體在 20 個不同天進行交叉校準，來建立個別平均骨密度數值。若在不同設備間發現平均骨密度有大於 0.5% 的差異，需聯繫製造商做維修/校正，將新增設備送回以符合指標掃描儀，並以相同步驟驗證新的校準。
- 特定可能適用額外狀況如
    - ◆ 當 DXA 掃描儀是安裝在同一建築物

installed in the same building or campus and using the same technologists, then the original LSC of the index scanner can be used for inter-scanner comparisons. or • When the systems are installed in geographically distinct locations, or using different technologists, or seeing a different patient population, then precision studies must be done at each site and an average LSC of all the individual technologist precision assessments can be calculated. Use the ISCD positions on calculating an LSC when multiple technologists are using a single scanner. • When adding a DXA system or systems made by either the same or different manufacturer using different technologies, while maintaining the original scanner in service, the preferred approach to cross-calibration is: • One scanner should be designated the index (gold standard) device. Each additional different technology device should be cross-calibrated to the index device. • Scan a minimum of 30 patients, representative of the facility's patient population twice on the index system and twice on the new system within 60 days. Individual patients may be measured on both scanners the same day, or ideally on different days, but no more than 30 days apart for any one patient. • Measure those anatomic sites	或院區且使用同一技術員，則可使用指標掃描儀的原先最小顯著變化值來做為掃描儀間的比較。 或 ◆ 當系統是安裝在明顯不同地理位置、或使用不同技術員、或用在不同病人族群研究時，必須在不同位置執行精確度分析，來計算所有個別技術員的平均最小顯著變化值。當有多個技術員操作單一台掃描儀時，使用國際臨床骨密檢測學會官方立場提供的計算器來計算最小顯著變化值。 ● 當在加上不同技術的 DXA 系統、相同或不同製造商以不同技術做的系統，當需要同時維持原有掃描儀運作，建議的交叉校準方式如 ● 選定一台掃描儀作為指標(黃金準則)設備，每個新增的設備都應與指標設備做交叉校準 ● 在 60 天內掃描代表該設備的病患族群的 30 例患者，一次在指標系統，然後兩次在新系統上。每個病患可以在同一天於兩個掃描儀量測，也可以在不同天量測，但不能超過 30 天。 ● 測量臨床工作常用的測量解剖部位，一

commonly measured in clinical practice, typically spine and proximal femur(s). • Calculate the average LSC between the index and new machine using the ISCD DXA Machine Cross-Calibration Tool • Use the average LSC for comparison between the two systems. Inter-system quantitative comparisons can only be made if cross-calibration is performed for each skeletal site commonly measured for monitoring. • Once the in-vivo cross-calibration equivalence is established, the long term-stability of all the systems must be carefully monitored with frequent scanning of a suitable external phantom on all cross-calibrated devices. Stability of a running average of phantom BMD on each system should be within 0.5% of the value established at the time of the cross-calibration. • Inter-machine LSC should not be applied to patients who have both scans done on a single device. A separate intra-machine LSC, established using the duplicate scans on the second device during the generalized LSC (gLSC) process should be used for any patient having both scans on a single device. • Facilities must comply with locally applicable regulations regarding DXA.	般是脊椎和近端股骨。 ● 使用 ISCD DXA 交叉校準工具計算指標和新機之間的平均骨密度關係和 最小顯著變化值 ● 使用平均最小顯著變化值作新舊系統的比較。如果每個常用的骨骼測量部位可以進行交叉校準，則可以做系統間的定量比較。 ● 當活體交叉校準等效性建立後，要在所有交叉校準設備以合適外部假體頻繁地掃描，謹慎監測所有系統的長期穩定性。此穩定性應為假體平均骨密度在各系統間保持在交叉校準所得數值的0.5%以內。 ● 設備間最小顯著變化值不應用於同時在一個設備接受兩次掃描的病患。在第二個設備重複掃描，進行共通最小顯著變化值(gLSC))計算，所得到的設備內最小顯著變化值，應該被用於同時在一個設備接受兩次掃描的病患。 ● 設備必須服從該地區適用的 DXA 規範。
• If a cross-calibration assessment is not performed, no quantitative comparison to the prior machine can be made. Consequently, a new baseline BMD and	● 如果不進行交叉校準評估，就無法與過去機器作定量比較。因此應該建立一個新的基準骨密度和系統內最小顯著變化值。

intra-system LSC should be established.

BMD Comparison Between Facilities

- **Do not apply an LSC or report BMD change between instruments that are not cross-calibrated.**
- Patients should return to the same DXA device that was used to perform their most recent prior study, provided that the facility in-vivo precision and LSC values are known and do not exceed established maximum values

Vertebral Fracture Assessment Nomenclature

- Vertebral Fracture Assessment (VFA) is the correct term to denote densitometric spine imaging performed for the purpose of detecting vertebral fractures.

Indications for VFA

- Lateral Spine imaging with Standard Radiography or Densitometric VFA is indicated when T-score is < -1.0 and of one or more of the following is present;
    - Women age ≥ 70 years or men ≥ age 80 years
    - Historical height loss > 4 cm (>1.5 inches)
    - Self-reported but undocumented prior vertebral fracture
    - Glucocorticoid therapy equivalent to ≥ 5 mg of prednisone or equivalent per day for ≥ 3 months

Methods for Defining and Reporting Fractures on VFA

- The methodology utilized for vertebral fracture identification should be similar to standard radiological approaches and be provided in the report.
- Fracture diagnosis should be based on visual evaluation and include assessment of grade/severity. Morphometry alone is not recommended because it is unreliable for diagnosis.
- The Genant visual semi-quantitative method is the current clinical technique of choice for diagnosing vertebral fracture

設備間的骨密度比較

- **在無交叉校準的設備間，不可運用最小顯著變化值或報告骨密度變化。**
- 病患應回到最近一次接受 DXA 檢查的設備，取得該設備活體精確度及最小顯著變化值，並且不該超過已建立的最大數值資料。

脊椎骨折評估的命名

- 脊椎骨折評估(VFA)是正確的用詞，用來表示以檢測脊椎骨折的目的所進行的密度測量脊椎影像。

脊椎骨折評估的適應症

- 使用標準放射影像技術的側面脊椎影像或密度測量脊椎骨折評估的適應症為當 T 值小於 -1.0 和有下述一項或多項情況時；
    - 70 歲以上的女性或 80 歲以上的男性
    - 比過去身高減少大於 4 公分(大於 1.5 英吋)
    - 自訴但未證實的過去脊椎骨折
    - 糖皮質激素治療，持續 3 個月以上每天 5 毫克以上的醋酸去氫副腎皮質素(prednisolone)或相等效價者。

定義和報告脊椎骨折評估有骨折之方法

- 用於脊椎骨折鑑別的方法應該是類似於標準的放射學方法，並在報告中提供。
- 骨折的診斷應根據視覺評估，包括級別/嚴重程度的評估。不建議單獨的 形態測定法 ，因為它是不可靠的診斷。
- 該 Genant 視覺半定量方法是目前診斷脊椎骨折與脊椎骨折評估的臨床技術選擇。

with VFA.
- Severity of deformity may be confirmed by morphometric measurement if desired.

Indications for Following VFA With Another Imaging Modality

- The decision to perform additional imaging must be based on each patient's overall clinical picture, including the VFA result.
- Indications for follow-up imaging studies include:
  - Lesions in vertebrae that cannot be attributed to benign causes
  - Vertebral deformities in a patient with a known history of a relevant malignancy
  - Equivocal fractures
  - Unidentifiable vertebrae between T7-L4
  - Sclerotic or lytic changes, or findings suggestive of conditions other than osteoporosis

Note: VFA is designed to detect vertebral fractures and not other abnormalities.

Follow-up Lateral Imaging

- Use Follow-up VFA or radiographic lateral spine imaging in patients with continued high risk (e.g., historical height loss > 4 cm (>1.5 inches), self-reported but undocumented vertebral fracture, or glucocorticoid therapy equivalent to ≥ 5 mg of prednisone or equivalent per day for greater than or equal to three months).

DXA to Detect Abnormalities In The Spectrum of AFF

- Femur DXA images should be reviewed for localized cortical abnormalities in the spectrum of AFF.
- When using DXA systems to detect abnormalities in the spectrum of AFF, scanning methods that generate bilateral

- 如果需要的話，變形的嚴重程度可以通過形態的測量作確認。

使用額外影像方式作後續脊椎骨折評估的適應症

- 執行額外影像的決定必須根據每個病人的整體臨床表現，包括脊椎骨折評估結果。
- 後續影像檢查的適應症包括：
  - 不能歸因於良性原因的脊椎病灶
  - 脊椎變形出現在已知有惡性腫瘤相關病史的病人
  - 不確定性骨折
  - 第 7 胸椎至第 4 腰椎有 無法辨識的脊椎
  - 硬化性或溶骨性變化，或有除骨質疏鬆症外的情況

備註：脊椎骨折評估是用來檢測脊椎骨折而非其他異常。

追蹤性側面影像檢查

- 運用追蹤性脊椎骨折評估或側面脊椎影像於高風險病患(如：比過去身高減少大於 4 公分(大於 1.5 英吋)、自訴但未證實的脊椎骨折、糖皮質激素治療持續 3 個月以上每天 5 毫克以上的醋酸去氫副腎皮質素(prednisolone)或相等效價者。

DXA 用於偵測非典型股骨骨折範疇之異常

- 在非典型股骨骨折範疇，應檢視股骨 DXA 影像中局部皮質骨的異常。
- 當 DXA 用於偵測非典型股骨骨折範疇之異常時，應使用可產生雙側全股骨影像(FFI)之掃描。雙側股骨全長影像報告須指出有無發現非典型股骨骨折。

full-length femur images (FFI) should be used. The FFI report should state the absence or presence of abnormalities in the spectrum of AFF. • Consider bilateral FFI for detecting abnormalities in the spectrum of AFF in patients who are receiving bisphosphonate or denosumab therapy or discontinued it within the last year, with a cumulative exposure of 3 or more years, especially those on glucocorticoid therapy.	● 在使用雙磷酸鹽類藥物或 denosumab 治療或累積使用三年以上或於最近一年內剛停止此類藥物、特別是有接受糖皮質激素治療之病患，都宜考慮接受雙側股骨全長影像以偵測非典型股骨骨折範疇之異常。
Baseline DXA Report: Minimum Requirements • Demographics (name, medical record identifying number, date of birth, sex). • Requesting provider. • Indications for the test. • Manufacturer and model of instrument used • BMD in g/cm2 for each site. • The skeletal sites, ROI, and, if appropriate, the side, that were scanned. • The T-score and/or Z-score where appropriate. • **Identify the fracture risk calculator used. Include positive fracture risk components that were included in the calculation.** • Recommendations for the necessity and timing of the next BMD study. • **Reports should contain a statement describing why acquired exams were not reported or when a technically acceptable DXA exam has aspects that might confound BMD results.** • **Diagnostic classification is an essential component of the report, with application of the WHO diagnostic criteria when appropriate.** • **When reporting or referring to race, "White" is preferred to "Caucasian".**	基本的 DXA 報告：最低要求 ● 人口統計資料(姓名、病歷號碼、出生日期、性別)。 ● 需求提供者 ● 檢測的適應症 ● 製造商和使用的儀器型號 ● 每個部位骨密度 g/cm^2 ● 骨骼部位、判讀區間，如果適當的話，加註被掃描側。 ● 適當的 T 值和/或 Z 值。 ● **確認所使用的骨折風險計算工具，有包括各種正向增加骨折風險項目在計算中。** ● 下一次骨密度檢查的必要性和時機的建議。 ● **報告內容須包含為何取得之檢查結果沒有呈現，或技術上可接受的 DXA 報告但有某些可能影響骨密度結果的觀點。** ● **診斷分類是報告的重要組成，應用世界衛生組織診斷標準是較適當的。** ● **當要報告或指出種族時，建議使用"白種人"而非"高加索人" 。**
Follow-Up DXA Report • **A DXA report (baseline and follow-up) should state that a follow-up exam is recommended as long as a valid comparison is available, and the precise timing depends on clinical**	追蹤性 DXA 報告 ● **DXA 報告(基本和追蹤性)應指出當可取得有效的比較時，建議安排追蹤檢查，而精準的時機則取決於特定的臨床情境。**

circumstances.

- Statement regarding which previous or baseline study and ROI is being used for comparison.
- Statement about the LSC at your facility and the statistical significance of the comparison.
- Report significant change, if any, between the current and previous study or studies in g/cm2 and percentage.
- Comments on any outside study including manufacturer and model on which previous studies were performed and the appropriateness of the comparison.
- Recommendations for the necessity and timing of the next BMD study.
    - **If the DXA interpreter has adequate clinical information, a precise timing for next bone mineral density (BMD) should be recommended; otherwise, a general recommendation about repeat testing should still be part of the report.**

DXA Reporting: Reporting of Bilateral Hip Exams

- **The acquisition of bilateral hip BMD measurements is appropriate to generate data for reporting T-scores (or Z-scores).**
- **When both hips have been scanned, the lowest T-score (or Z-score) of the right or left femoral neck or total hip should be used for diagnostic classification, but not the mean T-score (or Z-score).**
- **When both hips have been scanned on repeat tests, mean bilateral total hip BMD should be used for monitoring.**
- **Preferred terminology is to use "hip" when describing the site instead of "femur" or "total proximal femur". Use" bilateral hips" when referring to both hips.**

DXA Reporting: Reporting Less Than Four Vertebrae

- **We do not recommend using a single vertebral body for diagnostic classification or for monitoring.**
- **Precision worsens progressively with**

- 關於哪次過去或基本檢查和判讀區間被用以比較的說明。
- 關於你的設備的最小顯著變化和比較的統計顯著性之說明。
- 如果可以的話，以 g/cm^{2}和百分比方式報告目前和過去的檢查之間的顯著變化。
- 對任何外面檢查的意見，包括過去執行檢查的製造商及型號和比較的適當性。
- 下一次骨密度檢查的必要性和時機的建議。
    - **若 DXA 判讀者有足夠的臨床資訊，應給予下一次骨密度精準檢查時機的建議；反之也應將需要重複安排檢查，列入報告的一般性建議。**

DXA 報告：雙側髖骨之檢查報告

- **以雙側髖骨取像得到的骨密度，當成報告的 T 值(或 Z 值)是適當的。**
- **當雙側髖骨都接受掃描後，左右股骨頸或全髖骨的最低 T 值(或 Z 值)，可用來做診斷分類，而非使用平均 T 值(或 Z 值)。**
- **當雙側髖骨在追蹤檢查時都接受掃描後，應以平均雙側髖骨骨密度做為監測。**
- **描述此部位的建議名詞，使用"髖骨"而非"股骨"或"全近端股骨"，使用"雙側髖骨" 來表述兩邊的髖骨。**

DXA 報告：少於四節脊椎骨之檢查報告

- **不建議使用單節脊椎骨當作做診斷分類或監測。**

fewer than 4 vertebral bodies included, whether contiguous or non-contiguous. The LSC should be modified according to the precision assessment for corresponding combinations of fewer than 4 vertebrae.	● 當少於四節脊椎骨時，越少節數的脊椎骨會讓精確度越差，無論是相連或非相連的脊椎。最小顯著變化應根據精確度評估而被調整。

DXA Reporting: Reporting Results from Full-Femur Imaging (FFI)
• **FFI is considered a screening tool for iAFFs.**
• **Clinical assessment of prodromal symptoms (pain) is not required for assessment of FFI.**
• **Focal lateral cortical thickening and transverse lucencies should be reported when identified on FFI.**
• **When both focal lateral cortical thickening and a transverse lucent line are present, there is a high likelihood for an iAFF.**
• **Diffuse cortical thickening alone is non-specific for an iAFF.**
• **Suggestions for Reporting of FFI (based on features):**
  • **NONDIAGNOSTIC: Images are inadequate either due to acquisition issues, artifact or other patient factors. Consider dedicated radiographs to evaluate patient if necessary.**
  • **LOW likelihood features: Isolated diffuse cortical thickening, or no findings. Clinical correlation to decide if dedicated radiographs are necessary.**
  • **MODERATE likelihood features: Questionable focal lateral cortical thickening without a transverse lucent line. Clinical correlation and dedicated radiographs for clarification.**
  • **HIGH likelihood features: Definite focal lateral cortical thickening and a transverse lucent line. Urgent consultation and further imaging are recommended.**
	DXA 報告：雙側股骨全長影像之檢查報告
	● 雙側股骨全長影像可考慮作為不完全非典型股骨骨折**(iAFFs)**的篩檢工具。
	● 對前驅症狀**(**疼痛**)**的臨床評估，在雙側股骨全長影像的評估並非必要。
	● 當有發現局部側邊皮質骨增厚和橫向半透明線，在雙側股骨全長影像需要被報告。
	● 當局部側邊皮質骨增厚和橫向半透明線兩者皆存在時，不完全非典型股骨骨折的可能性就很高。
	● 單獨出現瀰漫性皮質骨增厚，在不完全非典型股骨骨折並非特異性。
	● 雙側股骨全長影像報告的建議**(**根據特徵**)**
	  ● 無法診斷：圖像不足以判讀，可能因為取像因素、假影或其他病人因素。若必要可考慮以專用影像評估個案。
	  ● 低可能性特徵：單獨出現全層皮質骨增厚或沒有發現。可根據臨床相關性來決定專用影像是否必要。
	  ● 中可能性特徵：疑似局部側邊皮質骨增厚但沒有橫向半透明線，以臨床相關性和專用影像來澄清。
	  ● 高可能性特徵：確定局部側邊皮質骨

	增厚及橫向半透明線，建議緊急會診並安排進一步影像檢查。
DXA Reporting: Quality Assurance • **Implement an internal program of peer-learning, following accepted radiologic practice, to facilitate quality reporting.**	**DXA 報告：品質信心** ● **推行內部計畫，包括同儕學習及後續放射影像練習，可促進報告品質。**
DXA Report: Optional Items • Recommendation for further non-BMD testing, such as X-ray, magnetic resonance imaging, computed tomography, etc. • Recommendations for pharmacological and non pharmacological interventions. • Addition of the percentage compared to a reference population. • Specific recommendations for evaluation of secondary osteoporosis. • **A general statement that a medical evaluation for secondary causes of low BMD may be appropriate.** • **WHO criteria for diagnosis in postmenopausal females and in men age 50 and over.**	DXA 報告：選擇性項目 ● 建議進一步的非骨密度檢測，如 X 光、磁振造影、電腦斷層掃描等。 ● 對藥物和非藥物介入的建議。 ● 對比參考族群的增加比例。 ● 對評估續發性骨質疏鬆症的特定建議。 ● **對低骨密度的續發性原因作醫療評估的一般性說明可能是適當的。** ● **停經後婦女和 50 歲以上男性的 WHO 診斷標準。**
DXA Report: Items That Should not be Included • A statement that there is bone loss without knowledge of previous bone density. • Mention of “mild,” “moderate,” or “marked” osteopenia or osteoporosis. • Separate diagnoses for different ROI (e.g., osteopenia at the hip and osteoporosis at the spine). • Expressions such as “She has the bones of an 80-year-old,” if the patient is not 80 years old. • Results from skeletal sites that are not technically valid. • The change in BMD if it is not a significant change based on the precision error and LSC.	DXA 報告：不應該包括的項目 ● 無過去骨密度的資訊就說明有骨流失。 ● 提及 “輕度 ”、“中度 ”或 “顯著”骨缺乏或骨質疏鬆症。 ● 對不同的判讀區間作分別的診斷(例如，髖部的骨缺乏和脊椎的骨質疏鬆症)。 ● 假如病人不是 80 歲，說明如 “她有 80 歲的骨頭 ”。 ● 非技術上有效的骨骼部位之結果。 ● 骨密度的變化，如果依據精確度誤差和最小顯著變化下並不顯著改變時。

Components of a VFA Report

- Patient identification, referring physician, indication(s) for study, technical quality and interpretation.
- A follow-up VFA report should also include comparability of studies and clinical significance of changes, if any.
- VFA reports should comment on the following
  - Unevaluable vertebrae
  - Deformed vertebrae, and whether or not the deformities are consistent with vertebral fracture
  - Unexplained vertebral and extra-vertebral pathology
- Optional components include fracture risk and recommendations for additional studies.

Trabecular Bone Score (TBS)

- **TBS is appropriate in adults aged ≥ 40 years.**
- **TBS results are most likely to alter clinical management in individuals who are close to a specific pharmacologic intervention threshold.**
- **TBS should be performed only within BMI range recommended by the manufacturer and can be used regardless of sex, race/ethnicity and prior or current osteoporosis treatment.**
- **L1-L4 vertebral levels, without exclusions, should be used for TBS measurement and to calculate TBS-adjusted FRAX probabilities even in the presence of moderate degenerative changes and chronic lumbar compression fractures. It is recommended not to report TBS if there is severe structural or pathological artifact (e.g., vertebra plana, laminectomy, hardware, metastatic lesions).**
- TBS is associated with vertebral, hip and major osteoporotic fracture risk in postmenopausal women.

脊椎骨折評估報告(VFA)的組成

- 患者身分、轉介醫師、檢查適應症、技術品質和判讀。
- 如果可以的話，VFA 報告也應包括檢查的比較和臨床變化的意義。
- VFA 報告應對以下作解說
  - 無法評估的脊椎
  - 變形的脊椎，以及變形是否與脊椎骨折一致
  - 不明原因的脊椎以及脊椎外病變
- 選擇的部分包括骨折風險及進一步的檢查建議。

骨小樑指數(TBS)

- **骨小樑指數適合用在 40 歲以上成人。**
- **當個案接近特定的藥物介入閾值時，骨小樑指數結果可能改變臨床決策。**
- **骨小樑指數只能在製造商建議的身體質量指數區間內操作，無論性別、種族/族群及過去或當下的骨質疏鬆治療都可使用。**
- **沒有例外節之第 1 至第 4 腰椎，應被用來計算骨小樑指數及 TBS 調整後之十年骨折風險(FRAX)估計值，即使有中度退化性變化和慢性腰椎壓迫性骨折。若有以下嚴重的結構性或病理性假影則不建議報告骨小樑指數(如：扁平錐體、椎板切除術、固定物、轉移性病灶)**
- 骨小樑指數與停經後婦女的脊椎、髖骨及主要骨鬆性骨折風險有關。
- 骨小樑指數與 50 歲以上男性的髖骨骨折風

● TBS is associated with hip fracture risk in men over the age of 50 years. ● TBS is associated with major osteoporotic fracture risk in men over the age of 50 years. ● TBS is associated with major osteoporotic fracture risk in postmenopausal women with type II diabetes. ● TBS should not be used alone to determine treatment recommendations in clinical practice. ● **When available, use the TBS value for adjusting and reporting fracture risk.** ● **In routine clinical practice, monitoring and reporting TBS change is not recommended.**	險有關。 ● 骨小樑指數與 50 歲以上男性的主要骨鬆性骨折風險有關。 ● 骨小樑指數與有第二型糖尿病的停經後婦女之主要骨鬆性骨折風險有關。 ● 骨小樑指數不應單獨用以決定臨床工作上的治療建議。 ● **當可取得報告時，骨小樑指數數值可用來調整及報告骨折風險。** ● **在常規臨床工作上，不建議監測或報告骨小樑指數的改變。**
Hip Geometry ● Hip axis length (HAL) derived from DXA is associated with hip fracture risk in postmenopausal women. ● The following hip geometry parameters derived from DXA (CSA, OD, SM, BR, CSMI, NSA) should not be used to assess hip fracture risk. ● Hip geometry parameters derived from DXA (CSA, OD, SM, BR, CSMI, HAL, NSA) should not be used to initiate treatment. ● Hip geometry parameters derived from DXA (CSA, OD, SM, BR, CSMI, HAL, NSA) should not be used for monitoring.	髖骨幾何測量 ● 來自 DXA 的髖骨軸長(HAL)與停經後婦女的髖骨骨折風險有關。 ● 下述來自 DXA 的髖骨幾何測量參數[CSA (橫斷面面積)、OD(外徑)、SM(斷面模數)、BR(屈曲應力比)、CSMI(橫斷面慣性矩)、NSA(股骨頸幹角)]不應用於評估髖骨骨折風險。 ● 來自 DXA 的髖骨幾何測量參數(CSA, OD, SM, BR, CSMI, HAL, NSA)不應用於啟動治療。 ● 來自 DXA 的髖骨幾何測量參數(CSA, OD, SM, BR, CSMI, HAL, NSA)不應用於監測。
General Recommendations for Non Central DXA Devices: QCT, pQCT, QUS, and pDXA The following general recommendations for QCT, pQCT, QUS, and pDXA are analogous to those defined for central DXA technologies. Examples of technical differences amongst devices, fracture prediction ability for current manufacturers and equivalence study requirements are provided in the full text documents printed in the *Journal of Clinical*	對非中軸型雙能量 X 光吸收儀儀器的一般性建議：定 量電腦斷層(QCT)、周邊型定量電腦斷層(pQCT)、定量超音波(QUS)及周邊型雙能量 X 光吸收儀(pDXA) 對於 QCT、pQCT、QUS 及 pDXA，以下的一般建議是類似於中軸型 DXA 的技術定義。臨床骨密雜誌(Journal of Clinical Densitometry)印有全文文檔，提供設備間技術性差異的範例，目前製造商骨折預測能力，以及等效性研究的需求。

Densitometry. • Bone density measurements from different devices cannot be directly compared. • Different devices should be independently validated for fracture risk prediction by prospective trials, or by demonstration of equivalence to a clinically validated device. • T-scores from measurements other than DXA at the femur neck, total femur, lumbar spine, or one-third (33%) radius cannot be used according to the WHO diagnostic classification because those T-scores are not equivalent to T-scores derived by DXA. • Device-specific education and training should be provided to the operators and interpreters prior to clinical use. • Quality control procedures should be performed regularly.	● 來自不同的設備骨密度測量不能直接比較。 ● 應由前瞻性試驗或通過證明與臨床驗證設備等效的方法獨立驗證不同設備的骨折風險預測。 ● 根據世界衛生組織的診斷分類，不能使用來自於非 DXA 在股骨頸、全股骨、腰椎，或三分之一(33%)橈骨測量的 T 值，因為這些 T 值並不等同於經 DXA 所得之 T 值。 ● 在臨床應用前，應提供給操作者和判讀者其設備特定的教育和培訓 ● 品質管控程序應定期進行。
Baseline Non Central DXA Devices (QCT, pQCT, QUS, pDXA) Report: Minimum Requirements • Date of test • Demographics (name, date of birth or age, sex) • Requesting provider • Names of those receiving copy of report • Indications for test • Manufacturer, and model of instrument and software version • Measurement value(s) • Reference database • Skeletal site/ROI • Quality of test • Limitations of the test including a statement that the WHO diagnostic classification cannot be applied to T-scores obtained from QCT, pQCT, QUS, and pDXA (other than one-third (33%) radius) measurements • Clinical risk factors • Fracture risk estimation • A general statement that a medical evaluation for secondary causes of low BMD may be appropriate • Recommendations for follow-up imaging	基本非中軸型 DXA 儀器(QCT、pQCT、QUS 及 pDXA)報告：最低要求 ● 測試日期 ● 人口統計資料（姓名、出生日期或年齡、性別） ● 需求提供者 ● 報告的接受副本名稱 ● 檢測適應症 ● 製造商，以及儀器型號和軟體版本 ● 測量值 ● 參考數據庫 ● 骨骼部位/判讀區間 ● 檢測的品質 ● 檢測的限制，包括 WHO 分類不能應用於從 QCT、pQCT、QUS，和 pDXA [非三分之一(33%)橈骨]等獲得的 T 值之說明 ● 臨床危險因子 ● 骨折風險估算 ● 對低骨密度的續發性原因作醫療評估的一般性說明可能是適當的。 ● 後續追蹤影像的建議

Note: A list of appropriate technical items is provided in the QCT and pQCT sections of the full text documents printed in the *Journal of Clinical Densitometry.*

Non Central DXA Devices (QCT, pQCT, QUS, pDXA) Report: Optional Items

- Report may include the following optional item:
  - Recommendations for pharmacological and non pharmacological interventions.

QCT and pQCT

- **Acquisition**
  - With single-slice QCT, L1-L3 should be scanned; with 3D QCT, L1- L2 should be scanned.
  - QCT acquisition of the proximal femur should extend from the femoral head to the proximal shaft.
  - For density-based QCT measurements the in-scan calibration phantom can be replaced by asynchronous calibration if scanner stability is maintained.
  - Opportunistic CT to screen for patients with low BMD or low bone strength of the spine or proximal femur is possible only if validated machine-specific cutoff values and scanner stability have been established.

- Diagnosis
  - Femoral neck and total hip T-scores calculated from 2D projections of QCT data are equivalent to the corresponding DXA T-scores for diagnosis of osteoporosis in accordance with the WHO criteria.

- Fracture Prediction
  - Spinal trabecular BMD as measured by QCT has at least the same ability to predict vertebral fractures as AP spinal BMD measured by central DXA in postmenopausal women. There is lack of sufficient evidence to support this position for men.
  - There is lack of sufficient evidence

備註：臨床骨密雜誌印有 定 量電腦斷層和周邊型定量電腦斷層章節中的全文文檔提供適當的技術項目的清單。

非中軸型 DXA 儀器(QCT、pQCT、QUS 及 pDXA)報告：選擇性項目

- 報告可以包括下述選擇性項目：
  - 藥物和非藥物介入的建議

定 量電腦斷層(QCT)和周邊型定量電腦斷層(pQCT)

- 取像
  - 使用單張切片 QCT，第 1 腰椎至第 3 腰椎應該掃描；使用 3 維 QCT，第 1 腰椎至第 2 腰椎應該掃描。
  - 近端股骨的 QCT 取像應該從股骨頭延伸至股骨幹。
  - 對於以密度為基礎的 QCT，如果保持掃描儀的穩定性，則可以使用非同步校準來取代掃描校準假體。
  - 僅當驗證儀器特異切點和掃描儀穩定度建立時，才可能以隨機斷層掃描篩檢脊椎或近端股骨有低骨密度或低骨強度的病患

- 診斷
  - 自 QCT 的 2 維投影資料計算的股骨頸和全髖骨 T 值等於根據 WHO 標準診斷骨質疏鬆症的相應 DXA 之 T 值。

- 骨折預測
  - QCT 測量脊椎骨小樑骨密度與 DXA 測量前後位脊椎骨密度有至少相同的能力預測停經後婦女脊椎骨折。目前缺乏足夠的證據來支持男性立場。
  - 目前缺乏足夠的證據建議脊椎定量電腦

to recommend spine QCT for hip fracture prediction in either women or men. • Total femur trabecular BMD measured by QCT predicts hip fractures as well as hip BMD measured by DXA in postmenopausal women and older men. • pQCT of the forearm at the ultra-distal radius predicts hip, but not spine, fragility fractures in postmenopausal women. There is lack of sufficient evidence to support this position for men.	斷層作為無論是女性或男性髖骨骨折的預測。 ● 在停經後婦女和老年男性，除了 DXA 測量髖骨骨密度，QCT 測量全股骨骨小樑骨密度也可預測髖骨骨折。 ● 前臂 橈骨最末端的 pQCT 可以預測停經後婦女髖部而非脊椎的脆弱性骨折。目前缺乏足夠的證據可支持此立場用於男性。
■ Therapeutic Decisions • Central DXA measurements at the spine and femur are the preferred method for making therapeutic decisions and should be used if possible. Where QCT and DXA are both available and provide comparable information, DXA is preferred to limit radiation exposure. • However, if central DXA cannot be done, pharmacologic treatment can be initiated if the fracture probability, as assessed by QCT of the spine or pQCT of the radius using device specific thresholds, and in conjunction with clinical risk factors, is sufficiently high.	● 治療決策 ● 中軸型 DXA 測量脊椎和股骨是作治療決策的首選方法，可能的話應該使用。當 QCT 和 DXA 都可用並提供比較信息時，DXA 是首選以限制輻射暴露。 ● 但是，如果中軸型 DXA 不能做，但脊椎 QCT 及橈骨 pQCT 使用設備特定的閾值，並結合臨床危險因子評估的骨折機率是夠高時，可以開始藥物治療。
■ Monitoring • Trabecular BMD of the lumbar spine measured by QCT can be used to monitor age-, disease-, and treatment-related BMD changes. • Integral and trabecular BMD of the proximal femur measured by QCT can be used to monitor age- and treatment-related BMD changes. • Trabecular and total BMD of the ultra-distal radius measured by pQCT can be used to monitor age-related BMD changes.	● 監測 ● QCT 的腰椎骨小樑骨密度可以使用於監測年齡、疾病、治療相關的骨密度變化。 ● QCT 測量近端股骨的整體和骨小樑骨密度可以用於監測年齡和治療相關的骨密度變化 ● pQCT 測量橈骨的最末端骨小樑及整體骨密度可以使用於監測年齡相關的骨密度變化。

■ Finite Element Analysis (FEA) • Vertebral strength as estimated by QCT-based FEA predicts vertebral fracture in postmenopausal women. • Vertebral strength as estimated by QCT-based FEA is comparable to spine DXA for prediction of vertebral fractures in older men. • Femoral strength as estimated by QCT-based FEA is comparable to hip DXA for prediction of hip fractures in postmenopausal women and older men. • FEA cannot be used to diagnose osteoporosis using the current WHO T-score definition. • Vertebral or femoral strength as estimated by QCT-based FEA can be used to initiate pharmacologic treatment using validated thresholds and in conjunction with clinical risk factors. • Vertebral or femoral strength as estimated by QCT-based FEA can be used to monitor age- and treatment-related changes.	● 有限元素分析(FEA) ■ QCT 為基礎的 FEA 估計之脊椎強度可預測停經後婦女的脊椎骨折。 ■ QCT 為基礎的 FEA 估計之脊椎強度與用於預測老年男性脊椎骨折的脊椎 DXA 能力相當。 ■ QCT 為基礎的 FEA 估計之股骨強度與用於預測停經後婦女與老年男性股骨骨折的髖骨 DXA 能力相當。 ■ FEA 不能用於使用目前 WHO 的 T 值之定義診斷骨質疏鬆症。 ■ QCT 為基礎的 FEA 估計之脊椎或股骨強度可用於使用驗證的的閾值並結合臨床危險因子啟動的藥物治療。 ■ QCT 為基礎的 FEA 估計之脊椎或股骨強度可用於監測與年齡和治療相關的變化。
■ Reporting • For QCT using whole body CT scanners the following additional technical items should be reported: • Tomographic acquisition and reconstruction parameters • kV, mAs • Collimation during acquisition • Table increment per rotation • Table height • Reconstructed slice thickness, reconstruction increment	● 報告 ● 對於使用全身電腦斷層掃描儀的 QCT，以下額外的技術項目應報告： ◆ 斷層取像和重建參數 ◆ 千伏(kV)、 毫安培秒(mAs) ◆ 取像過程的準直 ◆ 每轉檯面增加量 ◆ 檯面高度 ◆ 重構切片厚度，重建增加量

• Reconstruction kernel	◆ 重建核心
■ For pQCT using dedicated pQCT scanners, the following additional technical items should be reported: • Tomographic acquisition and reconstruction parameters • Reconstructed slice thickness • Single / multi-slice acquisition mode • Length of scan range in multi-slice acquisition mode	● 對於使用專用 pQCT 掃描儀的 pQCT，下列額外的技術項目應報告： ● 斷層取像和重建參數 ● 重構的切片厚度 ● 單/多切片取像模式 ● 多片取像模式的掃描範圍長度
QUS	定量超音波(QUS)
■ Acquisition • The only validated skeletal site for the clinical use of QUS in osteoporosis management is the heel.	● 取像 ● 臨床使用 QUS 處理骨質疏鬆症的唯一驗證之骨骼部位是足跟。
■ Fracture Prediction • Validated heel QUS devices predict fragility fracture in postmenopausal women (hip, vertebral, and global fracture risk) and men over the age of 65 (hip and all non-vertebral fractures), independently of central DXA BMD. • Discordant results between heel QUS and central DXA are not infrequent and are not necessarily an indication of methodological error. • Heel QUS in conjunction with clinical risk factors can be used to identify a population at very low fracture probability in which no further diagnostic evaluation may be necessary. (Examples of device-specific thresholds and case findings strategy are provided in the full text documents printed in the *Journal of Clinical Densitometry*.)	● 骨折預測 ● 經過驗證的足跟 QUS 設備可預測停經後婦女(髖部，脊椎，和整體骨折風險)和 65 歲以上男性(髖部和所有非脊椎骨折)的脆弱性骨折，並獨立於中軸型 DXA 骨密度。 ● 足跟 QUS 和中軸型 DXA 間結果不一致的情況並不少見，不一定是方法錯誤。 ● 足跟 QUS 結合臨床危險因子可以辨識骨折機率很低的族群，而不需要作進一步診斷評估。（臨床骨密雜誌印有全文文檔提供設備特定閾值的範例和個案研究結果的策略。）

■ Therapeutic Decisions • Central DXA measurements at the spine and femur are preferred for making therapeutic decisions and should be used if possible. However, if central DXA cannot be done, pharmacologic treatment can be initiated if the fracture probability, as assessed by heel QUS, using device specific thresholds and in conjunction with clinical risk factors, is sufficiently high. (Examples of device-specific thresholds are provided in the full text documents printed in the *Journal of Clinical Densitometry*.) ■ Monitoring • QUS cannot be used to monitor the skeletal effects of treatments for osteoporosis. pDXA ■ Fracture Prediction • Measurement by validated pDXA devices can be used to assess vertebral and global fragility fracture risk in postmenopausal women, however its vertebral fracture predictive ability is weaker than central DXA and heel QUS. There is lack of sufficient evidence to support this position for men. • Radius pDXA in conjunction with clinical risk factors can be used to identify a population at very low fracture probability in which no further diagnostic evaluation may be necessary. (Examples of device-specific thresholds and case findings strategy are provided in the full text documents printed in the *Journal of Clinical Densitometry*.)	● 治療決策 ● 中軸型雙能量 X 光吸收儀測量脊椎和股骨是作治療決策的首選方法，可能的話應該使用。但是，如果中軸型雙能量 X 光吸收儀不能做時，但足跟定量超音波使用特定的設備的閾值，並結合臨床危險因子評估的骨折機率是夠高時，可開始使用藥物治療。（臨床骨密雜誌印有全文文檔提供設備特定閾值的範例。） ● 監測 ● QUS 不能使用於監測骨質疏鬆症治療的骨骼效果。 周邊型雙能量 X 光吸收儀(pDXA) ● 骨折預測 ● 通過驗證 pDXA 設備的測量可用於評估停經後婦女脊椎和的整體脆弱性骨折的風險，但其脊椎骨折的預測能力比中軸型 DXA 和足跟 QUS 差。目前缺乏足夠的證據可支持此立場用於男性。 ● 橈骨的 pDXA 結合臨床危險因子可以辨識骨折機率很低的族群，而不需要作進一步診斷評估。（臨床骨密雜誌印有全文文檔提供設備特定閾值的範例和個案研究結果的策略。）

- Diagnosis
  - The WHO diagnostic classification can only be applied to DXA at the femur neck, total femur, lumbar spine and the one-third (33%) radius ROI measured by DXA or pDXA devices utilizing a validated young-adult reference database.

- Therapeutic Decisions
  - Central DXA measurements at the spine and femur are the preferred method for making therapeutic decisions and should be used if possible. However, if central DXA cannot be done, pharmacologic treatment can be initiated if the fracture probability, as assessed by radius pDXA (or DXA) using device specific thresholds and in conjunction with clinical risk factors, is sufficiently high. (Examples of device-specific thresholds are provided in the full text documents printed in the *Journal of Clinical Densitometry*.)

- Monitoring
  - pDXA devices are not clinically useful in monitoring the skeletal effects of presently available medical treatments for osteoporosis.

Body Composition

- Indications
  - DXA total body composition with regional analysis can be used in the following conditions:
    - In patients living with HIV to assess fat distribution in those using anti-retroviral agents associated with a risk of lipoatrophy (currently stavudine [d4T] and zidovudine [ZDV, AZT]).
    - In obese patients undergoing bariatric surgery (or medical, diet, or weight loss regimens with anticipated large weight loss) to assess fat and lean

- 診斷
  - 世界衛生組織診斷分類可以應用於 DXA 測量的股骨頸、全股骨、腰椎，以及利用驗證過的年輕成人資料庫的 DXA 和 pDXA 測量的三分之一(33%)橈骨判讀區間。
- 治療決策
  - 中軸型 DXA 測量脊椎和股骨是作治療決策的首選方法，可能的話應該使用。但是，如果中軸型 DXA 不能做時，但橈骨 pDXA (或 DXA) 使用設備特定的閾值，並結合臨床危險因子所評估的骨折機率是夠高時，可以開始藥物治療。（臨床骨密雜誌印有全文文檔提供設備特定閾值的範例。）
- 監測
  - pDXA 設備不能用於臨床上監測目前骨質疏鬆症藥物治療的骨骼效果。

人體組成

- 適應症
  - DXA 的全人體組成及區間分析可以在下述情況下使用：
    - ◆ 在愛滋病病患，評估使用抗反轉錄病毒藥物有脂肪萎縮相關風險的脂肪分布情形。(目前 stavudine [d4T] 和 zidovudine [ZDV, AZT])
    - ◆ 在接受減重手術的肥胖病患(或藥物、飲食、或減重療法有預期性大量體重減少)，當減重超過 10%時，

mass changes when weight loss exceeds approximately 10%. The impact on clinical outcomes is uncertain. • In patients with muscle weakness or poor physical functioning to assess fat and lean mass. The impact on clinical outcomes is uncertain. • Pregnancy is a contraindication to DXA body composition. Limitations in the use of clinical DXA for total body composition or bone mineral density are weight over the table limit, recent administration of contrast material and/or artifact. Radiopharmaceutical agents may interfere with accuracy of results using systems from some DXA manufacturers.	評估脂肪和瘦體質量變化。對臨床結果的影響未確定。 ◆ 在肌肉無力或身體功能較差的患者，評估脂肪和瘦體質量。對臨床結果的影響未確定。 ● 懷孕是 DXA 檢測人體組成的禁忌。在臨床上使用 DXA 作全身組成分析和骨密度檢查的限制是體重超過檢查檯限制，最近服用顯影劑和/或假影。放射性藥物可能會干擾一些 DXA 製造商所使用的系統結果準確性。
■ Acquisition • No phantom has been identified to remove systematic differences in body composition when comparing in-vivo results across manufacturers. • An in-vivo cross-calibration study is necessary when comparing in-vivo results across manufacturers. • Cross-calibrating systems of the same make and model can be performed with an appropriate whole body phantom. • Changes in body composition measures can be evaluated between two different systems of the same make and model if the systems have been cross-calibrated with an appropriate total body phantom. • When changing hardware, but not the entire system, or when replacing a system with the same technology (make and model), cross-calibration should be	● 取像 ● 沒有假體在跨廠牌比較活體結果時，可以除去人體組成的系統差異。 ● 當比較跨廠牌的活體結果時，活體交叉校準的研究是必要的。 ● 相同品牌和型號的交叉校準系統時，可以使用適當的全身假體進行。 ● 如果系統已經用適當的全身假體交叉校準過，則測量人體組成的變化，可以在同一品牌和型號的兩種不同的系統之間進行評估。

performed by having one technologist do 10 whole body phantom scans, with repositioning, before and after hardware change. If a greater than 2% difference in mean percent fat mass, fat mass or lean mass is observed, contact the manufacturer for service/correction. • No total body phantoms are available at this time that can be used as absolute reference standards for soft-tissue composition or bone mineral mass.	● 當變更硬體，而不是整個系統，或使用相同的技術（品牌和型號）更換系統時，交叉校準應在硬體變更前後，由一個技術員進行做 10 次有重新定位的全身假體掃描。如果觀察到平均百分比脂肪質量，脂肪質量或瘦體質量大於 2%的差異，則與製造商聯繫維修/校正。 ● 目前沒有全身假體可以用來作為軟組織組成或骨礦物質量的絕對參考標準。
• The Quality Control (QC) program at a DXA body composition facility should include adherence to manufacturer guidelines for system maintenance. In addition, if not recommended in the manufacturer protocol, the following QC procedures are advised: • Perform periodic (at least once per week) body composition phantom scans for any DXA system as an independent assessment of system calibration. • Plot and review data from calibration and body composition phantom scans. • Verify the body composition phantom mean percent fat mass and tissue mass after any service performed on the densitometer. • Establish and enforce corrective action thresholds that trigger a call for service.	● 在 DXA 人體組成設備的品質管控程序應包括遵循製造商系統維護的指引。此外，若製造商的指引未有建議，則建議採取以下品質管控程序： ◆ 對任何雙能量 X 光吸收儀系統執行週期性(每週至少一次)的人體組成假體掃描，作為系統校準的獨立評估。 ◆ 繪製及回顧校準和假體掃描的資料。 ◆ 在執行任何骨密儀檢查後，驗證人體組成假體平均百分比脂肪質量和組織質量。 ◆ 建立和執行會觸發呼叫服務的校正

• Maintain service logs. • Comply with radiation surveys and regulatory government inspections, radiation surveys and regulatory requirements.	措施之閾值。 ◆ 維護檢查紀錄。 ◆ 遵守政府審查，輻射檢測和法規要求。
• Consistent positioning and preparation (e.g. fasting state, clothing, time of day, physical activity, empty bladder) of the patient is important for accurate and precise measures.	● 病患一致的定位和準備（如空腹狀態、服裝、當日時間、體能活動、排空膀胱）對精確的測量很重要。
• Positioning of the arms, hands, legs and feet whenever possible should be the NHANES method (palms down isolated from the body, feet neutral, ankles strapped, arms straight or slightly angled, face up with neutral chin).	● 手臂，手，腿和腳應該盡可能按NHANES的 方法擺放(手心向下離開身體，雙腳置中，腳踝約束，雙臂伸直或略有角度，面朝上及下巴置中)。
• "Offset-scanning" should be used in patients who are too wide to fit within the scan boundaries, using a validated procedure for a specific scanner model.	● "偏移掃描"應使用在病人身材太寬，以至於不在掃描範圍內，且是使用特定掃描儀型號驗證過的程序。
• Every technologist should perform an in-vivo precision assessment for all body composition measures of interest using patients who are representative of the clinic's patient population.	● 每個技術員應使用代表該院所病患族群所有人體組成的量測，執行活體精密度評估。
• The minimum acceptable precision for an individual technologist is 3%, 2% and 2% for total fat mass, total lean mass, and percent fat mass, respectively.	● 個別技術員的總脂肪質量，總瘦體質量和百分比脂肪質量之最小可接受精確度分別為3%、2%和2%。
• Consistently use manufacturer's recommendations for ROI placement.	● 始終使用製造商的建議作判讀區間定位。
• Consistently use manufacturer's recommendations for artifact removal.	● 始終使用製造商的建議去除假影。

■ Analysis and Reporting • For adults total body (with head) values of BMI, BMD, BMC, total mass, total lean mass, total fat mass, and percent fat mass should appear on all reports. • Total Body BMC as represented in the NHANES 1999-2004 reference data should be used when using DXA in 4-compartment models. • DXA measures of adiposity and lean mass include visceral adipose tissue (VAT), appendicular lean mass index (ALMI: appendicular lean mass/ht^2), android/gynoid percent fat mass ratio, trunk to leg fat mass ratio, lean mass index (LMI: total lean mass/ht^2), fat mass index (FMI: fat mass/ht^2) are optional. The clinical utility of these measures is currently uncertain. • When comparing to the US population, the NHANES 1999-2004 body composition data are most appropriate for different races, both sexes, and for ages from 8 to 85 years. [Note: Reference to a population does not imply health status.] • Both Z-scores and percentiles are appropriate to report if derived using methods to adjust for non-normality. • The use of DXA adiposity measures (percent fat mass or fat mass index) may be useful in risk-stratifying patients for cardio-metabolic outcomes. Specific thresholds to define obesity have not been established. • "Low lean mass" could be defined using appendicular lean mass divided by height squared (ALM/height^2) with Z-scores derived from a young adult, race, and sex-matched population. Thresholds for low lean mass from consensus guidelines for sarcopenia await confirmation.	● 分析和報告 ■ 對於成年人全身(含頭)的身體質量指數、骨密度、骨礦物含量、總質量、總瘦體質量、總脂肪質量和百分比脂肪質量的數值應該出現在所有的報告。 ■ 當使用四組份模式時，DXA 的全身骨礦物含量應該使用 NHANES 1999 年至 2004 年的參考資料作為代表。 ■ DXA 之肥胖和瘦體質量包括內臟脂肪組織(VAT)、四肢瘦體質量指數(ALMI：四肢瘦體質量/身高 ^{2})、雄型/雌型百分比脂肪質量比、軀幹比腿部脂肪質量比、瘦體質量指數(LMI：瘦體質量/身高 ^{2})、脂肪質量指數(FMI：脂肪質量/身高 ^{2})則是選擇性的測量值。這些測量值的臨床應用目前尚未確定。 ■ 當與美國族群比較時，1999 至 2004 年 NHANES 的人體組成資料是最適合於不同的種族、性別，及年齡從 8 至 85 歲。[備註：參照某個族群的結果並不意味著健康狀況。] ■ 如果要使用方法來調整非常態，用 Z 值和百分位數兩者來報告是適當的。 ■ 使用 DXA 作肥胖測量(百分比脂肪質量和脂肪質量指數)可能在有心臟代謝的結果風險分層的患者是有用的。用來定義肥胖的特定閾值尚未建立。 ■ "低瘦體質量"可以用四肢瘦體質量除以身高的平方(ALM/height^2)與從一個年輕的成人、種族和性別匹配的族群衍生的 Z 值來的定義。來自肌少症的共識指引的低瘦體質量閾值仍有待進一步確立。

DXA In Patients With Spinal Cord Injury

- All adults with spinal cord injury resulting in permanent motor or sensory dysfunction should have a DXA scan of the total hip, proximal tibia and distal femur, as soon as medically stable.
- In adults with SCI, total hip, proximal tibia and distal femur bone density should be used to diagnose osteoporosis, predict lower extremity fracture risk and monitor response to therapy when normative data are available.
- Serial DXA assessment of treatment effectiveness among individuals with SCI should include evaluation at the total hip, distal femur, and proximal tibia, following a minimum of 12 months of therapy at 1- to 2-year intervals. Segmental analysis of total hip, distal femur and proximal tibia sub-regions from a whole-body scan should not be used for monitoring treatment.
- There is no established threshold BMD value below which weight-bearing activities are absolutely contraindicated. BMD and clinical risk factors should be used to assess fracture risk prior to engaging in weight-bearing activities.

DXA In Transgender and Gender Non-conforming Individuals

- Baseline BMD testing is indicated for Transgender and Gender Non-Conforming (TGNC) individuals if they have any of the following conditions:
    - History of gonadectomy or therapy that lowers endogenous gonadal steroid levels prior to initiation of hormone therapy.
    - Hypogonadism with no plan to take gender-affirming hormone therapy.
    - Existing ISCD indications for BMD

DXA 用於脊髓損傷病患

- 所有因脊隨損傷導致永久性運動或感覺失調的成人病患，都應在醫療情況穩定時，盡快接受全髖骨、近端脛骨及遠端股骨之 DXA 檢查。
- 當有正常值時，成人脊髓損傷病患全髖骨、近端脛骨及遠端股骨之骨密度應該用於診斷骨質疏鬆、預測下肢骨折機率及監測治療反應。
- 對脊髓損傷病患治療效果之系列 DXA 評估應包含全髖骨、近端脛骨及遠端股骨，且在治療後最少 12 個月後、每間隔 1 至 2 年評估。
- 目前對負重運動之絕對禁忌，尚無已確立之骨密度最低閾值。在從事負重運動前應該以骨密度及臨床風險因子來評估骨折風險。

DXA 用於跨性別及非常規性別者

- 跨性別及非常規性別者若有以下狀況，基準骨密度檢測是必要的
    - ◆ 有生殖腺切除術病史，或在接受賀爾蒙療法前有接受會降低內生性性腺類固醇的治療
    - ◆ 性腺功能低下症且無計畫接受性別確認之賀爾蒙療法。
    - ◆ 存在現有國際臨床骨密檢測學會對骨密度檢測的情況，如：使用糖皮

testing, such as glucocorticoid use and hyperparathyroidism, apply.

- Follow-up BMD testing in TGNC individuals should be done when the results are likely to influence patient management. Examples include:
  - Low bone density as defined by current ISCD guidelines.
  - Individuals taking treatment to suppress puberty, such as GnRH analogs.
  - Non-adherence with or inadequate doses of gender-affirming hormone therapy.
  - Plan to discontinue gender-affirming hormone therapy.
  - Presence of other risks for bone loss or fragility fracture.
  - Bone mineral density testing intervals should be individualized based on each patient's clinical status: typically, every one to two years until BMD is stable or improved is appropriate, with longer intervals thereafter.
- T- and Z-Score Calculation in TGNC Individuals
  - T-scores should be calculated using a uniform **white** (non-race **/ethinicity** adjusted) female normative database for all transgender individuals of all ethnic groups; we recommend using a T-score of <-2.5 or less for diagnosis of osteoporosis in all TGNC individuals age 50 years or older, regardless of hormonal status.
  - Calculate Z-scores using the normative database that matches the gender identity of the individual.
  - If requested by the ordering provider, Z-scores may also be calculated using the normative database that matches the sex recorded at birth.

質激素和副甲狀腺亢進。

- 當檢測結果可能會影響病人處理時，跨性別及非常規性別者應作追蹤骨密度檢測。舉例如下：
  - 符合國際臨床骨密檢測學會定義之低骨密度
  - 接受抑制青春期的治療，如：性釋素類似物
  - 性別確認賀爾蒙療法之服藥不醫從、或劑量不適當
  - 計畫停止性別確認賀爾蒙療法
  - 有其他骨流失或脆弱性骨折發生
  - 骨密度檢測之間隔應該依據每個病人的臨床情況做個人化考量，一般來說，每 1 至 2 年一次，直至骨密度穩定或進步，爾後可將間隔拉長。
- 跨性別及非常規性別者之 T 值及 Z 值計算
  - T 值計算應統一使用白種人(未經種族**/族群**校正)女性的正常資料庫於所有種族的跨性別者，我們建議對 50 歲以上跨性別及非常規性別者，無論賀爾蒙狀態，皆以 T 值等於或小於-2.5 時診斷骨質疏鬆症。
  - 以符合個案性別認同之性別正常資料庫來計算 Z 值。
  - 若醫囑開立者要求，也可用符合個案出生紀錄之性別正常資料庫來計

- In gender-nonbinary individuals, the normative database that matches the sex recorded at birth should be used.
- Gender data should be obtained on the intake questionnaire.

■ The parameters to be included in the DXA report for transgender individuals are the same as are included in reports for the general population, but when specially requested, the report should include Z-scores calculated according to both male and female databases

Peri-prosthetic and Orthopedic Uses of DXA

- Bone health assessment should be considered in patients prior to elective orthopedic and spine surgery. BMD should be measured in those meeting ISCD or regional indications for DXA testing.
  - Routine DXA scans should include PA lumbar spine and hip.
  - Forearm DXA should be considered in patients having upper limb surgery.
  - VFA should be considered in patients having spine surgery.
- Elective orthopedic and spine surgery patients with the following conditions are at greater risk for impaired bone health and should have DXA testing:
  - Diabetes mellitus (long term duration of diabetes (>10yrs) and poor control)
    - Trabecular bone score measurement should be obtained in patients with diabetes, if available
  - Inflammatory arthritis
  - Exposed to chronic corticosteroids (≥ 5mg/day for three or more months of treatment)
  - A low-trauma fracture after 50 years

算 Z 值。

◆ 對非二元性別個案，應使用符合個案出生紀錄之性別正常資料庫。

◆ 在諮詢問卷時應取得性別資料。

■ 跨性別個案 DXA 報告包含的測量參數與一般大眾相同，若有特別要求，報告應該包含根據男性及女性資料庫的 Z 值。

DXA 用於人工關節及骨科

■ 在選擇性骨科手術和脊椎手術前應該先評估骨頭健康，當符合國際臨床骨密檢測學會或該地區適應症，應該量測骨密度。

◆ 常規 DXA 掃描應包含腰椎和髖骨的前後照 X 光

◆ 接受上肢手術的病人應考慮前臂 DXA

◆ 接受脊椎手術的病人應考慮脊椎骨折評估

■ 當選擇性骨科手術和脊椎手術的病人有以下會增加骨頭健康受損風險情況時，應該考慮 DXA 檢測

◆ 糖尿病(糖尿病齡超過 10 年且控制不佳)

● 若可取得，糖尿病患應接受骨小樑指數檢查。

◆ 發炎性關節炎

of age o Chronic kidney disease stage 3, 4 and 5 o Limited mobility o Smoking • When poor bone quality is identified during surgery, bone health assessment including DXA testing is indicated. • When assessing hip and knee arthroplasty, ROI should include periprosthetic metaphyseal and diaphyseal bone around and away from the implant: o After total hip arthroplasty, Gruen zones are recommended at the femur and the DeLee / Charnley or Wilkinson method are recommended at the pelvis. o Modifications of ROI based on patient conditions and implant geometry are acceptable. • Indications for pre-operative DXA testing for patients having hip surgery include: o A Dorr classification of B or C. o A Cortical Index of less than 0.4 measured at 10 cm below the mid lesser trochanter. • The Cortical Index and/or cortical thickness adjacent to the femoral hip implant can be used to monitor bone ingrowth or resorption, identify periprosthetic loosening, predict subsidence, and assess the effectiveness of medical and surgical methods to modulate BMD around the hip prostheses. • Opportunistic CT-based attenuation using Hounsfield Units (HU) can be used to estimate the likelihood of osteoporosis (L1 HU < 100) and normal (L1 HU > 150) bone density to support decisions regarding bone health assessment.	◆ 長期暴露糖皮質激素治療(持續 3 個月以上每天 5 毫克以上) ◆ 50 歲以後有發生低衝擊性骨折 ◆ 第三、四、五期慢性腎臟病 ◆ 活動受限 ◆ 抽菸 ■ 當手術時確認骨質不佳，骨頭健康評估、包含 DXA 檢測是必要的 ■ 當評估髖關節和膝關節置換術時，判讀區間須包含人工關節周圍之骨幹及幹骺端並遠離植體 ◆ 在髖關節置換術後，股骨附近建議選擇 Gruen 區域，骨盆復健建議使用 DeLee / Charnley 或 Wilkinson 方法。 ◆ 根據病人情況及植體幾何測量來調整判讀區間是可接受的。 ■ 髖關節置換術病患手術前 DXA 檢測的適應症包含： ◆ Dorr 分類 B 或 C。 ◆ 在小轉子中點下方 10 公分處的皮質骨指數小於 0.4。 ■ 在髖關節植體周圍的皮質骨指數及/或皮質骨厚度可用來監測骨頭長入或吸收狀況、辨認人工關節周圍鬆脫狀況、預測植入物下陷問題、評估髖部人工關節附近接受藥物或手術對骨密度調節的效果。

DXA Nomenclature

- **DXA – not DEXA.**
- **T-score – not T score, t-score, or t score**
- **Z-score – not Z score, z-score, or z score**

DXA Decimal Digits Preferred number of decimal digits for DXA reporting:

BMD: (example 0.927 g/cm2)	**3 digits**
T-score: (example -2.3)	**1 digit**
Z-score: (example 1.7)	**1 digit**
BMC: (example 31.76 g)	**2 digits**
Area: (example 43.25 cm2)	**2 digits**
% reference database: (example 82%)	**Integer**

Glossary

AFF – atypical femur fracture

ALMI – appendicular lean mass index

BMC – bone mineral content

BMD – bone mineral density (equivalent to areal BMD, aBMD)

BMI - body mass index

- 使用隨機斷層掃描篩為基礎的衰減程度(Hounsfield Units(HU))可用來預測骨質疏鬆 (L1 HU < 100)和骨密度正常(L1 HU > 150) 的可能性，以支持關於骨健康評估的醫療決策。

DXA 命名

- **DXA – 非 DEXA.**
- **T 值 – 非 T-值, t-值, 或 t 值***
- **Z 值 – 非 Z-值, z-值, 或 z 值***

(*中文慣用呈現方式略有不同於英文)

DXA 小數點以下位數於 DXA 報告時的偏好位數:

骨密度: (例如 0.927 克/公分 ^{2})	**3 位數**
T 值: (例如 -2.3)	**1 位數**
Z 值: (例如 1.7)	**1 位數**
骨礦物含量: (例如 31.76 克)	**2 位數**
面積: (例如 43.25 公分 ^{2})	**2 位數**
% 參考資料庫: (例如 82%)	**整數**

詞彙表

AFF – atypical femur fracture(非典型股骨骨折)

ALMI – appendicular lean mass index（四肢瘦體質量指數）

BMC – bone mineral content（骨礦物含量）

BMD – bone mineral density（骨密度）(相當於面積骨密度)

BR – buckling ratio CSA – Cross Sectional Area CSMI – cross-sectional moment of inertia DXA – dual-energy X-ray absorptiometry **FEA – Finite element analysis** **FFI – full femur imaging (from DXA)** FMI – fat mass index HAL – hip axis length **iAFF – incomplete atypical femur fracture** ISCD – International Society for Clinical Densitometry LMI – lean mass index LSC – least significant change NHANES III – National Health and Nutrition Examination Survey III NSA – neck shaft angle OD – outer diameter PA – posterior anterior pDXA – peripheral dual-energy x-ray absorptiometry pQCT – peripheral quantitative computed tomography QC – quality control	BMI - body mass index（身體質量指數） BR – buckling ratio (屈曲應力比) CSA – Cross Sectional Area (橫斷面面積) CSMI – cross-sectional moment of inertia (橫斷面慣性矩) DXA – dual-energy X-ray absorptiometry（雙能量 X 光吸收儀） **FEA – Finite element analysis(有限元素分析)** **FFI – full femur imaging (由 DXA 得出的雙側股骨全長影像)** FMI – fat mass index（脂肪質量指數） HAL – hip axis length (髖骨軸長) **iAFF – incomplete atypical femur fracture(不完全非典型股骨骨折)** ISCD – International Society for Clinical Densitometry（國際臨床骨密檢測學會） LMI – lean mass index（瘦體質量指數） LSC – least significant change（最小顯著變化） NHANES III – National Health and Nutrition Examination Survey III（第三次全國健康與營養檢驗調查） NSA – neck shaft angle (股骨頸幹角) OD – outer diameter (外徑) PA – posterior anterior（後前位） pDXA – peripheral dual-energy x-ray absorptiometry（週邊型雙能量 X 吸收儀）

QCT – quantitative Computed Tomography QUS – quantitative Ultrasound ROI – region(s) of interest SCI – spinal cord injury SM – section modulus SSI - strain strength index TBLH – total body less head TBS – trabecular bone score VAT – visceral adipose tissue VFA – Vertebral Fracture Assessment vBMD – volumetric BMD WHO – World Health Organization	pQCT – peripheral quantitative computed tomography（週邊型定量電腦斷層） QC – quality control（品質管控） QCT – quantitative Computed Tomography（定量電腦斷層） QUS – quantitative Ultrasound（定量超音波） ROI – region(s) of interest（判讀區間） SCI – spinal cord injury(脊髓損傷) SM – section modulus (斷面模數) SSI - strain strength index（應變強度指數） TBLH – total body less head（去頭外全身） TBS – trabecular bone score (骨小樑指數) VAT – visceral adipose tissue（內臟脂肪組織） VFA – Vertebral Fracture Assessment(脊椎骨折評估） vBMD – volumetric BMD（體積骨密度） WHO – World Health Organization（世界衛生組織）
 Approved and Accepted by the ISCD Board on August 24, 2023 • Traditional Chinese version was translated by Hsuan-Jui Chang and Paulo, Chih-Hsing Wu	 **ISCD 理事會於 2023 年 08 月 24 日認可接受** ■ 繁體中文版由張軒睿/吳至行翻譯。