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.</td>
<td>BMD z Score Less Than -2.0:</td>
<td>Longer duration and greater severity of HIV disease</td>
<td>Prevention: Ensure sufficient calcium intake and vitamin D sufficiency.</td>
<td>Same options as for prevention.</td>
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<td></td>
<td>Specific Agents of Concern: • TDF • PIs, especially LPV/r</td>
<td>Presentation: Usually asymptomatic Rarely presents as osteoporosis, a clinical diagnosis defined by evidence of bone fragility (e.g., fracture with minimal trauma).</td>
<td></td>
<td>Vitamin D insufficiency/deficiency</td>
<td>Encourage weight-bearing exercise.</td>
<td>Consider changing the ARV regimen (e.g., switching from TDF to TAF, and/or from LPV/r to EFV or an INSTI whenever possible).</td>
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<td>Delayed growth or pubertal delay Low BMI Lipodystrophy Non-black race Smoking Prolonged systemic corticosteroid use Medroxyprogesterone use</td>
<td>Minimize modifiable risk factors (e.g., smoking, low BMI, use of steroids or medroxyprogesterone).</td>
<td>Treat with vitamin D3 to raise serum 25-OH-vitamin D concentrations to &gt;30 ng/mL.</td>
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<td>Lack of weight-bearing exercise</td>
<td>Use TAF instead of TDF whenever possible.</td>
<td>The role of bisphosphonates in managing osteopenia and osteoporosis in children with HIV has not been established.</td>
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</tbody>
</table>

* Some experts periodically measure 25-OH-vitamin D. This is especially important in youth with HIV infection who live in urban areas; the prevalence of vitamin D insufficiency is high in that population.

* Until more data are available about the long-term effects of TDF on bone mineral acquisition in childhood, some experts obtain a DXA at baseline and every 6 to 12 months for prepubertal children and for children in early puberty who are initiating treatment with TDF. Obtaining a DXA could also be considered for adolescent women on TDF and medroxyprogesterone and for children with indications not uniquely related to HIV infection (such as cerebral palsy).

**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

**References**

**Osteopenia and Osteoporosis**


