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Review Article

DXA Reporting Updates: 2023 Official Positions of the International Society for Clinical Densitometry

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Abstract

Introduction: Professional guidance and standards assist radiologic interpreters in generating high quality reports. Initially DXA reporting Official Positions were provided by the ISCD in 2003; however, as the field has progressed, some of the current recommendations require revision and updating. This manuscript details the research approach and provides updated DXA reporting guidance. *Methods*: Key Questions were proposed by ISCD established protocols and approved by the Position Development Conference Steering Committee. Literature related to each question was accumulated by searching PubMed, and existing guidelines from other organizations were extracted from websites. Modifications and additions to the ISCD Official Positions were determined by an expert panel after reviewing the Task Force proposals and position papers. *Results*: Since most DXA is now performed in radiology departments, an approach was endorsed that better aligns with standard radiologic reports. To achieve this, reporting elements were divided into required minimum or optional. Collectively, required components comprise a standard diagnostic report and are considered the minimum necessary to generate an acceptable report. Additional elements were retained and categorized as optional. These optional components were considered relevant but tailored to a consultative, clinically oriented report. Although this information is beneficial, not all interpreters have access to sufficient clinical information, or may not have the clinical expertise to expand beyond a diagnostic report. Consequently, these are not required for an acceptable report. *Conclusion*: These updated ISCD positions conform with the DXA field's evolution over the past 20 years. Specifically, a basic diagnostic report better aligns with radiology standards, and additional elements (which are valued by treating clinicians) remain acceptable but are optional and not required. Additionally, reporting guidance for newer elements such as fracture risk assessment are incorporated. It is our expectation that these updated Official Positions will improve compliance with required standards and generate high quality DXA reports that are valuable to the recipient clinician and contribute to best patient care.

Keywords: Official positions; DXA; Reporting; Bone mineral density; Radiology reports.

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Introduction

The current reporting Official Positions include minimum requirements that make up a "consultative" dual-energy X-ray absorptiometry (DXA) interpretation. A consultative DXA report includes not only diagnostic data, but additional information meant to provide treatment guidance to the ordering clinician such as recommendations for when to perform a follow-up exam, advise work-up for secondary causes, or treatment suggestions. This was appropriate as at the time these were crafted in 2003, over half of the Medicare claims for DXA interpretation were submitted by non-radiologists or multispecialty providers *(1)*. However, since 2005, Centers for Medicare & Medicaid Services (CMS) data shows DXA interpretation by Primary Care and Internal Medicine subspecialties has declined ~20% and ~5% respectively while Radiology has increased over 30%. As a result, in 2019 Radiologists interpreted over 70% of DXAs submitted to Medicare *(2)*. Consequently, these updated Official Positions are structured so that minimum elements meet criteria for a diagnostic radiology report. Given the variety of healthcare systems worldwide, this allows for recommendations that accommodate many infrastructures.

As fewer clinicians with expertise in osteoporosis treatment are interpreting DXA exams, these updated positions reflect the current trend and consultative report elements have moved to the optional category. Therefore, reporting elements were categorized as diagnostic or consultative; diagnostic elements constitute the minimum required for an acceptable report; those considered consultative (or related to management) are applicable but listed as optional. These element categorizations were based on current (defined as those released since 2012) international osteoporosis diagnosis and treatment guidelines.

To determine appropriate categorization, we evaluated the American College of Radiology (ACR) communication performance parameters for DXA and communication of findings *(3,4)*, and existing DXA reporting guidance. These are summarized in Table 1. Additionally, international osteoporosis management guidelines were reviewed to differentiate between diagnostic and treatment components. Furthermore, an early study by El-Hajj Fuleihan et al. *(5)* acknowledged geographic and medical specialty variations in the practices of bone density reporting, complicating the crafting of guidelines; and a recent report by Jones et al. highlighted non-compliance with International Society for Clinical Densitometry (ISCD) reporting elements *(6)*. It is plausible that some of these positions might be inapplicable in some settings or outdated, therefore contributing to absence from reports. We present herein a systematic update of selected previously recommended DXA report elements at baseline and follow-up *(7,46)*.

Methods

To develop draft positions as responses to our Key Questions, we performed a search from inception to November 11,2022 using PubMed. Given the diversity of questions, several targeted searches were undertaken. A search for diagnostic and treatment guidelines was performed using the following search approach: ("Absorptiometry, Photon"[Mesh] OR DEXA[tiab] OR dual emission x-ray absorptiomet*[tiab] OR dual-energy radiographic absorptiomet*[tiab] OR dual-energy radiographic densitomet*[tiab] OR dual-energy Roentgen absorptiomet*[tiab] OR dual-energy x-ray absorptiomet*[tiab] OR dual-energy x-ray densitomet*[tiab] OR dual-energy x-ray absorptiomet*[tiab] OR dual-energy x-ray absorptiomet*[tiab] OR dual x-ray absorptiomet*[tiab] OR dual x-ray densitomet*[tiab] OR dual x-rays absorptiomet*[tiab] OR dual x-ray absorptiomet*[tiab] OR DXA[tiab]) AND ("Osteoporosis"[Mesh] OR age

Table 1
DXA reporting guidance summary.

Organization	Year	Country	Technical Quality	% Compared to Reference Population	List WHO Criteria	Fracture Risk Factors	Medical Management	Compare to Outside Study
Canadian Association of Radiologist *(15)*	2013	Canada	N	N	N	Y	When expertise permits	N
Royal Osteoporosis Society *(14)*	2019	UK	Y	N	Y	Y	Y	N
Healthy Bones Australia *(13)*	2021	Australia	N	N	Y	N	N	N
The American College of Radiology *(4)*	2018	USA	Y limitations only	N	N	N	N	Y
American Association of Clinical Endocrinologists *(19)*	2020	USA	N	N	N	N	N	N

WHO = World Health Organization, N = not present.

related bone loss[tiab] OR age related bone losses[tiab] OR osteoporoses[tiab] OR osteoporosis[tiab] OR osteoporotic[tiab] OR pathologic decalcification[tiab]) AND "Guideline"[Publication Type]. The following search terms were used targeting DXA monitoring: Dual X-ray Absorptiometry, DXA, Bone Mineral Density (BMD), adherence, satisfaction, monitoring, serial monitoring, serial DXA/BMD monitoring, DXA/BMD follow-up, results report, management of chronic disease, quality report, radiology report, actionable report. These terms were appropriately linked by Boolean operators such as "AND" and "OR." These search strategies were limited to humans and English-language publications. As some DXA reporting recommendations are not published in peer-reviewed, indexed publications, a Google search of "DXA reporting guidance" generated useful reference material. These guidelines were truncated for recency from 2012 to present, and no other restrictions were applied. Finally, publications from prior ISCD positions were included in our assessments and task force members were consulted regarding additional studies, abstracts, or existing formal recommendations. Manuscripts identified during manual search of bibliographies from relevant papers identified in searches noted above were also utilized. We selected relevant evidence by screening titles and abstracts generated from the formal searches, and subsequently reviewed full texts of those deemed potentially appropriate for inclusion. Any disagreements were resolved by consensus.

Key question #1

Should DXA reports contain a statement regarding scan technical quality and validity?

ISCD official position

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.

GRADE: Fair – C – W

Rationale

It is assumed that technically invalid exams will not be reported, however, it is also recognized that suboptimal scans - those not perfectly conforming to ideal technical acquisition or analysis due to patient, technologist or machine/software factors - might still have clinical value. Examples of suboptimal circumstances include vertebral fracture, degenerative changes, spinal hardware, bony islands, laminectomy, and limited hip rotation due to arthritis or soft tissue variation *(9-12)*. However, commentary specifying these abnormalities (and therefore limitations of the exam) would be beneficial to treating clinicians. In their Practice Parameters, the ACR recommends that a report, when appropriate, should identify factors that may compromise the clinical utility of an exam *(3)*.

Key question #2

Is it essential/still appropriate to list WHO diagnostic criteria in postmenopausal females and in men aged 50 and over?

ISCD official position

- The current Official Position: "WHO criteria for diagnosis in postmenopausal females and in men age 50 and over," will be moved to "DXA report Optional Items".
- Diagnostic classification is an essential component of the report, with application of the WHO diagnostic criteria when appropriate.

GRADE: Fair – C – W

Rationale

Available reporting guidelines recommend a statement specifying WHO diagnostic classification based on T-score. There is no consensus about including an additional listing of the classification definition, some guidelines recommend inclusion *(13,14)*, while others do not *(4,15)*. Rationale to exclude this information is not apparent, and some providers may find this a useful reference; consequently, this element is not being removed, but transitioned to a new location in "Optional Items". Importantly, a diagnosis based on WHO classification (without listing the entire components) should be part of the DXA report.

Key question #3

What information related to fracture risk assessment should be reported?

ISCD official position

Identify the fracture risk calculator used. Include positive fracture risk components that were included in the calculation.

GRADE: Fair – B – W

Rationale

This updated recommendation for listing fracture risk calculator, clinical factors used and calculated risk is linked to the increased use of fracture risk prediction tools. Fracture risk factors provide important information for patient management; however, their collective utility is optimized by integration into a fracture risk calculator *(16)*. It is also recognized that fracture risk prediction is impacted by the type and number of factors selected, consequently, it is critical to accurately select factors during calculation *(17)*. In many facilities, risk factors are entered by the technologist using patient self-report.

These technologists may have not been trained in acquiring medical history, therefore, it is possible that fracture risk calculation errors might occur. For this reason, instead of the independent listing of clinical risk factors, as suggested in prior ISCD Official Positions (7), the newly approved 2023 Official Position recommends listing only the factors selected for fracture risk calculation. This allows validation of fracture risk prediction results by the clinician making patient care decisions. It is thus suggested to rewrite the current recommendation to simply list a patient's clinical risk factors, to specify the fracture risk calculator used, and the clinical fracture risks that were included.

Key question #4

Is it appropriate to include statements regarding medical management?

ISCD official position

The current Official Position in Baseline DXA Report Minimum Requirements: "A general statement that a medical evaluation for secondary causes of low BMD may be appropriate" will be moved to "DXA Report Optional Items".

GRADE: Fair – B – W

Rationale

In a review of DXA reporting guidelines, only the Royal Osteoporosis Society lists patient management recommendations as a required element (14). Additionally, the Canadian Association of Radiologists encourages providing treatment guidance to the degree appropriate based on the knowledge and experience of the reporting physician (15). No other groups recommend including management guidance in the report. We further reviewed diagnostic and treatment guidelines to categorize elements as diagnostic versus consultative, specifically, the main elements of T-score, fracture risk prediction and presence of fracture. These were not consistently recommended between organizations (Table 2). Almost all groups promoted use of T-scores for diagnosis, whereas only half use them independently to identify who to treat (18-24), therefore, T-score was retained as a diagnostic, and consequently a required reporting element. However, fracture and fracture risk prediction as an independent element to diagnose is only endorsed by some (19,20,23,25,26) and therefore are considered consultative and optional elements.

Key question #5

Is it appropriate to compare the results of a new DXA scan to an outside study, if yes which parameters should be compared and how?

ISCD official position

Do not apply an LSC or report BMD change between instruments that are not cross-calibrated.

GRADE: Good – A – W

Rationale

This is well defended and detailed in the ISCD Cross-Calibration Official Positions (27). In brief it is not appropriate to apply an LSC to any scan pairs that were not acquired on the same instrument unless cross-calibration has been performed. Consistent with this, ACR guidance allows only qualitative comparison between non-cross-calibrated instruments and does not recommend cross-manufacturer comparison (4). In some cases, cross-calibration can be accomplished with phantoms; in others it's necessary to scan human volunteers. Additionally, it's important to appreciate that a person's BMD measured on a Hologic instrument is about 10% lower than on a General Electric scanner largely due to differences in technology, therefore making determination of BMD change inappropriate (28). However, ACR noted that qualitative comparison may be necessary; thus, change from previous scans on different machines should not be completely discounted but rather interpreted in the clinical context acknowledging the limitations.

Conversion equations have been published for spine and hip BMD and body composition; but have not been tested in clinical populations and cannot be used for clinical monitoring (29,30). Despite this, some DXA software offers the option to apply these equations to existing scans from another manufacturer and make these values available for trending in the new system. Additionally, these standardized BMD equations are based on parametric statistics for large groups of measures, not individual values. It is not acceptable to apply an LSC and report change to monitor BMD using these values.

Key question #6

Is it appropriate to evaluate reporting accuracy?

ISCD official position

Implement an internal program of peer-learning, following accepted radiologic practice, to facilitate quality reporting.

GRADE: Fair – B – W

Rationale

It is a best practice to evaluate radiologic interpretation competence as highlighted by ACR modality accreditation requiring a score-based peer-learning program (31). Traditional peer-review, random over-reads of reports, are cumbersome and ineffective, as was the finding of the ACR Peer Learning Summit (32). This group evaluated the approach of peer learning which substitutes a mandatory random over-read with the submission of cases when errors are identified by peers (33). These reports are then de-identified of patient and interpreter information and discussed as a group, consistent with

Table 2
Osteoporosis guideline summary.

Organization/Year	Diagnosis Guidelines				Treatment Guidelines			
	T-score	Fx Risk	Fx	Other	T-score	Fx Risk	Fx	Other
American College of Radiology - 2022 *(84)*	X	X	X		[3]			
Bone Health and Osteoporosis Society - 2022 *(20)*	X	X	X		X	X	X	
North American Menopause Society - 2021 *(26)*	X	X	X		X	X	X	
American Association of Clinical Endocrinology - 2020 *(19)*	X	X	X		X	X	X	X [5]
Gulf Cooperation Council[1] - 2020 *(25)*	X	X	X		X[2]	X	X	
The Endocrine Society - 2019 *(68)*	ND	-	-	-	X	X	X	
International Osteoporosis Foundation[1] - 2019 *(66)*	X					X	X	
Brazilian Guidelines -2017 *(21)*	ND	-	-	-	X		X	
Italian Society for Osteoporosis, Mineral Metabolism and Bone Diseases - 2016 *(67)*	X					X		
Saudi Osteoporosis Society - 2015 *(18)*	X				X	X	X[4]	
German Osteology Society 2014 *(69)*	ND	-	-	-	X	X	X	
American College of Obstetricians and Gynecologists - 2013 *(22)*	ND	-	-	-	X	X	X	
Japan Osteoporosis Society & Japanese Society for Bone and Mineral Research - 2012 *(23, 24)*	X[6]		X[7]		X[6]	X[8]	X[7]	

Fx = Fracture.
[1]In conjunction with the European Society for Clinical and Economic Aspects of Osteoporosis and Osteoarthritis.
[2]Must have other clinical indications present to treat T-score osteoporosis.
[3]Do not have independent criteria but reference American Association of Clinical Endocrinology and National Osteoporosis Foundation treatment guidance.
[4]Only if also diagnosed with at least osteopenia.
[5]Use of medications with side effect of skeletal compromise, frequent falls or injurious falls.
[6]Does not use T-score, but percent of young adult mean.
[7]Always if hip or vertebral fragility fracture; conditional if other fragility fracture.
[8]Conditional, only in patients without fracture and BMD 70% ≤ but > 80% of young adult mean.

case-based learning approaches. This method has been endorsed by radiology groups in the United States, Canada, and the UK *(32,34,35)*.

Key question #7

Which term is preferred, "Caucasian" or "White" when categorizing race?

ISCD official position

When reporting or referring to race, "White" is preferred to "Caucasian".

GRADE: Fair – C – W

Rationale

Emerging literature is supporting harmonizing nomenclature for race classification as White, in preference to Caucasian. JAMA has endorsed this approach as it was adopted by the AMA Manual of Style, stating "language and terminology must be accurate, clear, and precise, and must reflect fairness, equity, and consistency in use and reporting of race and ethnicity"*(36)*. Specifically, Caucasian refers to people from the Caucasus region in Eurasia and therefore does not appropriately describe the broad categorization encompassed by the term White *(36,37)* Additionally, there are cultural associations with this specific group that some might find sensitive *(38)*. A preference for the term White is also demonstrated by government agencies including the National Institutes of Health (NIH) *(39)* and Census Bureau *(40)*. Consistent with these and other reports, the American Society for Bone and Mineral Research (ASBMR) has advocated a shift to using White and recommends race classification within FRAX® also become compliant with this recommendation *(41)*.

Key question #8

Should a recommendation about timing for the next DXA scan be required in the DXA report?

Key question #8a

In light of the controversies about precise timing for BMD monitoring should the DXA report (at baseline

and follow-up) include a recommendation about the next DXA scan?

ISCD official position

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 particular clinical circumstances.

GRADE: *Fair – B – W*

Rationale

Since the first publication of ISCD positions regarding reporting results of DXA scans, authors have stressed that baseline and repeat DXA reports should include recommendations on necessity and timing of the next BMD study *(42)*, but this advice is debated *(43)*.

More recently, some have recommended longer intervals for repeat BMD testing *(44,45)*, but others recommended shorter intervals (1 to 3 years), taking into account several clinical parameters as published by the ISCD in 2019 *(46)*. This advice underscores the helpful roles of monitoring BMD as response to therapy or fracture risk reassessment *(8)*. The specific timing for serial monitoring has evolved in the last decades *(42,43,46)* and will continue to do so in light of the controversies regarding this issue, a basic question of principle arises: should or should not DXA reports contain a statement regarding repeat BMD testing, regardless of the monitoring interval recommended?

An acceptable specific LSC value determined according to ISCD standard procedures at the facility where the DXA scan is performed and repeated *(8,43)* is critical to allow comparison between two DXA scans. However, uncontrollable circumstances may arise preventing return to the same facility (insurance requirements, closed sites, patient location, etc.), and in such a situation, a direct comparison can be reported as long as cross-calibration has been performed according to ISCD recommendations *(27)*. As noted above, when quantitative comparison is not possible, qualitative assessment may still be valuable.

We did not find a study evaluating if a recommendation about serial DXA monitoring has a clinical impact on osteoporosis management. However, we identified several advantages to including a monitoring recommendation in the report. Most are based on physicians' survey preferences and potentially aiding reimbursement.

First, it is important to acknowledge that when patients receive, read and understand a written DXA report, there is a better understanding of their disease and an improvement in adherence to management plans including therapy *(47,48)*. This aligns with studies demonstrating that an interim DXA test had a positive impact on medication adherence and behavior to prevent osteoporosis progression and fracture *(49–51)* Furthermore, additional evidence asserts that "close patient monitoring" (using bone turnover markers and/or short interval BMD monitoring) would identify earlier declining adherence *(45)*.

Second, additional evidence points to some benefits of a written monitoring recommendation for referring physicians: one study based on a survey of physicians ordering DXA scans showed that 83% considered a recommendation about DXA monitoring necessity and timing essential or helpful *(52)*. Similarly, in another study which evaluated quality of radiology reports in the view of referring physicians, most considered recommendations about next step (repeat imaging, recommendations for additional imaging, suggestion of a diagnostic procedure or other follow-up) as valuable *(53)*. Therefore, the notion of BMD monitoring and its potential impact on patient behavior is reinforced even though the precise interval may be a matter of controversy.

Finally, in the field of radiology reporting, many national guidelines are available *(54–56)*, and high importance is given to suggestions about next steps, follow-up and monitoring recommendations, as a part of an actionable structured report *(57–60)*. Interestingly, a recent review about structured radiology reports *(61)*. identified quality metrics of radiology reports which are considered for reimbursement in the Center for Medicare and Medicaid Services' Merit-based Incentive Payment System (MIPS) *(62)*. These include many follow-up and timing recommendations for monitoring specific findings. Reimbursement policies depend on local economic and public health considerations; however as medical globalization, medical tourism, and migration are increasing, standardized high quality structured radiology reports with specific templates can be easily translated by multilingual programs *(63)*. This opens the door to worldwide applicability of standardized radiology reports using high quality-rated items – including DXA report statements on the necessity for repeat BMD testing.

Therefore, we see that written results are important to help patients' understanding of their condition, that referring physicians consider it important to receive recommendations about performing a next DXA scan (or further imaging study), and that in radiology reports, a paragraph with recommendations about monitoring is considered a quality characteristic which may improve reimbursement. Moreover, even if it was not directly evaluated, encouraging a repeat BMD by writing a recommendation in the DXA report may result in performing a follow-up DXA which may have positive impact on patients' adherence. Specifically, a short-term monitoring DXA may identify an early declining adherence. It results that creating a recommendation about serial monitoring in the DXA report confers non-clinical benefits for patients and referring physicians and qualifies for one of the most important aspects of quality of care: communication *(64)*. For all these reasons, it is our opinion that the DXA report should contain a recommendation about monitoring, on the condition that an acceptable LSC is

available and cross-calibration (if required) has been performed at the DXA facility.

Key question #8b

Should a statement about BMD monitoring be general or specific?

ISCD official position

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.

GRADE: Fair – B – W.

Rationale

Precise timing for serial DXA monitoring depends on the probability to observe a BMD change which can influence patient management *(46)*. One main condition to identify a significant BMD change is the LSC at the facility where the DXA scan is performed, but ISCD underscores other parameters such as the baseline or previous BMD results, clinical circumstances (specific osteoporosis medication, use of deleterious treatment for bone health such as glucocorticoids or aromatase inhibitors for example), and individual rate of bone loss in untreated patients *(46)*. When sufficient clinical Information is available, the DXA report should include precise timing for serial monitoring. This may help to prevent over-testing as the recommendation is specifically tailored to the patient's characteristics. When there are insufficient clinical data, or lack of relevant expertise by the interpreter, a general statement is recommended. In this circumstance, the referring physician will determine the appropriate timing for the next BMD.

In a radiology quality improvement study *(65)* aimed to improve adherence to recommendations, reports including a precise timing for next imaging modality had a better positive impact on follow-up of patients than reports with vague recommendations. In 61.9% of the reports no time frame recommendation appeared; in those with time monitoring, half were one year or longer, and 4.7% were not explicit. Importantly, shorter time frame recommendations had better chances to be applied by the referring physicians and the patients who received the reports. In the same study, two other important parameters improved adherence to recommendations: absence of contingency language and direct communication between the referring physician and the radiologist. If a precise recommendation with shorter time frame for the next serial DXA scan may be associated with clinical benefit and improved adherence to perform the exam, a general recommendation still may have a non-clinical benefit and may improve communication between referring physicians and DXA interpreters, which at the end can improve patients' care.

We conclude that radiology actionable reports have a better impact by using appropriate wording and clear recommendations for the next steps to monitor patients. Extrapolating to DXA reports, a precise timing should be proposed if adequate clinical information is available, and the interpreter has relevant expertise. Otherwise, a general recommendation for the next DXA scan is appropriate, using contingency language (referring to clinical circumstances). In these situations, a direct communication between the referring physician and the DXA reporter or a specialist may help to define the appropriate timing.

Discussion

The clinical use of DXA has evolved since the initial ISCD reporting positions were released in 2003. This update better harmonizes with the variety of health care systems and guidance provided by other organizations. For example, the modified language regarding technical quality is suggested to algin with current recommended approaches in radiology *(3)*. It is generally accepted that technically invalid exams will not be reported, therefore a stand-alone statement on technical acceptability is unnecessary. However, there are many instances where valid clinical data are available from technically imperfect scans. This has also been recognized in the ACR DXA Practice Parameter and it is suggested a report should note if artifacts or other technical issues may influence BMD results *(4)*.

The field has experienced a shift in osteoporosis care approaches since the development of ISCD Reporting Positions in the early 2000s. In addition to therapeutics, integration of fracture risk prediction into clinical assessment and management has revolutionized decision-making in the care of patients with or at risk for fracture. Consequently, it is appropriate to update positions to align with current guidelines and management approaches. This recommendation to replace an independent listing of clinical risk factors related to fracture harmonizes with similar guidance from the UK and Canada that recommend only reporting risk factors as they relate to fracture risk assessment *(14,15)*. As noted above, this is valuable information to validate the accuracy of fracture risk calculation.

One might detect the omission of a statement to make an osteoporosis diagnosis based on the presence of fracture or high fracture risk, which is recommended by some organizations *(19,20,25,26)*. However, this is not universally recommended *(18,21–23,66–69)* and is discouraged by some *(70,71)*. Consequently, as these are meant to be minimum elements designed for international applicability, osteoporosis diagnosis without BMD T-score classification is not included. Additionally, as full clinical information is often not readily available to DXA interpreters, it is unreasonable to expect an interpreter to accurately diagnose osteoporosis based on the presence,

or history, of fracture. For example, history regarding trauma, age of fracture incidence and knowledge of secondary cause may impact the decision to diagnose osteoporosis. Therefore, it is more appropriate for treating clinicians to diagnose clinical osteoporosis when based on factors other than BMD.

The initial positions were designed to generate a consultative report, which is beneficial for managing an osteoporosis patient. This was demonstrated by Opperman et. al. who investigated the impact of a detailed consultative report on adherence to treatment guidelines *(72)*. In addition to the diagnostic data in the report, the following treatment recommendations were provided: 1. Treatment recommendation and suggestion for secondary work-up when appropriate, 2. Nutritional supplement, 3. Comment on modifiable risk factors and 4. Monitoring interval. It is recognized this is an ideal approach for reporting; in fact, the Royal Osteoporosis Society identifies many of these consultative elements as required *(14)* and this approach is preferred by referring physicians *(52)*. Consequently, there is value in retaining these elements for use when possible. However, given the diversity of healthcare systems and related resources globally, it's unreasonable to require these elements in all reports; this is acknowledged by the Canadian Association of Radiologists when they specify patient management should only be provided by interpreters with appropriate expertise. Classifying elements and recognizing both approaches as acceptable should make these Official Positions universally applicable. We presently recommend moving the previously required element of "providing a general statement that a medical evaluation for secondary causes of low BMD may be appropriate" *(7)* to "Optional Elements Included in a DXA Report."

Reporting the appropriate timing for repeat DXA recommendations is also closely related to consultative reports. Despite the ISCD official position to include a recommendation about monitoring in the DXA report *(42)*, data presented at the ISCD 2016 Annual Meeting *(73)* showed that lack of recommendation for DXA monitoring was frequent and varied from 64% to 95%. In another recent study which analyzed the quality of DXA reports and their adherence to ISCD guidelines, very few reports included a recommendation about necessity and/or timing of monitoring *(6)*. Similarly, frequency of recommendations in radiology reports about repeating imaging or performing another imaging modality or a diagnostic procedure varies and may be as low as 10.6% *(74)* or 12% *(75)* and up to 37% of radiology reports, with a wide inter-radiologist variation concerning the timing and the appropriate modality, and sometimes non-adherence to guidelines *(76)*. Moreover, no studies evaluated the potentially multiple reasons for omitting a DXA monitoring recommendation in the DXA reports, although specifically avoiding writing a recommendation about monitoring may be due to incertitude about specific timing. Having said that, a general comment regarding timing for DXA monitoring is a required reporting component. However, guidance regarding specific timing may not be practical and is therefore no longer a required but optional reporting element. Reviewing all adequate clinical data and medical background approaches the concept of writing a consultative report, which is known as noticed earlier, to have a better impact on management of patients, but the DXA interpreter frequently does not have access to necessary data to propose exact timing for the next DXA *(72)*. The clinical and medical parameters to consider that precisely define the appropriate timing for monitoring are evolving over time; these areas are addressed in the 2023 PDC Follow-up BMD Testing Task Force.

It is recognized that providers need to make patient care decisions with serial DXA results from various non-cross-calibrated instruments. There is no standardized approach to apply in these instances. Therefore, clinicians find themselves reviewing this DXA data without quantitative comparison information and instead making a general assessment and using "clinical judgement" with the information at hand. However, it's important to appreciate that LSC includes three sources of variance: the instrument, technologist and patient population thereby making the calculated LSC unique to each facility and instrument. Consequently, it is inappropriate to apply either facility's LSC to scans obtained at different centers. Furthermore, given instrument variation, multiple scanners within the same facility also require cross-calibration before applying LSC. Details are described elsewhere in ISCD Official Positions *(27)*.

There are sources for BMD and body composition conversion equations in the literature and online *(28–30,77)* However, though these equations may be useful for research purposes when studying outcomes in large populations, they have not been tested or refined for clinical monitoring in an individual patient. Consequently, the conversion approach is not acceptable to determine change.

As a field, it is important that we improve the technical acquisition and accurate reporting of DXA exams *(78–82)*. The ISCD has contributed to this effort through education, generating Official Positions and developing technologist and clinician certification and facility accreditation. In part, these are meant to set a standard that when followed will result in quality DXA testing and reporting. ISCD offers quality parameters to document appropriate technical performance that include phantom scanning, quality assurance and precision assessment, but there are no formal recommendations on how to assess interpretation accuracy. As general quality assessment is an expectation in other radiology testing modalities *(31)*, it is logical for ISCD to promote similar standards specific to DXA. The peer-learning approach is effective compared to peer-review approaches and has been embraced by several groups in the field *(31,32,34,35)*. This approach is integrated in the work-flow process and therefore

scalable to facility size and should be an expectation to ensure quality, promote learning and optimize patient care.

The last update that we assessed included guideline harmonization to enhance compliance and reduce confusion in the field. Therefore, embracing the recommendations of the AMA and ASBMR Task Force on Clinical Algorithms to formally promote the use of "White" is appropriate *(41)*. Moreover, as some find the term Caucasian exclusive and demeaning *(38)*, there is little rationale to retain this term.

Future directions

Investigation of our Key Questions helped identify areas where more research would enhance available literature. Most notably, we propose additional research on approaches to provide clinical guidance on how to monitor BMD change between non-cross-calibrated instruments. This is not intended to discourage cross-calibration, but to provide clinicians with valuable tools for patient care. With the rise of managed care and HMO networks, radiology choices may be limited to a narrow network, and this may not allow return to a previous location. There are no data one can use to provide clinical care guidance in these common situations.

Although not formally considered by the Expert Panel, our task force did assess the issue of the existing Official Position on reporting the percentage of a patient's BMD compared to the reference population. When using this approach, it is important to avoid describing results as "bones of an 85-year-old". Second, most DXA reporting guidelines do not recommend inclusion of listing percent of normal in their report *(4,9,13–15)*. However, current guidelines in Japan, and perhaps other regions, specify this approach as preferred to T-scores *(23)*. It is important to recognize that the percentage of young normal is repetitive of T-score and when reporting percent of reference, it should be *used it in place of T-score, not in addition (23)*. As T-scores are most widely used and associated with WHO classification, ISCD endorses T-score as the preferred method to interpret BMD *(18,19,25,26,66,67,71)*, but percentage of patient BMD is an acceptable approach in regions where guidelines dictate its use. However, we suggest reporting either a percentage of reference or T-score to keep information clear and not confuse clinicians or patients.

Concerning providing a monitoring recommendation in the DXA report, a study evaluating the reasons why such a recommendation is often absent from the DXA report, but also the impact of a precise timing versus a general recommendation on patient management may further help assess the value of repeat DXA recommendations. For example, DXA facilities sending DXA reports offering either a precise or a general recommendation for repeat DXA scan can assess a difference in clinical impact of both recommendations by several ways: understanding of the patients about her/his condition and the recommendation; understanding of the referring physician about the addressed patient's condition and the recommendation; prescription and changes of anti-osteoporotic medications, as well as adherence to the prescriptions; occurrence of fragility fractures. Moreover, a mindful questionnaire filled-in by DXA readers may unravel why a recommendation about timing (either general or precise) was missing.

Further research evaluating whether these updated Official Positions improve compliance and patient care is indicated. For example, these minimum requirements should generate a report that aligns with standard radiologic approaches thereby improving compliance. A repeat of the Jones evaluation that surveys if existing DXA reports adhere to these Positions could determine whether facilities will be more compliant with the diagnostic style *(6)*. As was noted, a consultative reporting style is preferred by referring physicians, however, these Positions indirectly endorse a diagnostic report. A study similar to that of Oppermann that surveys physician satisfaction with this approach would generate insight to clinical utility *(72)*. Krueger et. al. demonstrated that use of a reporting template improved adherence with ISCD Reporting Positions and reduced the likelihood of reporting errors leading to inappropriate patient care decisions *(83)*. A similar evaluation between diagnostic and consultative reports that investigates the reporting error rates and associated patient management decisions would validate these positions.

Summary

Given the international diversity of healthcare systems and interpreters reporting bone density results and in effort to harmonize our positions with existing reporting guidance, our task force overarching principal goal was to propose only universally necessary items for the minimal element listing. It was recognized that some prior elements may not have been viewed as useful in some practices, accounting for reporting deficiencies highlighted in the Jones paper *(6)* and diversity of information contained in early reports *(5)*. Additionally, centers should not be penalized for exclusion of non-essential reporting elements during quality assurance evaluation, therefore consultative and descriptive components are now listed as optional. This approach should help encourage full compliance with a minimal report.

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