### Table 15a. Antiretroviral Therapy-Associated Adverse Effects and Management Recommendations—Central Nervous System Toxicity (Last updated April 16, 2019; last reviewed April 16, 2019)  

<table>
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| **Global CNS Depression**                           | LPV/r oral solution (contains both ethanol and propylene glycol as excipients) | **Onset:**  
• 1 day–6 days after starting LPV/r  
**Presentation**  
Neonates/Premature Infants:  
• Global CNS depression (e.g., abnormal EEG, altered state of consciousness, somnolence)  
**Variable, depending on age, symptoms, and assessment method**  
Children:  
• 24% for any EFV-related CNS manifestations in one case series, with 18% of participants requiring drug discontinuation.  
• Five of 45 participants (11%) experienced new-onset seizures in one study in children aged <36 months. Two of these participants had alternative causes for seizures.  
• Cases of cerebellar dysfunction have been reported in children with very high EFV plasma levels.  
**Adults:**  
• 30% incidence for any CNS manifestations of any severity.  
• 6% incidence for EFV-related, severe CNS manifestations, including suicidality. However, evidence is conflicting about whether EFV use increases the incidence of suicidality.  
• One case series reported 20 women with ataxia that resolved upon EFV discontinuation, but frequency was not reported. | Unknown; rare case reports have been published | Prematurity  
Low birth weight  
Aged <14 days (whether birth was premature or term) | Avoid use of LPV/r until a postmenstrual age of 42 weeks and a postnatal age of ≥14 days. | Discontinue LPV/r; symptoms should resolve in 1 day–5 days. If needed, reintroduction of LPV/r can be considered once outside the vulnerable period (i.e., postmenstrual age of 42 weeks and a postnatal age ≥14 days). |
| **Neuropsychiatric Symptoms and Other CNS Manifestations** | EFV | **Onset:**  
• For many symptoms, onset is 1 day–2 days after starting EFV.  
• Many symptoms subside or diminish by 2 weeks–4 weeks, but symptoms may persist in a significant proportion of patients.  
**Presentation (May Include One or More of the Following)**  
Neuropsychiatric Symptoms:  
• Abnormal dreams  
• Psychosis  
• Suicidal ideation or attempted/completed suicide  
**Other CNS Manifestations:**  
• Dizziness  
• Somnolence  
• Insomnia or poor sleep quality  
• Impaired concentration  
• Seizures (including absence seizures)  
• Cerebellar dysfunction (tremor, dysmetria, ataxia)  
**Note:** CNS side effects such as impaired concentration, abnormal dreams, or sleep disturbances may be more difficult to assess in children.  
**Variable, depending on age, symptoms, and assessment method**  
**Children:**  
• 24% for any EFV-related CNS manifestations in one case series, with 18% of participants requiring drug discontinuation.  
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**Adults:**  
• 30% incidence for any CNS manifestations of any severity.  
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• One case series reported 20 women with ataxia that resolved upon EFV discontinuation, but frequency was not reported. | Insomnia is associated with elevated EFV trough concentration (≥4 mcg/mL)  
CYP2B6 polymorphisms that decrease EFV metabolism and cause increased EFV serum concentrations (CYP2B6 516 TT genotype or co-carriage of CYP2B6 516 G/T and 983 T/C variants)  
Prior history of psychiatric illness or use of psychoactive drugs | Administer EFV on an empty stomach, preferably at bedtime.  
Prescreen for psychiatric illness; avoid use in the presence of psychiatric illness, including depression or suicidal thoughts. Avoid concomitant use of psychoactive drugs.  
Consider using TDM in children with mild or moderate EFV-associated toxicities | If symptoms are excessive or persistent, obtain EFV trough concentration. If EFV trough concentration >4 mcg/mL and/or symptoms are severe, strongly consider drug substitution if a suitable alternative exists.  
Alternatively, consider dose reduction with repeat TDM and dose adjustment (with expert pharmacologist input). |
### Table 15a. Antiretroviral Therapy-Associated Adverse Effects and Management Recommendations—Central Nervous System Toxicity  (Last updated April 16, 2019; last reviewed April 16, 2019)  (page 2 of 3)

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| Neuropsychiatric Symptoms and Other CNS Manifestations, continued | RPV | Onset:  
• Most symptoms occur in the first 4 weeks–8 weeks of treatment  
Presentation  
Neuropsychiatric Symptoms:  
• Depressive disorders  
• Suicidal ideation  
• Abnormal dreams/nightmares  
Other CNS Manifestations:  
• Headache  
• Dizziness  
• Insomnia  
• Somnolence | Adults:  
• CNS/neuro-psychiatric adverse events of all severity grades were reported in 43% of patients at 96 weeks (mostly Grade 1). Depressive disorders of all severity grades were reported in 9% of patients. One percent of patients discontinued RPV due to severe depressive disorders.  
Children:  
• Depressive disorders of all severity grades were reported in 19.4% of pediatric patients aged 12 years–17 years. Severe depressive disorders were reported in 5.6% of patients, including one suicide attempt.  
• Somnolence was reported in five of 36 children (14%). | Prior history of neuropsychiatric illness | Monitor carefully for depressive disorders and other CNS symptoms. | Consider drug substitution in cases of severe symptoms. |
| | RAL | Onset:  
• As early as 3 days–4 days after starting RAL  
Presentation:  
• Increased psychomotor activity  
• Headaches  
• Insomnia  
• Depression  
• Cerebellar dysfunction (e.g., tremor, dysarthria, ataxia) | Children:  
• Increased psychomotor activity was reported in one child.  
Adults:  
• Headache  
• Insomnia (<5% in adult trials)  
• Rare case reports of cerebellar dysfunction in adults  
Elevated RAL concentrations  
Co-treatment with TDF, a PPI, or inhibitors of UGT1A1  
Prior history of insomnia or depression | Prescreen for psychiatric symptoms.  
Monitor carefully for CNS symptoms.  
Use with caution in the presence of drugs that increase RAL concentration. | Consider drug substitution (RAL or coadministered drug) in cases of severe insomnia or other neuropsychiatric symptoms. |
Table 15a. Antiretroviral Therapy-Associated Adverse Effects and Management Recommendations—Central Nervous System Toxicity  *(Last updated April 16, 2019; last reviewed April 16, 2019)*  (page 3 of 3)

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<td>Neuropsychiatric Symptoms and Other CNS Manifestations, continued</td>
<td>DTG</td>
<td>Onset: 7 days–30 days after starting DTG</td>
<td>Children: CNS symptoms were uncommonly reported in early clinical experience in children and adolescents. Adults: Exact frequency of neuropsychiatric symptoms is uncertain; there are case reports for four adult patients. Headache, insomnia, and dizziness are common and usually mild, with a rate of 6.1% reported for insomnia in adults. More severe symptoms that require drug discontinuation, including suicidality, are less common, occurring in ≤1% patients in Phase 3 trials, but these severe symptoms are reported with increasing frequency (4% to 10%) in recent post-marketing reports. Higher frequency of neuropsychiatric symptoms reported with DTG than with other INSTIs. A class effect has been suggested.</td>
<td>Pre-existing depression or other psychiatric illness Higher frequency of neuropsychiatric symptoms reported when coadministered with ABC; however, evidence is conflicting. UGT1A1*6 and/or *28 polymorphism (reported in patients of Asian descent)</td>
<td>Use with caution in the presence of psychiatric illness, especially depression. <strong>Consider morning dosing of DTG.</strong></td>
<td>For persistent or severe neuropsychiatric symptoms, consider discontinuation of DTG if suitable alternative exists. For mild symptoms, continue DTG and counsel patient that symptoms will likely resolve with time.</td>
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**Key to Acronyms:** ABC = abacavir; ARV = antiretroviral; CNS = central nervous system; CYP = cytochrome P; DTG = dolutegravir; EEG = electroencephalogram; EFV = efavirenz; INSTI = integrase strand transfer inhibitor; LPV/r = lopinavir/ritonavir; PPI = proton pump inhibitor; RAL = raltegravir; RPV = rilpivirine; TDF = tenofovir disoproxil fumarate; TDM = therapeutic drug monitoring; UGT = uridine diphosphate-glucuronosyltransferase


