### Table 15j. Antiretroviral-Therapy-Associated Adverse Effects and Management Recommendations—Osteopenia and Osteoporosis  (Last updated May 22, 2018; last reviewed May 22, 2018)

<table>
<thead>
<tr>
<th>Adverse Effects</th>
<th>Associated ARVs</th>
<th>Onset/Clinical Manifestations</th>
<th>Estimated Frequency</th>
<th>Risk Factors</th>
<th>Prevention/Monitoring</th>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Osteopenia and Osteoporosis</td>
<td>Any ART regimen</td>
<td>Onset:  • Any age; decrease in BMD usually seen soon after initiation of ART. Presentation:  • Usually asymptomatic  • Rarely presents as osteoporosis, a clinical diagnosis defined by evidence of bone fragility (e.g., fracture with minimal trauma).</td>
<td>BMD z Score Less Than -2.0:  • &lt;10% in U.S. cohorts  • Approximately 20% to 30% in international cohorts</td>
<td>Longer duration and greater severity of HIV disease  Vitamin D insufficiency/deficiency  Delayed growth or pubertal delay  Low BMI  Lipodystrophy  Non-black race  Smoking  Prolonged systemic corticosteroid use  Medroxyprogesterone use  Lack of weight-bearing exercise</td>
<td>Prevention:  • Ensure sufficient calcium intake and vitamin D sufficiency.  • Encourage weight-bearing exercise.  • Minimize modifiable risk factors (e.g., smoking, low BMI, use of steroids or medroxyprogesterone).  • Use TAF instead of TDF whenever possible. Monitoring:  • Assess nutritional intake (calcium, vitamin D, and total calories).  • Strongly consider measuring serum 25-OH-vitamin D levels, particularly in those patients taking ARVs of concern.  • Obtain a DXA.</td>
<td>Same options as for prevention. Consider changing the ARV regimen (e.g., switching from TDF to TAF, and/or from LPV/r to EFV or an INSTI whenever possible). Treat with vitamin D3 to raise serum 25-OH-vitamin D concentrations to &gt;30 ng/mL. The role of bisphosphonates in managing osteopenia and osteoporosis in children with HIV has not been established.</td>
</tr>
</tbody>
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**Key to Acronyms:** ART = antiretroviral therapy; ARV = antiretroviral; BMD = bone mineral density; BMI = body mass index; DXA = dual-energy x-ray absorptiometry; EFV = efavirenz; INSTI = integrase strand transfer inhibitor; LPV/r = lopinavir/ritonavir; PI = protease inhibitor; TAF= tenofovir alafenamide; TDF = tenofovir disoproxil fumarate

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**References**

**Osteopenia and Osteoporosis**


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