St. John's Wort

Scientific Name(s): Hypericum perforatum L.
Common Name(s): Amber touch-and-heal, Esbericum, Goatweed, Gol-raei, Hofariqoun, Hyperforat, Hyperiforce, John's wort, Kira, Klamath weed, LI 160, Millepertuis, Neuroplant, Psychotonin, Rosin rose, Sedariston, St John's wort, St. John's wort, STEI 300, WS 5573, Ze 117

Medically reviewed by Drugs.com. Last updated on Nov 20, 2024.

Clinical Overview

Use

Meta-analyses of quality clinical trials support a place for St. John's wort in the treatment of depression as mono- or adjunctive therapy. Effectiveness is comparable with standard antidepressants, while St. John's wort is associated with fewer and milder adverse reactions compared with conventional antidepressants. Benefit in reducing some climacteric symptoms in women with natural menopause has also been demonstrated. Unintended interactions with other drugs and quality control issues need to be considered prior to use. Limited data are available for several other areas of therapeutic use.

Dosing

Preparations vary greatly in chemical content and quality, and may be standardized regarding quantity of hyperforin (commonly 3% to 5%) or hypericin (commonly 0.3%) constituents. Clinical trials evaluating the efficacy of St. John's wort in depression have commonly used 900 mg of extract daily in 3 divided doses for up to 12 weeks (range, 200 to 1,800 mg/day).

Contraindications

Use with various antineoplastics, anticoagulants, and anti-infectives (including antivirals), as well as boceprevir, cobicistat, telaprevir, and voriconazole is contraindicated.

Pregnancy/Lactation

Avoid use. Hypericin and hyperforin have been detected in breast milk. St. John's wort should be avoided during pregnancy and lactation until further long-term studies demonstrate a lack of toxicity in the developing fetus and breastfeeding infants.

Interactions

St. John's wort has been reported to interact with numerous drugs. Drugs with a narrow therapeutic window should be

monitored closely. Patients should be cautioned on the potential for interactions and consult their health care provider before taking St. John's wort with prescription or nonprescription drugs.

Adverse Reactions

Adverse reactions are usually mild. Potential adverse reactions include GI symptoms (eg, dry mouth, dizziness, constipation) and confusion. Photosensitization may also occur. In clinical trials, adverse reactions and discontinuations due to adverse effects were usually less with St. John's wort than with standard antidepressants. Other possible rare adverse reactions include induction of mania and effects on male and female reproductive capabilities. Impaired glucose tolerance has been documented in healthy volunteers.

Toxicology

Information is lacking.

Scientific Family

- Hypericaceae

Botany

St. John's wort is a perennial plant native to Europe but found throughout the United States and parts of Canada. It is an aggressive weed that grows in the dry ground of roadsides, meadows, woods, and hedges. It generally reaches a height of 0.3 to 0.61 m, except on the Pacific coast where it has attained heights of 1.5 m.Awang 1991 The plant has oval-shaped leaves and yields golden-yellow flowers that bloom from June to September. The flower petals have black or yellow glandular dots and lines. There are approximately 370 species in the genus Hypericum, which is derived from the Greek words "*hyper"* and "*eikon"* meaning "over an apparition," alluding to the plant's ancient use to ward off evil spirits. "Perforatum" refers to the leaf's appearance; when held up to light, the translucent leaf glands resemble perforations.Hahn 1992, Upton 1997 Harvest of the plant for medicinal purposes occurs in July and August, and the plant material must be dried immediately to avoid loss of potency.Bombardelli 1995 The dried herb consists of the plant's flowering tops.Upton 1997

History

St. John's wort has been used as an herbal remedy for its anti-inflammatory and healing properties since the Middle Ages,Bombardelli 1995 with many herbalists, including Hippocrates and Pliny, recording its medicinal properties. It was noted for its wound-healing and diuretic properties, as well as for the treatment of neuralgic conditions such as back pain. In 1633, *Gerard's Herbal* recorded the plant's use as a balm for burns, and its oil was also popular during this time.Upton 1997 A reddish-colored olive oil extract made from the fresh flowers has been taken internally for the treatment of anxiety but has also been applied externally to relieve inflammation and promote healing.Hahn 1992

St. John's wort has been approved since 1984 by the German Commission E for the treatment of anxiety, depression, and insomnia. Although it fell into disuse for a time, a renewed interest, especially in Western countries, has led to use as a component of numerous preparations for treating anxiety and depression. The plant has been used in traditional medicine as an antidepressant and a diuretic, as well as for gastritis and insomnia.Hahn 1992, Ng 2017, Russo 2014 Topically, it was traditionally used in the management of wounds, bruises, skin ulcers, cuts, burns, contusions, myalgia, and hemorrhoids, and as an antiseptic.Samadi 2010, Yucel 2017 It is now licensed in many European countries and widely prescribed for depression.Ng 2017

Chemistry

Several reports regarding the chemical components in St. John's wort are available.Butterweck 2007, Mauri 2000, Schmitt 2006, Wurglics 2006 More than 150 constituents have been identified that interact in synergistic, additive, and antagonistic manners to produce a variety of actions. The most commonly described constituents are naphthodianthrones, flavonoids, phloroglucinols, and essential oils. The naphthodianthrones (hypericin, pseudohypericin) and the phloroglucinols (hyperforin, adhyperforin) are the most characterized.Russo 2014

Naphthodianthrons occur in St. John's wort in concentrations of less than 0.1% to 0.15%. The anthraquinone derivatives hypericin and pseudohypericin (also emodin-anthranol and cyclo-pseudohypericin) are the best known components of the plant. Isohypericin and protohypericin are also present. The reddish dianthrone pigment hypericin (Hypericum red) ranges from 0.02% to 2.5%, depending on harvesting period, drying process, and storage.Bombardelli 1995, Newall 1996 Hypericin content varies widely among growing regions, and concentrations are contingent on plant part, with flowers, buds, top leaves, and secondary stems yielding the highest percents.Upton 1997 Microscopic evaluation revealed that hypericin accumulates in secretory cell globules within these plant structures.Liu 1999 Numerous reports concerning high-performance liquid chromatography analysis of hypericin in St. John's wort exist.Balogh 1999, Chi 1999, Fourneron 1999, Michelitsch 2000, Mulinacci 1999, Sirvent 2000, Stochmal 1998, Tateo 1998 Liposoluble pigments from the plant, including hypericin, carotenoids, and chlorophylls, have also been reported.Omarova 1998 A review of the chemistry of phenanthroperylene quinones from hypericin reveals photosensory pigments.Falk 1999

Flavonoid concentrations in St. John's wort occur at less than 12% in flowers and approximately 7% in leaves/stalksUpton 1997 and include kaempferol, quercetin, quercitrin, isoquercitrin, amentoflavone, luteolin, myricetin, hyperin, hyperoside, rutin, miquelianin, and astilbin.Bombardelli 1995, Butterweck 2000, Newall 1996, Upton 1997 The proanthocyanidins (approximately 12% of aerial parts) are certain forms of catechin and epicatechin.Upton 1997

Hyperforin and adhyperforin are in the phloroglucinol class of compounds.Erdelmeier 1998, Hahn 1992, Upton 1997 Hyperforin appears in St. John's wort in concentrations of 2% to 4%, and its isolation, purity, and stability have been studied.Orth 1999 The recovery of hyperforin in plasma has been measured.Chi 1999 The related structure furohyperforin, an oxygenated analog of hyperforin, has been isolated from the plant,Verotta 1999 as have other hyperforin analogs.Verotta 2000 The essential oil component of St. John's wort is between 0.05% and 0.9%.Hahn 1992, Upton 1997 It consists of mono- and sesquiterpenes, mainly 2-methyl-octane (16% to more than 30%), n-nonane, alpha- and beta-pinene, alpha-terpineol, geraniol, and traces of myrecene, limonene, and caryophyllene, as well as others.Bombardelli 1995, Newall 1996, Upton 1997

Other compounds present in St. John's wort include xanthones (1.28 mg per 100 g) and tannins (3% to 16%). One study reports that tannin content in extracts is influenced by parameters such as temperature of maceration.Rafajlovska 1998 Phenol constituents include caffeic, chlorogenic, and p-coumaric acids, and hyperfolin. Other plant constituents include acids (eg, nicotinic, myristic, palmitic, stearic), carotenoids, choline, pectin, hydrocarbons, and long-chain alcohols. Amino acids include cysteine, gamma-aminobutyric acid (GABA), glutamine, leucine, lysine, and others.Bombardelli 1995, Hahn 1992, Newall 1996, Upton 1997

St. John's wort products are not regulated by the US Food and Drug Administration because they are classified as dietary supplements.Congress 1994 Several reports evaluating commercial preparations of St. John's wort have found inconsistencies in active ingredients, such as potency variations of labeled hypericin concentrations (from 47% to 165%),Constantine 1998 different concentrations of major components among brands,Liu 1999 and marked deviations in hyperforin and adhyperforin amounts in certain preparations.Melzer 1998 Several reports address these issues, with various proposed standardization methods.Khwaja 1999, Kurth 1998, Mason 1999, Schempp 1999

Uses and Pharmacology

Animal and human studies have elucidated the pharmacokinetic differences among the structurally similar components hypericin, pseudohypericin, and hyperforin. Bioavailability of these constituents after oral administration is low and ranges from approximately 15% to 20%. Penetration of the blood-brain barrier is similarly low with only about 5% of hypericin likely to reach the brain; hypericin's half-life in the brain appears to be a few weeks.(Russo 2014) Time to peak plasma levels (C_{max}) ranges from 30 minutes to 3 hours for pseudohypericin, from 4.6 to 8.1 hours for hypericin, and about 2.8 to 3.6 hours for hyperforin after single doses of St. John's wort (range, 300 to 1,800 mg [approximately 0.3% of hypericins]).(Hammer 2014, Russo 2014) Steady-state levels of hypericin are reached at 4 days, with a prolonged plasma half-life of about 25 hours due to hypericin's high affinity for albumin and lipoprotein. Hyperforin exhibits linear pharmacokinetics at doses up to 600 mg, after which plasma levels tend to be lower than expected. After repeat doses of 900 mg/day of extract, hyperforin steady-state levels of about 100 ng/mL have been reported, with a half-life of 9 hours. (Russo 2014)

St. John's wort, particularly hyperforin, has been shown in vitro and in vivo to inhibit monoamine oxidase type A (MAO-A) and MAO-B as well as the reuptake of norepinephrine, dopamine, and serotonin. It has a strong affinity for GABA, glutamate, and adenosine receptors.(Sood 2010) It induces the cytochrome P450 (CYP-450) system, the uridine diphosphate glucuronosyltransferase (UGT) isozyme, and P-glycoprotein.(Kummer 2016, Markert 2015, Pereira 2013) Downregulation of beta-adrenergic receptors has also been documented.(Russo 2014) The major coactive constituents shown to mediate the broad-spectrum inhibition of neurotransmitter reuptake are hypericin, hyperforin, quercetin, and kaempferol.(Chrubasik-Hausmann 2018)

Bioactivities of the various constituents in St. John's wort are a result not only of their bioavailability but also of the complex interactions of the constituents themselves, some of which are light dependent. This complexity also highlights the challenge of interpreting existing data.(Hammer 2014)

Anti-inflammatory activity

Animal and in vitro data

In vitro studies revealed that St. John's wort at low concentrations is capable of increasing immunity, but at high concentrations can suppress immunity.(Cabrelle 2008, Evstifeeva 1996, Fidan 2008, Mukerjee 2008) A number of signaling pathways elicited by compounds in Hypericum have been identified in human and animal cell cultures and in vivo in animal models. Quercetin, amentoflavone, hyperforin, and hypericin have been shown to individually reduce nuclear factor kappa B, tumor necrosis factor alpha (TNF-alpha), cyclooxygenase-2, p38, and other key factors in inflammatory signaling pathways. Combining the individual compounds altered the resulting activities, reflecting apparent interactions among the constituents of St. John's wort when combined. Additionally, bioactivities of some compounds were dependent on light, whereas others were light independent. These interactions appear to provide a balance of both pro- and anti-inflammatory activities, as well as phototoxic and photoprotective actions. Pseudohypericin was a necessary element in the anti-inflammatory process, as it was required for the reduction in prostaglandin E_2.(Hammer 2014) Similarly, St. John's wort ethanolic extract inhibited the increase in neutrophil recruitment and the inflammatory biomarkers interleukin 1beta (IL-1beta) and TNF-alpha as well as the decrease in glutathione that was induced by acetaminophen toxicity in mice. Subsequently, AST and ALT levels were also decreased. A dose-dependent reduction in acetaminophen-induced lethality was also observed.(Hohmann 2015)

Antimicrobial activity

In vitro data

Antibacterial activity has been described.(Barbagallo 1987, Bejaoui 2017) Extracts of H. perforatum and Hypericum humifusum containing differing amounts of hypericin (60 mg/g and 90 mg/g, respectively) and hyperforin (8.5 mg/g and 30 mg/g, respectively) exhibited very strong inhibitory and bactericidal activity against several gram-positive and gram-

negative bacteria as well as Candida albicans. Strongest minimum inhibitory concentrations (MICs) (200 to 250 mcg/mL) were observed against Enterococcus faecium, Staphylococcus aureus, and Staphylococcus epidermidis by H. humifusum extract and against C. albicans by H. perforatum extract. The lowest minimum bactericidal concentrations (350 mcg/mL) were observed for S. epidermidis, Bacillus subtilis, and C. albicans, and were fairly comparable between the 2 extracts. Weakest effects were seen for Salmonella typhimurium and 2 strains of Pseudomonas aeruginosa. (Bejaoui 2017)

Antiviral/HIV activity

Antiviral activity has been reported for influenza, herpes simplex types 1 and 2 (HSV-1, HSV-2), Sindbis virus, poliovirus, retrovirus infection in vitro and in vivo, murine cytomegalovirus, and hepatitis C.(Bombardelli 1995, Jacobson 2001, Müller 2004, Newall 1996, Upton 1997) Hypericin and pseudohypericin exert unique effective antiviral actions, possibly because of nonspecific associations with cellular and viral membranes. Hypericin and pseudohypericin inhibit a variety of encapsulated viruses, including HIV.(Upton 1997)

In vitro data

3-Hydroxy lauric acid obtained from H. perforatum exhibited light-independent, anti-HIV activity in an in vitro experiment. (Maury 2009)

Clinical data

Clinical trials of St. John's wort use in HIV are limited by the prevalence of interactions between St. John's wort and standard HIV therapy. In 1999, a phase 1 study evaluating hypericin's effects in 30 patients concluded that hypericin had no antiretroviral activity, with phototoxicity being observed.(Gulick 1999)

Antiviral activity may involve a photoactivation process, as exposure of hypericin to fluorescent light markedly increases antiviral activity.(Bombardelli 1995, Maury 2009) An example of this was demonstrated in a case series in which an approximate 50% improvement was observed in acyclovir-recalcitrant herpes skin lesions treated with a phototherapy protocol that included H. perforatum (10% extract containing 1% w/v hypericin and 0.5% w/v chlorophyll) as the photosensitizer compared to phototherapy with red laser therapy alone. Patients ranged in age from 7 to 77 years and presented with HSV-1, HSV-2, or combination-type lesions.(Tardivo 2012)

Cancer

In vitro data

The cytocidal activity of hyperforin and its effect on tumor growth inhibition have been demonstrated against human cell lines.(Business Wire 1998, Hostanska 2003, Lorusso 2009, Schmitt 2006, Stavropoulos 2006)

Clopidogrel nonresponders

Clinical data

Platelet response improved significantly subsequent to administration of St. John's wort versus placebo in clopidogrel nonresponders with stable angina who underwent elective percutaneous coronary intervention (PCI). In a small, open-label, randomized clinical trial (N=23), known clopidogrel nonresponders were randomized 2:1 to receive St. John's wort 300 mg 3 times daily or placebo, in addition to dual antiplatelet therapy (aspirin 80 mg and clopidogrel 75 mg), for 2 weeks after PCI. Platelet response improved significantly when measured as P2Y12 reaction units to clopidogrel but not when measured as thrombin receptor activating peptide units to thrombin receptor activating peptide or as aspirin reaction units or arachidonic acid units to aspirin, which indicated a selective interaction of St. John's wort with the clopidogrel pathway.(Trana 2013)

CNS effects

Anxiety

Clinical data

There is no evidence of efficacy for St. John's wort in anxiety disorders in randomized controlled trials as a primary outcome, including generalized social anxiety disorder.(Kobak 2005b) Reduction in associated anxiety has been reported as a secondary outcome in 2 clinical trials of St. John's wort, one in patients with major depression, the other in patients with somatization disorder.(Mannel 2020, Volz 2003)

Depression

Clinical data

Meta-analyses, including Cochrane meta-analyses, of quality clinical trials have been conducted to examine effects of St. John's wort in comparison with placebo and antidepressant therapy for treatment of depression.(Kasper 2008, Linde 2000, Linde 2005, Linde 2015, Magni 2013, Rahimi 2009) In some studies of mild, moderate, and major(Linde 2000, Seifritz 2016) depression, St. John's wort was more effective than placebo and similarly effective as standard antidepressants.(Kasper 2008, Linde 2000, Linde 2005, Linde 2015, Rahimi 2009, Sarris 2007, Seifritz 2016, Thachil 2007) Adverse effects are lower for St. John's wort than for standard antidepressants.(Asher 2017, Knüppel 2004, Linde 2000, Qaseem 2016, Rahimi 2009, Thachil 2007) A previous Cochrane review found insufficient evidence to support a place in therapy for St. John's wort in treating major depression(Linde 2005); however, more recent trials and analysis of participants meeting criteria for major depression have led to a somewhat more positive, but cautious, recommendation for Hypericum.(Linde 2000, Qaseem 2016) Issues raised in the meta-analyses include the heterogeneity of older clinical trials, the wide variation and quality of Hypericum preparations, use of comparatively low doses of pharmaceutical antidepressants, and the emergence of more favorable trials.(Asher 2017, Linde 2000, Linde 2005, Qaseem 2016, Sarris 2007) Limited evidence is available for use in depression in adolescents(Charrois 2007, Sarris 2007, Walter 1999) or the elderly, or for patients with comorbid conditions such as Alzheimer disease(Chatterjee 1999) or anxiety.(Sarris 2009) However, one analysis of 4 studies (N=1,058) that used a stabilized dry extract of H. perforatum, WS 5570, showed a significant improvement in depression scores (P<0.01) compared to placebo in younger patients (younger than 60 years) as well as older patients (60 years of age and older).(Kasper 2015)

More recent meta-analyses examining the benefits and risks of St. John's wort compared to selective serotonin reuptake inhibitors (SSRIs), specifically in patients with major depressive disorder (MDD), found no statistically significant difference in response, remission, and depression scores between the 2 treatments. As in earlier studies, the risks of treatment were significantly higher for SSRIs than St. John's wort, as was treatment discontinuation due to adverse events.(Asher 2017, Magni 2013, Ng 2017, Purgato 2014) St. John's wort was also shown in head-to-head comparisons in network meta-analyses to have superior efficacy in MDD when compared to exercise and omega-3 fatty acids.(Asher 2017) Commercial extracts used were mostly standardized to hypericin 0.12% to 0.3% and hyperforin 2% to 5%; doses ranged from 300 to 1,800 mg/day given over 4 to 12 weeks. Two meta-analyses evaluating data on SSRIs as a group included 12 randomized controlled trials (RCTs) (N=1,806)(Asher 2017) and 27 RCTs (N=3,808), repsectively.(Ng 2017) Overall, the strength of evidence was considered low by one paper because of the moderate to low doses of comparator antidepressants used in the studies.(Asher 2017)

Further studies have shown St. John's wort to be effective in the acute treatment of mild depression at a range of dosages (600 to 1,200 mg daily),(Kasper 2008) while long-term studies describe clinical advantage over placebo with regard to time to relapse and overall relapse rates when St. John's wort 900 mg daily was administered over 26 and 52 weeks.(Brattström 2009, Kasper 2008) Unintended drug-herb interactions with St. John's wort may compromise the efficacy of other drugs; however, St John's wort as adjunctive therapy has been used clinically to reduce the dose needed for pharmaceutical antidepressants.(Izzo 2016, Ravindran 2016) Additionally, as in clinical trials with

pharmaceutical antidepressants, a significant placebo effect and similar placebo response pattern occurs in MDD trials with St. John's wort, such that nonresponders will likely exhibit no clinical response early in the trial (ie, within the first 4 weeks) and placebo responders will experience a clinical response within the first 2 weeks of the trial.(Sarris 2013)

Guidelines discussing the use of St. John's wort in MDD have been published. The American Psychiatric Association practice guideline for the treatment of patients with MDD recognizes that while modest evidence supports the use of St. John's wort, data are conflicting and insufficient to make a recommendation for its use in the treatment of MDD. In addition, careful attention to drug-drug interactions is needed with St. John's wort. However, the guidelines also state that in patients who prefer complementary and alternative therapies, St. John's wort may be considered.(Gelenberg 2010) The Canadian Network for Mood and Anxiety Treatments (CANMAT) clinical guidelines for the management of MDD in adults (2016) recommend St. John's wort as first-line monotherapy in mild to moderate MDD based on level 1 evidence (defined as at least 2 RCTs with adequate sample sizes, preferably placebo-controlled, and/or meta-analysis with narrow confidence interval). St. John's wort is recommended as second-line adjunctive therapy in moderate and higher-severity MDD, based on level 2 data (defined as at least 1 RCT with adequate sample size and/or meta-analysis with wide confidence intervals).(Ravindran 2016) The American College of Physicians clinical practice guideline for treatment of adults with MDD report no significant difference in response or remission (low-quality evidence) but better tolerability (moderate-quality evidence) with St. John's wort monotherapy compared to low-dose second-generation antidepressants. Due to the lack of rigorous standardization of product purity and potency in the United States, data were deemed insufficient to recommend a place in therapy for St. John's wort in the treatment of MDD.(Qaseem 2016) The Veteran’s Affairs and Department of Defense (VA/DoD) clinical practice guideline for the management of major depressive disorder (2022) recommends the use of standardized extract of St. John’s wort as monotherapy in patients with mild MDD who are not pregnant or breastfeeding and who prefer herbal treatments to first-line psychotherapy or pharmacotherapy (weak).(VA/DoD 2022)

Based on efficacy in depression, Hypericum extracts have been recommended as appropriate therapy in mild or moderate depression with bipolar disorder as an alternative to standard antidepressant therapy.(Andreescu 2008) A trial (N=54) evaluating the efficacy of 900 mg of Hypericum extract daily in adolescents with attention-deficit/hyperactivity disorder and a subsequent systematic review found no difference compared with placebo at 8 weeks(Sarris 2011, Weber 2008) and no difference using the same dosage in burning mouth syndrome.(Sardella 2008) St. John's wort 600 mg/day performed better than placebo in 6 primary outcome measures in patients with somatoform disorders.(Müller 2004) Equivocal results have been demonstrated for Hypericum extracts in the management of premenstrual symptoms, which may be reflective of the different dosages used.(Hicks 2004, Stevinson 2000) Improvement in total, behavioral, and physical symptoms in women diagnosed with premenstrual syndrome (PMS) has been demonstrated with Hypericum compared to placebo in double-blind RCTs that include a small crossover pilot study (N=36) and a larger prospective trial (N=170).(Canning 2010, Ghazanfarpour 2011)

Seasonal affective disorder, a type of depression in which symptoms occur in fall/winter and resolve in spring/summer, improved with St. John's wort in combination with light therapy.(Martinez 1994) In an open-label trial, statistically but not clinically significant improvements in several target behaviors in 3 young autistic males (19 to 22 years of age) were documented after 4 weeks of St. John's wort 20 mg/day. The patients were resistant to previous treatment with neuroleptics or methylphenidate.(Niederhofer 2009)

St. John's wort was identified as one of the 3 most common herbs used by certified or licensed midwives for postpartum depression based on state-wide surveys in California, Texas, and North Carolina.(Dennehy 2010)

The Scottish Intercollegiate Guidelines Network (SIGN) guidelines on the management of perinatal mood disorders (2012) state that St John's wort and other alternative medicines should not be used during pregnancy and lactation based on lack of evidence specific to use in perinatal mood disorders, the risk of drug interactions, and lack of regulation for such products.(SIGN 2012)

Obsessive-compulsive disorder

Clinical data

No significant effect was found with St John's wort compared to placebo in Yale-Brown Obsessive-Compulsive Scale total or subscale scores in patients with at least a 1-year history of primary obsessive-compulsive disorder (OCD). Patients received a flexible dose of St John's wort (minimum dose, 300 mg twice daily) or placebo for 12 weeks in a double-blind, randomized fashion. The most common adverse events reported with St John's wort were headache, GI symptoms, fatigue, agitation, and sleep disturbance.(Kobak 2005a)

Crigler-Najjar syndrome

Clinical data

A case of reduced hyperbilirubinemia, decreased fatigue, and improved quality of life has been reported in a patient with congenital Crigler-Najjar syndrome type II. The patient was administered 2 regimens given 18 months apart of Hypericum dry extract 300 mg 3 times daily for 8 weeks.(Kummer 2016)

Irritable bowel syndrome

Clinical data

Equivocal results have been reported by 2 studies using St. John's wort 900 mg/day in patients with irritable bowel syndrome (IBS).(Saito 2010, Wan 2010) In a small pilot study (N=30), 8 weeks of treatment with St. John's wort significantly improved psychological well-being, with improved scores on anxiety and depression scales (P<0.05). Autonomic response to physical stimuli was also significantly improved (P<0.01), but not to psychological stressors. Symptom improvement was reported for pain, bloating, and overall severity (P<0.05).(Wan 2010) However, in another study, placebo provided significantly better responses in overall symptom severity and diarrhea, and provided adequate relief in a 12-week double-blind RCT that enrolled 70 symptomatic adults with IBS.(Saito 2010)

Menopausal symptoms

Clinical data

A systematic review and meta-analysis assessing safety and efficacy of St. John's wort preparations in women who experienced natural menopause identified 9 studies (N=6,983) that met inclusion criteria, 6 of which were included in the efficacy meta-analysis (N=717). Interventions included H. perforatum as monotherapy (3 studies) as well as in combination with chaste tree or black cohosh. The meta-analysis revealed a significant improvement with St. John's wort in climacteric scale scores overall (standard mean difference, –1.08; 95% CI, –1.38 to –0.77; P<0.0001), with moderate heterogeneity, and in hot flush scores (standard mean difference, –0.64; 95% CI, –0.78 to –0.5; P<0.0001), with no heterogeneity. In addition to the overall improvement in hot flushes, hot flush severity, duration, and frequency also improved significantly (P<0.0001 each). However, no significant difference was found in depression scores. The 4 trials included in the safety analysis showed no difference between treatment and placebo.(Liu 2014) Similar results were reported with H. perforatum for hot flush frequency and intensity in a double-blind, randomized, placebo-controlled trial conducted in 80 postmenopausal women. However, in contrast, this study also reported a significant reduction in depression intensity for those taking hypericum. After the intervention, 80% vs 5.7% reported no depression in the treatment group vs control, respectively (P<0.001).(Eatemadnia 2019)

The updated American Association of Clinical Endocrinologists and American College of Endocrinology position statement on menopause (2017) advises against the use of St. John's wort for treatment of hot flushes in breast cancer survivors.(Cobin 2017) The Society of Obstetricians and Gynaecologists of Canada revised clinical practice guidelines

on managing menopause (2014) recommend that complementary and alternative medicine that has demonstrated efficacy for mild menopausal symptoms, including St. John's wort for healthy mood balance and associated sleep disturbances, may be offered (level I-B evidence).(Reid 2014) Another Canadian organization, the Committee on the Evolution of Practices in Oncology (CEPO), recommends against the use of St. John's wort for managing hot flashes in breast cancer survivors (level II evidence [ie, evidence demonstrated by small randomized trials with uncertain results), as no benefit was shown over placebo; however, the single study reviewed did report significant improvements in sleep and quality-of-life measures in the St. John's wort group (900 mg/day for 3 months).(L'Espérance 2013)

Restless legs syndrome

Clinical data

St. John's wort was investigated in an open-label pilot study in 21 patients with restless legs syndrome. All 17 patients who reported at least a 70% improvement in symptom severity scores and improved sleep during the 10-day induction phase opted to enter the 3-month continuation phase. During phase 1, a St. John's wort 300 mg standardized extract was taken daily. However, during phase 2, a dose of 300 mg was recommended to be taken daily for 4 to 5 days, stopped until symptoms recurred, and then continued as needed for the duration of the study. After 3 months, median severity score had improved significantly from 24 (±5.1) at baseline to 4.1 (±1) (P<0.0001). The St. John's wort regimen was taken for a median of 40 days during the 3-month period, with symptom-free periods ranging from 2 to 7 days (median, 3 days). No adverse effects were reported.(Pereira 2013)

Skin conditions

Clinical data

A double-blind, placebo-controlled trial conducted in 11 healthy volunteers demonstrated the ability of an H. perforatum extract cream (1.5%) rich in hyperforin to significantly improve protection of irradiated skin from radicals (80.6% reduction in radicals) compared to untreated skin; the placebo cream led to a 55.7% reduction in radical production.(Arndt 2013) Of the 8 trials included in a systematic review investigating topical herbal medicines for atopic eczema, one small double-blind, randomized, placebo-controlled trial published in 2003 assessed the safety and efficacy of a hyperforin topical cream in 21 patients (12 to 59 years of age). After 4 weeks, the topical H. perforatum cream significantly improved the intensity of eczema (ie, erythema, papulation, crust, excoriation, lichenification, scaling) as well as reduced S. aureus skin colonization compared to placebo. A few nonserious adverse events were reported. Risk of bias was low across all domains.(Thandar 2017) In a small pilot study (N=10), both St. John's wort and vehicle alone significantly improved erythema, scaling, and thickness in plaques of patients with mild psoriasis. Application of St. John's wort resulted in greater reduction in erythema scores, scaling scores, and thickness scores, with improvement in scaling being the most pronounced; on a 3-point scale, a mean difference of –1.8 and –0.3 was observed for treatment and vehicle, respectively. No between-group comparative statistics were provided.(Najafizadeh 2012)

The joint American Academy of Dermatology and National Psoriasis Foundation (AAD-NPF) guidelines of care for the management and treatment of psoriasis with topical therapy and alternative medicine modalities for psoriasis severity measures (2020) states that the use of topical St. John's wort may lower the severity of symptoms; however, the lack of standardized, commercially available products or robust clinical data prohibit recommendations for use.(Elmets 2020)

Substance dependence/smoking cessation

Animal data

A limited number of animal studies exist evaluating the role of Hypericum extracts in reducing craving and symptoms of withdrawal from morphine, ethanol, and stimulant substances (eg, nicotine, caffeine, amphetamine). Decreased self-

administration of ethanol and withdrawal syndrome have been demonstrated in rodents, as well as no increased ethanol intake after periods of deprivation.(De Vry 1999, Ebrahimie 2015, Uzbay 2008, Uzbay 2008)

Clinical data

A Cochrane review of antidepressants for smoking cessation also examined evidence for herbal products, including St. John's wort. The evidence for St. John's wort suggests that it is not significantly better than placebo for this indication (2 studies, N=261; relative risk [RR], 0.81; 95% CI, 0.26 to 2.53).(Hughes 2014) Clinical trials have produced equivocal results regarding a role in smoking cessation, with one small trial (N=24) without a control group showing efficacy in cessation rates with Hypericum at 12 weeks(Lawvere 2006) and others showing no difference from placebo.(Camfield 2013, Parsons 2009, Uzbay 2008) A larger randomized, blinded, placebo-controlled, dose-ranging study similarly found no difference in smoking cessation rates, mean cigarettes smoked per day, withdrawal symptoms, or tobacco cravings in the St. John's wort 900 mg/day or 1,800 mg/day groups compared to placebo. Of the 118 cigarette smokers enrolled in the 12-week study, 43% withdrew before study end and were smoking during their last study visit.(Sood 2010) Differences in study populations, dosing, and formulation of preparations make comparisons difficult. Further quality studies are needed with larger numbers of subjects.

Wound healing

Topical and internal use of St. John's wort has been reported to provide effective wound healing. It stimulates fibroblast motility, collagen production, and keratinocyte differentiation, as well as possesses antimicrobial and anti-inflammatory effects. Hyperforin, hypericin, and derivatives of these constituents have been effective in treating skin ulcers, abrasions, burns, scratches, decubitus, and surgical wounds.

Clinical data

In a case report, the oily extract of St. John's wort was used to facilitate healing of decubitus ulceration.(Yucel 2017) St. John's wort was also observed to provide significantly more benefit to wound healing and scar formation in women who underwent cesarean section compared to placebo and untreated controls (P<0.001).(Samadi 2010)

Other uses

Hypericin has been shown to inhibit T-type calcium channel activity(Shan 2000) and has a cellular protective effect. (Breyer 2007, Menegazzi 2008)

A Cochrane review exploring herbal treatments for neuropathic pain (diabetic and nondiabetic) identified 1 randomized, placebo-controlled, double-blind crossover trial (n=47) that used St. John's wort (2,700 mg/day for 5 weeks). No significant effect on total or individual pain scores was found between groups.(Boyd 2019)

Of 31 complementary and alternative medicine (CAM) remedies, St Johns wort was one of the least recommended remedies for dental issues (30%) by German dentists and maxillofacial surgeons according to a prospective, cross-sectional survey (N=250). As one might expect, perceived effectiveness was rated higher among CAM proponents than opponents.(Baatsch 2017)

Dosing

Preparations vary greatly in chemical content and quality, and may be standardized regarding hyperforin (commonly 2% to 5%) or hypericin (commonly 0.12% to 0.3%) content.Asher 2017, Linde 2005, Ng 2017, Wurglics 2006 Doses used for a variety of indications in clinical studies most commonly ranged from 300 mg/day to 1,800 mg/day.

Depression

Clinical trials evaluating the efficacy of St. John's wort in depression have commonly used 900 mg of extract daily in 3 divided doses for periods of up to 12 weeks (range, 200 to 1,800 mg/day).Kasper 2008, Linde 2000, Papakostas 2007

Skin conditions and wounds

Two studies used a topical hypericum cream containing hypericin 1% and 1.5%.Arndt 2013, Tardivo 2012

Pregnancy / Lactation

The use of St. John's wort in perinatal depression has been considered; however, insufficient data exist to support its use.Freeman 2009 There is a lack of systematic evidence on the safety of Hypericum in pregnancy or lactation.Dugoua 2006, Freeman 2009 A small study of case-matched infants born to mothers consuming St. John's wort during pregnancy found an increase in colic, drowsiness, and lethargy.Dugoua 2006

Studies in rats suggest the preparation may have teratogenic and toxic effects,Gregoretti 2004, Lee 2003, Russo 2014 while other studies suggest no changes in cognitive development or long-term behavior.Dugoua 2006 Emmenagogue and abortifacient effects due to uterine stimulant action have been suggested,Brinker 1998, Ernst 2002, Rotblatt 2002, Shipochliev 1981 but evidence is weak.Dugoua 2006

In 2 separate studies, the rates of major postnatal malformations (eg, hypospadias, bilateral hip dislocation, heart septum defect, obstructed ureter) in children of women exposed to St. John's wort while pregnant were 5% and 8.1%. A total of 5 cases of malformation were reported in 75 exposed live births; comparatively, malformations expected in the general population range from 3% to 5%. The differences reported in the studies were not statistically significantly different compared to women taking prescription antidepressants (4%) or those who were otherwise healthy and/or not exposed (0%). However, the hypericum-exposed sample sizes were small (N=38 and N=37), and caution is warranted in interpreting these results.Kolding 2015, Russo 2014 Case reports exist of low levels of hypericin and hyperforin detected in breast milk, but not in the breastfeeding infants.Freeman 2009, Klier 2006

St. John's wort should be avoided during pregnancy and lactation until further long-term studies demonstrate a lack of toxicity in the developing fetus and breastfeeding newborn.Freeman 2009, Kalra 2005

SIGN guidelines on the management of perinatal mood disorders (2012) state that St John's wort and other alternative medicines should not be used during pregnancy and lactation based on a lack of evidence specific to use in pregnancy or lactation, the risk of drug interactions, and lack of regulation for such products.SIGN 2012

Support for use of St. John's wort in surgical wound healing has been demonstrated in women who underwent caesarean section.Izzo 2016

Interactions

Drug interactions with St. John's wort are highly variable and often difficult to predict based solely on the St. John's wort dose because of the complex interactions among hypericum constituents in any particular product or doseform. (Chrubasik-Hausmann 2018, Hammer 2014, Mueller 2004) Additionally, single-dose compared to long-term administration (ie, at least 10 days) of St. John's wort in drug interaction studies has been shown to have opposite effects on the pharmacokinetics of coadministered substrate drugs.(Borrelli 2009)

St. John's wort enhances the expression of the CYP-450 system, apparently as a result of binding to the nuclear pregnane X receptor (PXR). Hyperforin appears to be the specific receptor ligand and it is hyperforin content, not

hypericin, that seems to most consistently determine the extent of the drug interaction, with 1 mg/day suggested as the critical cut-off dose for clinically significant interactions.(Chrubasik-Hausmann 2018, Kummer 2016, Pereira 2013) UGT isozyme induction is also mediated by PXR, so drugs metabolized by UGT have the potential to be affected by St. John's wort. The expression of P-glycoprotein (P-gp) is also stimulated by St. John's wort. Induction of both the intestinal and hepatic CYP3A4 has been observed.(Arold 2005, Kummer 2016, Markert 2015, Pereira 2013) Studies with voriconazole indicate that St. John's wort may be a stronger inducer of CYP2C19 and CYP2C9 than CYP3A4. Clinical studies have also reported induction of CYP2E1. However, the Food and Drug Administration reportedly classifies St. John's wort as a strong inducer (80% or greater decrease in area under the curve [AUC]) of CYP3A4 and a weak inducer (20% to 50% decrease in AUC) of CYP2C9.(Berry-Bibee 2016, Li 2017, Markert 2015, Russo 2014) The extent of induction of CYP3A4 and P-gp appears to be comparable among ethnic groups (ie, African American, white, Chinese, Hispanic, Indian, Malay).(Russo 2014) Organic anion-transporting polypepetides (OATPs) do not appear to be affected.(Li 2017, Markert 2015)

Abemaciclib: CYP3A4 inducers (moderate) may decrease the serum concentration of abemaciclib. Avoid combination. (Verzenio August 2018)

Abiraterone acetate: CYP3A4 inducers (moderate) may decrease the serum concentration of abiraterone acetate. Monitor therapy.(Benoist 2018, Bernard 2015, Zytiga September 2018)

Acalabrutinib: CYP3A4 inducers (moderate) may decrease the serum concentration of acalabrutinib. Monitor therapy. (Calquence November 2019)

Afatinib: P-gp/ABCB1 inducers may decrease the serum concentration of afatinib. Consider therapy modification.(Gilotrif January 2018, Wind 2014)

Alfentanil: CYP3A4 inducers (moderate) may decrease the serum concentration of alfentanil. Consider therapy modification.(Alfentanil October 2019, Kharasch 2012)

Aliskiren: P-gp/ABCB1 inducers may decrease the serum concentration of aliskiren. Monitor therapy.(Tapaninen 2010, Tekturna June 2020)

Alprazolam: CYP3A4 inducers (moderate) may decrease the serum concentration of alprazolam. Monitor therapy.(Arold 2005, Furukori 1998, Gashaw 2003, Markowitz 2000, Markowitz 2003, Xanax March 2021)

Ambrisentan: St. John's wort may decrease the serum concentration of ambrisentan. No action needed.(Markert 2015)

Amiodarone: CYP3A4 inducers (moderate) may decrease serum concentrations of the active metabolite(s) of amiodarone. CYP3A4 inducers (moderate) may decrease the serum concentration of amiodarone. No action needed. (Nexterone November 2016, Nolan 1990, Oude 2018, Zarembski 1999)

Aminolevulinic acid (systemic): Photosensitizing agents may enhance the photosensitizing effect of aminolevulinic acid (systemic). Avoid combination.(Alacare March 2015, Ameluz May 2016, Drucker 2011, Gleolan February 2019, Ladner 2001, Lankerani 2004, Levulan March 2010, Naldi 1999)

Aminolevulinic acid (topical): Photosensitizing agents may enhance the photosensitizing effect of aminolevulinic acid (topical). Monitor therapy.(Alacare March 2015, Ameluz May 2016, Drucker 2011, Ladner 2001, Lankerani 2004, Levulan March 2010, Naldi 1999)

Amitriptyline: St John's wort may enhance the serotonergic effect of amitriptyline. This could result in serotonin syndrome. St John's wort may decrease the serum concentration of amitriptyline. Monitor therapy.(Bonetto 2007, Boyer 2005, Dannawi 2002, Dunkley 2003, Ellison 2017, Johne 2002, Kitson 2005, Lantz 1999, Nisijima 2000, Parker 2001, Sternbach 1991)

Amlodipine: CYP3A4 inducers (moderate) may decrease the serum concentration of amlodipine. Monitor therapy. (Akamine 2015, Courlet 2021, Norvasc October 2017)

Amphetamines: Amphetamines may enhance the serotonergic effect of serotonin agents. The could result in serotonin syndrome. No action needed.(Adderall XR July 2019, Adzenys September 2017, Akingbola 2012, Boyer 2005, Clarissa 2017, Dexedrine February 2018, Dunkley 2003, Prior 2002, Sternbach 1991, Vyvanse July 2017)

Antiemetics (5-HT_3 antagonists): Antiemetics (5-HT_3 antagonists) may enhance the serotonergic effect of serotonin agents (moderate risk). This could result in serotonin syndrome. No action needed.(Altman 2010, Aloxi September 2014, Anzemet September 2014, Boyer 2005, Dunkley 2003, Gener 2010, George 2008, Gollapudy 2012, Sancuso January 2017, Sorscher 2002, Stanford 1999, Stanford 2010, Sternbach 1991, Turkel 2001, Zofran October 2017)

Antihepaciviral combination products: CYP3A4 inducers (moderate) may decrease the serum concentration of antihepaciviral combination products. Avoid combination.(Technivie December 2019, Viekira Pak December 2019)

Apixaban: St. John's wort may decrease the serum concentration of apixaban. Avoid combination.(Eliquis December 2012, Eliquis November 2012)

Apremiliast: CYP3A4 inducers (moderate) may decrease the serum concentration of apremilast. Monitor therapy.(Liu 2014, Otezla April 2020)

Aprepitant: CYP3A4 inducers (moderate) may decrease the serum concentration of aprepitant. Monitor therapy.(Emend November 2019)

Aripiprazole and aripiprazole lauroxil: CYP3A4 inducers (moderate) may decrease the serum concentration of aripiprazole and aripiprazole lauroxil. Monitor therapy.(Abilify February 2011, Abilify Maintena February 2013, Aristada June 2017, Aristada Initio June 2018, Castberg 2007, Citrome 2007, Darwish 2015, Nakamura 2009, Waade 2009)

Artemether and lumafantrine: St. John's wort may decrease serum concentrations of the active metabolite(s) of artemether and lumafantrine. Specifically, dihydroartemisinin concentrations, the active metabolite of artemether, may be decreased. St John's wort may decrease the serum concentration of artemether and lumafantrine. Avoid combination. (Coartem August 2019, Francis 2020)

Asunaprevir: CYP3A4 inducers (moderate) may decrease the serum concentration of asunaprevir. Avoid combination. (Sunvepra March 2016)

Atazanavir: St. John's wort may decrease the serum concentration of atazanavir. Avoid combination.(Reyataz September 2020)

Atogepant: CYP3A4 inducers (moderate) may decrease the serum concentration of atogepant. Consider therapy modification.(Qulipta September 2021)

Avacopan: CYP3A4 inducers (moderate) may decrease the serum concentration of Avacopan. Avoid combination. (Tavneos October 2021)

Avanafil: CYP3A4 inducers (moderate) may decrease the serum concentration of avanafil. Avoid combination.(Stendra August 2018)

Avapritinib: CYP3A4 inducers (moderate) may decrease the serum concentration of avapritinib. Avoid combination. (Ayvakit January 2020)

Axitinib: St. John's wort may decrease the serum concentration of axitinib. Avoid combination.(Inlyta January 2020, Pithavala 2010)

Bedaquiline: CYP3A4 inducers (moderate) may decrease the serum concentration of bedaquiline. Avoid combination. (Dooley 2012, Healan 2017, Sirturo May 2015, Svensson 2013, Svensson 2015, Winter 2015)

Belumosudil: CYP3A4 inducers (moderate) may decrease the serum concentration of belumosudil. Monitor therapy. (Rezurock July 2021)

Benidipine: CYP3A4 inducers (moderate) may decrease the serum concentration of benidipine. No action needed. (Codipin October 2017, Sunwoo 2019, Yoon 2007)

Benzhydrocodone: CYP3A4 inducers (moderate) may decrease the serum concentration of benzhydrocodone. Specifically, the serum concentrations of hydrocodone may be reduced. Monitor therapy.(Apadaz February 2018)

Berotralstat: P-glycoprotein/ABCB1 inducers may decrease the serum concentration of berotralstat. Avoid combination. (Orladeyo December 2020)

Bictegravir: St. John's wort may decrease the serum concentration of bictegravir. Avoid combination.(Biktarvy February 2018, Bictarvy February 2020)

Bortezomib: St. John's wort may decrease the serum concentration of bortezomib. Monitor therapy.(Velcade November 2011, Velcade April 2019)

Bosentan: St John's wort may decrease the serum concentration of bosentan. No action needed.(Markert 2014)

Bosutinib: St. John's wort may decrease the serum concentration of bosutinib. Avoid combination.(Bosulif September 2012)

Brentuximab vedotin: CYP3A4 inducers (moderate) may decrease the serum concentration of brentuximab vedotin. Specifically, concentrations of the active monomethyl auristatin E (MMAE) component may be decreased. No action needed.(Adcentris October 2019, Han 2013)

Brexpiprazole: St. John's wort may decrease the serum concentration of brexpiprazole. Consider therapy modification. (Rexulti July 2015)

Brigatinib: St. John's wort may decrease the serum concentration of brigatinib. Avoid combination.(Alunbrig April 2017)

Bromperidol: CYP3A4 inducers (moderate) may decrease the serum concentration of bromperidol. No action needed. (Brom October 2017, Otani 1997, Sato 2000, Tateishi 2000)

Brotizolam [INT]: CYP3A4 inducers (moderate) may decrease the serum concentration of brotizolam [INT]. No action needed.(Lendormin January 2021, Lendormin September 2021, Ujiie 2006)

Buprenorphine: CYP3A4 inducers (moderate) may decrease the serum concentration of buprenorphine. Monitor therapy.(Belbuca October 2019, Buprenex October 2019, Butrans October 2019, Intelence July 2019, McCance-Katz 2006, McCance-Katz 2011, Moody 2009, Sublocade February 2020, Suboxone October 2019, Zubsolv October 2019)

Bupropion: St John's wort may enhance the adverse/toxic effect of bupropion. St John's wort may decrease the serum concentration of bupropion. No action needed.(Detweiler 2002, Lei 2010, Milton 2007)

Buspirone: Buspirone may enhance the serotonergic effect of St John's wort. This could result in serotonin syndrome. St John's wort may decrease the serum concentration of buspirone. Monitor therapy.(Baetz 1995, Beckman 2000, Boyer

2005, Dannawi 2002, Dunkley 2003, Goldberg 1992, Kivisto 1999, Lamberg 1998, Lantz 1999, Manos 2000, Morrison 2012, Parker 2001, Spigset 1997, Sternbach 1991)

Cabozantinib: St. John's wort may decrease the serum concentration of cabozantinib. Avoid combination. Management recommendations differ between cabozantinib capsules used for the treatment of medullary thyroid cancer and cabozantinib tablets used for the treatment of renal cell carcinoma.(Cabometyx April 2016, Cometriq November 2012)

Cannabidiol: CYP3A4 inducers (moderate) may decrease serum concentrations of the active metabolite(s) of cannabidiol. CYP3A4 inducers (moderate) may decrease the serum concentration of cannabidiol. No action needed. (Epidiolex October 2020, Jiang 2011, Stott 2013)

Cannabis: CYP3A4 inducers (moderate) may decrease the serum concentration of cannabis. More specifically, tetrahydrocannabinol and cannabidiol serum concentrations may be decreased. Monitor therapy.(Stott 2013, Watanabe 2007)

Capmatinib: CYP3A4 inducers (moderate) may decrease the serum concentration of capmatinib. Avoid combination. (Tabrecta May 2020)

Carbamazepine: CYP3A4 inducers (moderate) may decrease the serum concentration of carbamazepine. Monitor therapy.(Burstein 2000, Carbatrol August 2018, Equetro September 2016, Ji 2008, Tegretol March 2018)

Cariprazine: CYP3A4 inducers (moderate) may decrease the serum concentration of cariprazine. Avoid combination. This combination is contraindicated in some non-US labeling.(Vraylar May 2019, Vraylar September 2022)

Carisoprodol: St. John's wort may increase serum concentrations of the active metabolite(s) of carisoprodol. Specifically, meprobamate concentrations may be increased. St. John's wort may decrease the serum concentration of carisoprodol. Monitor therapy.(Soma February 2013)

Celiprolol: P-gp/ABCB1 inducers may decrease the serum concentration of celiprolol. Monitor therapy.(Lilja 2004, Selectol July 2017)

Ceritinib: CYP3A4 inducers (moderate) may decrease the serum concentration of Ceritinib. Monitor therapy.(Zykadia March 2019)

Cladribine: P-gp/ABCB1 inducers may decrease the serum concentration of cladribine. Monitor therapy. This interaction is likely only clinically significant with orally administered cladribine.(Mavenclad March 2019)

Clarithromycin: CYP3A4 inducers (moderate) may increase serum concentrations of the active metabolite(s) of clarithromycin. CYP3A4 inducers (moderate) may decrease the serum concentration of clarithromycin. Consider therapy modification.(Biaxin September 2019, Hafner 1998, Kakuda 2014, Sustiva October 2019, Wallace 1995)

Clindamycin (systemic): CYP3A4 inducers (moderate) may decrease the serum concentration of clindamycin (systemic). Monitor therapy.(Arditi 1989, Bettoli 2014, Bernard 2015, Clindamycin February 2021, Curis 2015, Czekaj 2011, Join-Lambert 2014, Mendonca 2006, van der Zee 2009, Zeller 2010, Zinner 1982)

Clonazepam: CYP3A4 inducers (moderate) may decrease the serum concentration of clonazepam. No action needed. (Clonazepam January 2021, Khoo 1980, Saavedra 1985, Seree 1993)

Cobicistat: St. John's wort may decrease the serum concentration of cobicistat. Avoid combination.(Evotaz July 2020, Genvoya March 2021, Molto 2018, Prezcobix December 2020, Stribild August 2020, Symtuza December 2020, Tybost August 2020)

Cobimetinib: CYP3A4 inducers (moderate) may decrease the serum concentration of cobimetinib. Avoid combination. (Cotellic November 2015)

Codeine: CYP3A4 inducers (moderate) may decrease serum concentrations of the active metabolite(s) of codeine. Monitor therapy. Some non-US labels recommend avoiding this combination when possible.(Acetaminophen and Codeine November 2017, Caraco 1997, Codeine Phosphate December 2019)

Copanlisib: CYP3A4 inducers (moderate) may decrease the serum concentration of copanlisib. Monitor therapy.(Aliqopa February 2020)

Crizotinib: CYP3A4 inducers (moderate) may decrease the serum concentration of crizotinib. Monitor therapy.(Xalkori June 2019, Xu 2015)

Cyclobenzaprine: Cyclobenzaprine may enhance the serotonergic effect of serotonergic agents (moderate risk). This could result in serotonin syndrome. No action needed.(Boyer 2005, Day 2008, Dunkley 2003, Flexeril April 2013, Keegan 2006, Shprecher 2013, Sternbach 1991)

Cyclosporine (systemic): St. John's wort may decrease the serum concentration of cyclosporine (systemic). Consider therapy modification.(Ahmed 2001, Alscher 2003, Barone 2000, Barone 2001, Bauer 2003, Breidenbach 2000, Breidenbach 2000, Dresser 2003, Durr 2000, Karliova 2000, Mai 2000, Mai 2004, Mandelbaum 2000, Moschella 2001, Murakami 2006, Neoral March 2015, Ruschitzka 2000, Sandimmune March 2015, Turton-Weeks 2001, Yue 2000)

Cyproterone: St John's wort may decrease the serum concentration of cyproterone. Monitor therapy.(Apo-Cyproterone July 2018, Awortwe 2019, Piscitelli 2000, Wang 2001)

Dabigatran etexilate: P-gp/ABCB1 inducers may decrease the serum concentration of dabigatran etexilate. Avoid combination.(Chang 2017, Chin 2014, Gronich 2021, Hager 2017, Laureano 2016, Lutz 2018, Perlman 2021, Potdar 2022, Pradaxa March 2018, Wiggins 2016)

Daclatasvir: St John's wort may decrease the serum concentration of daclatasvir. Avoid combination.(Daklinza October 2019)

Dapsone: CYP3A4 inducers (moderate) may decrease the serum concentration of dapsone (systemic). Monitor therapy. (Mirochnick 2001, Mycobutin May 2015, Winter 2004)

Daridorexant: CYP3A4 inducers (moderate) may decrease the serum concentration of daridorexant. Avoid combination. (Gehin 2021, Quviviq January 2022)

Darolutamide: Inducers of CYP3A4 (moderate) and P-glycoprotein may decrease the serum concentration of darolutamide. Avoid combination.(Nubeqa July 2019)

Darunavir: St John's wort may decrease the serum concentration of darunavir. Avoid combination.(Prezista December 2020)

Dasabuvir: CYP3A4 inducers (moderate) may decrease the serum concentration of dasabuvir. Avoid combination. (Menon 2015, Technivie December 2019, Viekira Pak December 2019)

Dasatinib: St. John's wort may decrease the serum concentration of dasatinib. Avoid combination.(Sprycel December 2018)

Deflazacort: CYP3A4 inducers (moderate) may decrease serum concentrations of the active metabolite(s) of deflazacort. Avoid combination.(Emflaza February 2017)

Delamanid: CYP3A4 inducers (moderate) may decrease the serum concentration of delamanid. No action needed. (Mallikaarjun 2016, Sasahara 2015)

Delavirdine: St John's wort may decrease the serum concentration of delavirdine. Avoid combination.(Rescriptor August 2019)

Dexamethasone (systemic): CYP3A4 inducers (moderate) may decrease the serum concentration of dexamethasone (systemic). Monitor therapy.(Brooks 1972, Chalk 1984, Decadron March 2018, Haque 1972, Hemady October 2019)

Dexlansoprazole: St John's wort may decrease the serum concentration of dexlansoprazole. Avoid combination.(Dexilant June 2018)

Dexmethylphenidate-Methylphenidate: Dexmethylphenidate-Methylphenidate may enhance the serotonergic effect of serotonergic agents (moderate risk). This could result in serotonin syndrome. No action needed.(Azstarys March 2021, Bodner 1995, Boyer 2005, Concerta January 2017, Dunkley 2003, Focalin XR January 2019, Ishii 2008, Mazhar 2020, Park 2010, Peyre 2012, Sternbach 1991, Turkoglu 2015)

Dextromethorphan: Dextromethorphan may enhance the serotonergic effect of serotonergic agents (moderate risk). This could result in serotonin syndrome. No action needed.(Boyer 2005, Dunkley 2003, Dy 2017, Ganetsky 2007, Kinoshita 2011, Manaboriboon 2005, Navarro 2006, Nierenberg 1993, Schwartz 2008, Sternbach 1991, Tanaka 2011)

Diazepam: CYP3A4 inducers (moderate) may decrease the serum concentration of diazepam. Monitor therapy.(Ochs 1981, Ohnhaus 1987)

Digoxin: St. John's wort may decrease the serum concentration of digoxin. Monitor therapy.(Arold 2005, Johne 1999, Mueller 2004)

Diltiazem: CYP3A4 inducers (moderate) may decrease the serum concentration of diltiazem. Monitor therapy.(Cardizem CD March 2020, Sustiva October 2019)

Disopyramide: CYP3A4 inducers (moderate) may decrease the serum concentration of disopyramide. Monitor therapy. (Aitio 1981, Aitio 1980, Kapil 1987, Kessler 1982, Nightingale 1987, Norpace October 2020, Staum 1990)

Docetaxel: St. John's wort may increase clearance and decrease AUC. No action needed.(Goey 2014)

Dolutegravir: St. John's wort may decrease the serum concentration of dolutegravir. Avoid combination. The management of this potential interaction differs between US and Canadian labeling.(Dovato August 2019, Juluca July 2020, Tivicay August 2013, Tivicay Jun 2015, Triumeq November 2021)

Doravirine: St John's wort may decrease the serum concentration of doravirine. Avoid combination.(Delstrigo August 2018, Pifeltro August 2018, Yee 2017)

Doxorubicin (conventional): P-glycoprotein/ABCB1 inducers may decrease the serum concentration of doxorubicin (conventional). Avoid combination.(Adriamycin March 2018)

Dronabinol: CYP3A4 inducers (moderate) may decrease the serum concentration of dronabinol. Monitor therapy. (Marinol August 2017, Stott 2013, Watanabe 2007)

Dronedarone: St. John's wort may decrease the serum concentration of dronedarone. Avoid combination.(Multaq November 2020)

Duvelisib: CYP3A4 inducers (moderate) may decrease the serum concentration of duvelisib. Consider therapy

modification.(Copiktra September 2021)

Dydrogesterone: CYP3A4 inducers (moderate) may decrease the serum concentration of dydrogesterone. Monitor therapy.(Duphaston July 2018)

Ebastine: CYP3A4 inducers (moderate) may decrease the serum concentration of ebastine. No action needed.(Ebastel April 2021, Evastin April 2020, Shon 2010)

Edoxaban: P-glycoprotein/ABCB1 inducers may decrease the serum concentration of edoxaban. Consider therapy modification.(Mendell 2015, Potdar 2022, Savaysa September 2017, Sennesael 2021)

Efavirenz: CYP3A4 inducers (moderate) may decrease the serum concentration of efavirenz. Monitor therapy.(Atripla October 2019, Bachmann 2021, Bachmann 2021, Desnoyer 2010, Hsu 2010, Podany 2015, Sustiva October 2019, Symfi October 2019, Weiner 2005)

Elbasvir and grazoprevir: St John's wort may decrease the serum concentration of elbasvir and grazoprevir. Avoid combination.(Zepatier December 2019)

Elexacaftor, tezacaftor, and ivacaftor: St John's wort may decrease the serum concentration of elexacaftor, tezacaftor, and ivacaftor. Specifically, the serum concentration of ivacaftor may be decreased. Avoid combination.(Dresser 2003, Piscitelli 2000, Sugimoto 2001, Trikafta October 2019, Wang 2001)

Eliglustat: CYP3A4 inducers (moderate) may decrease the serum concentration of eliglustat. Monitor therapy.(Cerdelga August 2018, Vu 2020)

Elvitegravir: St. John's wort may decrease the serum concentration of elvitegravir. Avoid combination.(Genvoya March 2021, Ramanathan 2008, Stribild August 2020, Vitekta July 2015)

Encorafenib: CYP3A4 inducers (moderate) may decrease the serum concentration of encorafenib. Avoid combination.(Braftovi June 2018)

Entrectinib: CYP3A4 inducers (moderate) may decrease the serum concentration of entrectinib. Avoid combination.(Meneses-Lorente 2022, Rozlytrek September 2019)

Eplerenone: St John's wort may decrease the serum concentration of eplerenone. No action needed.(Inspra May 2018)

Eravacycline: CYP3A4 inducers (moderate) may decrease the serum concentration of eravacycline. No action needed.(Newman 2019, Xerava August 2018)

Erdafitinib: CYP3A4 inducers (moderate) may decrease the serum concentration of erdafitinib. Consider therapy modification.(April 2019)

Ergot derivatives: Ergot derivatives may enhance the serotonergic effect of serotonergic agents (moderate risk). This could result in serotonin syndrome. No action needed.(Boyer 2005, DHE 45 September 2009, Dunkley 2003, Jang 2019, Mathew 1996, Ozkardesler 2008, Sandyk 1986, Sternbach 1991)

Erlotinib: St. John's wort may decrease the serum concentration of erlotinib. Consider therapy modification.(Hamilton 2014, Molto 2017, Ohgami 2016, Tarceva October 2016)

Esomeprazole: St. John's wort may decrease the serum concentration of esomeprazole. Avoid combination.(Nexium August 2021, Wang 2004)

Estrogen derivatives: CYP3A4 inducers (moderate) may decrease the serum concentration of estrogen derivatives.

Monitor therapy.(Activella August 2021, Angeliq November 2017, Barditch-Crovo 1999, Cenestin November 2020, Clima Pro November 2021, Destilbenol S/A, Enjuvia March 2010, Estrace March 2005, Estragyn August 2016, Etogo-Asse 2008, Falcao 2013, Hall 2003, LeBel 1998, Menest April 2019, Murphy 2005, Notelovitz 1981, Ogen 2019, Premarin December 2014, Robertson 2002, Tibella May 2019, van Giersbergen 2006)

Etizolam: CYP3A4 inducers (moderate) may decrease the serum concentration of etizolam. No action needed.(Depas March 2017, Depas November 2006, Kondo 2005)

Etoposide and Etoposide phosphate: CYP3A4 inducers (moderate) may decrease the serum concentration of etoposide. Monitor therapy.(Jouinot 2018, Rodman 1994)

Etoricoxib: CYP3A4 inducers (moderate) may decrease the serum concentration of etoricoxib. No action needed. (Agrawal 2004, Arcoxia August 2020, Arcoxia September 2019)

Etravirine: St John's wort may decrease the serum concentration of etravirine. Avoid combination.(Gagliardini 2014, Intelence January 2018)

Everolimus: St. John's wort may decrease the serum concentration of everolimus. Avoid combination.(Afinitor October 2010, Zortress March 2010)

Exemestane: St. John's wort may decrease the serum concentration of exemestane. Consider therapy modification. (Aromasin May 2018, Schwartzberg 2017)

Fedratinib: CYP3A4 inducers (moderate) may decrease the serum concentration of fedratinib. Avoid combination. (Inrebic August 2019, Ogasawara 2021, Wu 2020)

Felodipine: CYP3A4 inducers (moderate) may decrease the serum concentration of felodipine. Monitor therapy. (Felodipine December 2020, Zaccara 1993)

Fenfluramine: Fenfluramine may enhance the serotonergic effect of serotonergic agents (moderate risk, miscellaneous). This could result in serotonin syndrome. Monitor therapy.(Baetz 1995, Beckman 2000, Boyer 2005, Dannawi 2002, Dunkley 2003, Fintepla June 2020, Goldberg 1992, Lantz 1999, Manos 2000, Morrison 2012, Parker 2001, Spigset 1997, Sternbach 1991)

Fentanyl: St John's wort may enhance the serotonergic effect of fentanyl. This could result in serotonin syndrome. St John's wort may decrease the serum concentration of fentanyl. Monitor therapy.(Ailawadhi 2007, Alkhatib 2010, Bonetto 2007, Boyer 2005, Dannawi 2002, Dunkley 2003, Duragesic September 2018, Insler 1994, Kharasch 2004, Kirschner 2010, Lantz 1999, Morii 2007, Nozari 2019, Parker 2001, Sternbach 1991, Takane 2005)

Fexinidazole: CYP3A4 inducers (moderate) may increase serum concentrations of the active metabolite(s) of fexinidazole. Avoid combination.(Fexinidazole July 2021)

Fexofenadine: P-glycoprotein/ABCB1 inducers may decrease the serum concentration of fexofenadine. Monitor therapy. (Akamine 2012, Dresser 2003, Erleada September 2019, Hamman 2001, Lorbrena February 2021, Wang 2002, Xie 2005, Yamada 2009)

Finerenone: CYP3A4 inducers (moderate) may decrease the serum concentration of finerenone. Avoid combination. (Kerendia July 2021)

Flibanserin: CYP3A4 inducers (moderate) may decrease the serum concentration of flibanserin. Avoid combination. (Addyi August 2015)

Filgotinib: P-glycoprotein/ABCB1 inducers may decrease the serum concentration of filgotinib. No action needed.(Hsueh 2022, Jyseleca January 2022)

Fosamprenavir: St John's wort may decrease the serum concentration of fosamprenavir. Avoid combination.(Lexiva March 2019)

Fosaprepitant: CYP3A4 inducers (moderate) may decrease the serum concentration of fosaprepitant. Specifically, CYP3A4 inducers (moderate) may decrease serum concentrations of the active metabolite aprepitant. Monitor therapy.(Emend November 2019)

Fosnetupitant: CYP3A4 inducers (moderate) may decrease serum concentrations of the active metabolite(s) of fosnetupitant. Monitor therapy.(Akynzeo October 2020, Calcagnile 2013)

Fostamatinib: CYP3A4 inducers (moderate) may decrease serum concentrations of the active metabolite(s) of fostamatinib. Monitor therapy.(Martin 2016, Tavalisse April 2018)

Fostemsavir: St. John's wort may decrease serum concentrations of the active metabolite(s) of fostemsavir. Avoid combination.(Rukobia July 2020)

Futibatinib: Inducers of CYP3A4 (moderate) and P-glycoprotein may decrease the serum concentration of futibatinib. Monitor therapy.(Lytgobi September 2022)

Ganaxolone: CYP3A4 inducers (moderate) may decrease the serum concentration of ganaxolone. Consider therapy modification.(Ztalmy March 2022)

Gefitinib: CYP3A4 inducers (moderate) may decrease the serum concentration of gefitinib. Monitor therapy.(Iressa August 2018, Molto 2017, Padda 2013)

Gemigliptin: CYP3A4 inducers (moderate) may decrease serum concentrations of the active metabolite(s) of gemigliptin. CYP3A4 inducers (moderate) may decrease the serum concentration of gemigliptin. Monitor therapy.(Noh 2012, Zemiglo June 2012)

Gilteritinib: Inducers of CYP3A4 (moderate) and P-glycoprotein may decrease the serum concentration of gilteritinib. Monitor therapy.(James 2020, Xospata May 2019)

Glasdegib: CYP3A4 inducers (moderate) may decrease the serum concentration of glasdegib. Consider therapy modification.(Daurismo March 2020, Shaik 2018)

Glecaprevir and pibrentasvir: St. John's wort may decrease the serum concentration of glecaprevir and pibrentasvir. Avoid combination.(Mavyret August 2017)

Gliclazide: St. John's wort may decrease the serum concentration of gliclazide. Monitor therapy.(Diamicron July 2016, Xu 2008)

Guanfacine: CYP3A4 Inducers (moderate) may decrease the serum concentration of guanfacine. Consider therapy modification. The management of this interaction depends on the formulation of guanfacine used (extended-release or immediate release).(Intuniv December 2019, Li 2018, Tenex July 2013)

Haloperidol: CYP3A4 inducers (moderate) may decrease the serum concentration of haloperidol. No action needed.(Fukuda 2000, Gex-Fabry 1997, Haldol November 2020, Hirokane 1999, Kim 1996, Linnoila 1980, Prakash 1984, Yukawa 2000, Yukawa 2002)

HMG-CoA reductase inhibitors (statins): St John's wort may decrease serum concentrations of the active metabolite(s) of HMG-CoA reductase inhibitors (statins). Consider therapy modification.(Eggertsen 2007, Sugimoto 2001)

Hormonal contraceptives: CYP3A4 inducers (moderate) may decrease the serum concentration of hormonal contraceptives. Consider therapy modification.(Barditch-Crovo 1999, Chateal EQ June 2021, Cicali 2021, Depo-Provera September 2020, Falcao 2013, Hall 2003, LeBel 1998, MHRA 2016, Murphy 2005, NuvaRing January 2020, Pfrunder 2003, Robertson 2002, Scholler-Gyure 2009, Schwarz 2003, Taysofy May 2021, van Giersbergen 2006, Will-Shahab 2009)

Hydrocodone: CYP3A4 inducers (moderate) may decrease the serum concentration of hydrocodone. Monitor therapy.(Zohydro ER August 2014)

Hydrocortisone (systemic): CYP3A4 inducers (moderate) may decrease the serum concentration of hydrocortisone (systemic). Monitor therapy.(Kyriazopoulou 1984, Solu-Cortef November 2019)

Ibrexafungerp: CYP3A4 inducers (moderate) may decrease the serum concentration of ibrexafungerp. Avoid combination.(Brexafemme June 2021)

Ibrutinib: St. John's wort may decrease the serum concentration of ibrutinib. Avoid combination.(de Jong 2015, de Zwart 2016, Imbruvica August 2017)

Idelalisib: CYP3A4 inducers (moderate) may decrease the serum concentration of idelalisib. Monitor therapy.(Jin 2015, Zydelig October 2020)

Ifosfamide: CYP3A4 inducers (moderate) may decrease serum concentrations of the active metabolite(s) of ifosfamide. CYP3A4 inducers (moderate) may increase serum concentrations of the active metabolite(s) of ifosfamide. Monitor therapy.(Chang 1997, Ifex March 2012, Kerbusch 2001)

Imatinib: CYP3A4 inducers (moderate) may decrease the serum concentration of imatinib. Monitor therapy.(Frye 2004, Gleevec August 2020, Smith 2004)

Indinavir: St John's wort may decrease the serum concentration of indinavir. Avoid combination.(Crixivan September 2016, Piscitelli 2000)

Infigratinib: CYP3A4 inducers (moderate) may decrease serum concentrations of the active metabolite(s) of infigratinib. CYP3A4 inducers (moderate) may decrease the serum concentration of Infigratinib. Avoid combination.(Truseltiq May 2021)

Iobenguane radiopharmaceutical products: St John's wort may diminish the therapeutic effect of iobenguane radiopharmaceutical products. Avoid combination.(Adaniya 2021, AdreView March 2020, Azedra July 2018, Estorch 2004, Muraoka 2008, Nakajo 1984, Yokoyama 2014)

Irinotecan products: St John's wort may decrease serum concentrations of the active metabolite(s) of irinotecan products. Specifically, concentrations of SN-38 may be reduced. St John's wort may decrease the serum concentration of irinotecan products. Consider therapy modification.(Camptosar January 2020, Mathijssen 2002, Onivyde October 2015)

Isavuconazonium sulfate: St John's wort may decrease serum concentrations of the active metabolite(s) of isavuconazonium sulfate. Specifically, St John's wort may decrease isavuconazole serum concentrations. Avoid combination.(Cresemba December 2019, Townsend 2017)

Isradipine: CYP3A4 inducers (moderate) may decrease the serum concentration of Isradipine. Monitor therapy.

(Isradipine October 2018)

Istradefylline: St John's Wort may decrease the serum concentration of istradefylline. Avoid combination.(Mukai 2018, Nourianz August 2019)

Itraconazole: CYP3A4iInducers (moderate) may decrease serum concentrations of the active metabolite(s) of itraconazole. CYP3A4 inducers (moderate) may decrease the serum concentration of itraconazole. Monitor therapy. (Huet 2008, Kaewpoowat 2021, Koo 2007, Moon 2017, Moon 2015, Sporanox May 2018, Sustiva October 2019, Tolsura June 2020)

Ivabradine: St. John's wort may decrease the serum concentration of ivabradine. Avoid combination.(Corlanor May 2019, Portolés 2006)

Ivacaftor: St. John's wort may decrease the serum concentration of ivacaftor. Avoid combination.(Dresser 2003, Kalydeco July 2017, Piscitelli 2000, Sugimoto 2001, Wang 2001)

Ivosidenib: CYP3A4 inducers (moderate) may decrease the serum concentration of ivosidenib. No action needed. (Prakash 2020, Tibsovo May 2019)

Ixazomib: St John's wort may decrease the serum concentration of ixazomib. Avoid combination.(Gupta 2018, Ninlaro March 2021)

Ketamine: CYP3A4 inducers (moderate) may decrease the serum concentration of ketamine.Monitor therapy. This interaction is likely more clinically significant when ketamine is administered orally than when ketamine is administered via routes that bypass the gastrointestinal tract (eg, intravenous, nasal).(Noopers 2011, Peltoniemi 2012, Peltoniemi 2012, Spravato March 2019)

Ketozonazole (systemic): CYP3A4 inducers (moderate) may decrease the serum concentration of ketoconazole (systemic). Monitor therapy.(Ketoconazole March 2018, Sriwiriyajan 2007)

Lansoprazole: St John's wort may decrease the serum concentration of lansoprazole. Avoid combination.(Prevacid November 2020)

Lapatinib: St. John's wort may decrease the serum concentration of lapatinib. Avoid combination.(Smith 2009, Tykerb August 2011)

Larotrectinib: St John's wort may decrease the serum concentration of larotrectinib. Consider therapy modification. (Vitrakvi November 2018)

Lasmiditan: Lasmiditan may enhance the serotonergic effect of serotonergic agents (moderate risk). This could result in serotonin syndrome. No action needed.(Boyer 2005, Dunkley 2003, Reyvow October 2019, Sternbach 1991)

Ledipasvir: P-gp/ABCB1 inducers may decrease the serum concentration of ledipasvir. Avoid combination.(Harvoni March 2020, Natali 2020, Stark 2021)

Lefamulin: CYP3A4 inducers (moderate) may decrease the serum concentration of lefamulin and lefamulin (intravenous) and P-gp/ABCB1 inducers may decrease the serum concentration of lefamulin. Consider therapy modification. The clinical significance of the interaction with CYP3A4 inducers (moderate) and lefamulin may be greater when using oral lefamulin compared with IV lefamulin.(Xelenta August 2019)

Lemborexant: CYP3A4 inducers (moderate) may decrease the serum concentration of lemborexant. Avoid combination. (Dayvigo December 2019, Landry 2021)

Lercanidipine: CYP3A4 inducers (moderate) may decrease the serum concentration of lercanidipine. Monitor therapy. (Zan-Extra November 2019)

Letermovir: P-glycoprotein/ABCB1 inducers may decrease the serum concentration of letermovir. Avoid combination. (Prevymis August 2019)

Leuprolide and norethindrone: CYP3A4 inducers (moderate) may decrease the serum concentration of leuprolide and norethindrone. Specifically, concentrations of norethindrone may be decreased. No action needed.(Barditch-Crovo 1999, Hall 2003, LaBel 1998, Lupaneta Pak October 2013, Murphy 2005, Scholler-Gyure 2009, van Giersbergen 2006)

Levamlodipine: CYP3A4 inducers (moderate) may decrease the serum concentration of levamlodipine. Monitor therapy. (Akamine 2015, Conjupri December 2019, Courlet 2021)

Levoketoconazole: CYP3A4 inducers (moderate) may decrease the serum concentration of levoketoconazole. Monitor therapy.(Recorlev January 2022, Sriwiriyajan 2007)

Levomethadone: CYP3A4 Inducers (Moderate) may decrease the serum concentration of Levomethadone. Monitor therapy.(Brown 1996, Clarke 2001, Eich-Hochli 2003, Esteban 2008, Intelence July 2018, Marzolini 2000, Pelet 2011, Polamidone May 2018, Scholler-Gyure 2008)

Linagliptin: P-gp/ABCB1 inducers may decrease the serum concentration of linagliptin. Consider therapy modification. (Glyxambi January 2020, Jentadueto July 2019, Tradjenta July 2019, Trijardy XR January 2020)

Lonafarnib: CYP3A4 inducers (moderate) may decrease the serum concentration of Lonafarnib. Avoid combination. (Zokinvy November 2020)

Lopinavir: St John's wort may decrease the serum concentration of lopinavir. Avoid combination.(Kaletra October 2020)

Lorcaserin (withdrawn from US market): Lorcaserin (withdrawn from US market) may enhance the serotonergic effect of serotonergic agents (moderate risk, miscellaneous). This could result in serotonin syndrome. Monitor therapy.(Baetz 1995, Beckman 2000, Belviq May 2017, Boyer 2005, Dannawi 2002, Dunkley 2003, Fintepla June 2020, Goldberg 1992, Lantz 1999, Manos 2000, Morrison 2012, Parker 2001, Spigset 1997, Sternbach 1991)

Lorlatinib: CYP3A4 inducers (moderate) may enhance the hepatotoxic effect of lorlatinib. CYP3A4 inducers (moderate) may decrease the serum concentration of Lorlatinib. Consider therapy modification.(Lorbrena February 2021)

Lumacaftor and Ivacaftor: St John's wort may decrease the serum concentration of lumacaftor and ivacaftor. Specifically, the serum concentration of ivacaftor may be decreased. Avoid combination.(Dresser 2003, Orkambi August 2018, Piscitelli 2000, Sugimoto 2001, Wang 2001)

Lumateperone: CYP3A4 inducers (moderate) may decrease the serum concentration of lumateperone. Avoid combination.(Caplyta December 2019)

Lurasidone: St. John's wort may decrease the serum concentration of lurasidone. Avoid combination.(Latuda January 2017)

Lurbinectedin: CYP3A4 inducers (moderate) may decrease the serum concentration of lurbinectedin. Avoid combination. (Zepzelca June 2020)

Macimorelin: St. John's wort may decrease the serum concentration of macimorelin. Avoid combination.(Macrelin December 2017)

Macitentan: CYP3A4 inducers (moderate) may decrease the serum concentration of macitentan. Monitor therapy. (Bruderer 2012, Opsumit April 2019)

Maraviroc: St. John's wort may decrease the serum concentration of maraviroc. Avoid combination.(Abel 2008, Kakuda 2011, Pozniak 2008, Selzentry October 2020)

Maribavir: St John's wort may decrease the serum concentration of maribavir. Avoid combination.(Livtencity November 2021)

Mavacamten: CYP3A4 inducers (moderate) may decrease the serum concentration of Mavacamten. Avoid combination. (Zamzyos April 2022)

Mefloquine: CYP3A4 inducers (moderate) may decrease the serum concentration of mefloquine. Monitor therapy. (Mefloquine August 2017, Ridtitid 2000)

Meperidine: CYP3A4 inducers (moderate) may decrease the serum concentration of meperidine. Monitor therapy. (Demerol April 2019, Ramirez 2004)

Metaxalone: Metaxalone may enhance the serotonergic effect of serotonergic agents (moderate risk). This could result in serotonin syndrome. No action needed.(Bosak 2014, Boyer 2005, Dunkley 2003, Martini 2015, Skelaxin March 2018, Sternbach 1991, Surmaitis 2016)

Metformin: St John's wort may decrease the renal clearance of metformin. Improved glucose response may occur that has been shown to result from an acute increase in insulin response, which is independent of the glucose-lowering action of metformin.(Stage 2015)

Methadone: CYP3A4 inducers (moderate) may decrease the serum concentration of methadone. Monitor therapy. (Marzolini 2000, Brown 1996, Clarke 2001, Eich-Hochli 2003, Esteban 2008, Intelence July 2019, Methadone June 2021, Pelet 2011, Scholler-Gyure 2008)

Methoxsalen (systemic): Photosensitizing agents may enhance the photosensitizing effect of methoxsalen (systemic). Monitor therapy.(Oxsoralen-Ultra March 2003, Uvadex March 2021)

Methylprednisolone: CYP3A4 inducers (moderate) may decrease the serum concentration of methylprednisolone. Monitor therapy.(Bartoszek 1987, Solu-Medrol May 2021, Stjernholm 1975)

Metoclopramide: Metoclopramide may enhance the serotonergic effect of serotonergic agents (moderate risk). This could result in serotonin syndrome. No action needed.(Aussedat 2020, Boyer 2005, Dunkley 2003, Fisher 2002, Harada 2017, Reglan August 2017, Sanger 2009, Sternbach 1991)

Mianserin: CYP3A4 inducers (moderate) may decrease the serum concentration of mianserin. Monitor therapy.(Eap 1999, Leinonen 1991, Lumin December 2019)

Midazolam: CYP3A4 inducers (moderate) may decrease the serum concentration of midazolam. Monitor therapy. The magnitude and clinical consequences of this interaction appears greatest with oral midazolam compared with other routes of midazolam administration.(Bachman 2021, Chaobal 2005, Dresser 2003, Gorski 2003, Greene 2022, Imai 2008, Kakuda 2014, Lorbrena February 2021, Lumakras May 2021, Lutz 2018, Mikus 2017, Nayzilam February 2021, Polepally 2020, Rowland 2018, Tafinlar April 2020, Wang 2001, Zahir 2021)

Midostaurin: St John's wort may decrease the serum concentration of midostaurin. Avoid combination.(Dutreix 2013, Gu 2019, Rydapt April 2017)

Mifepristone: St. John's wort may decrease the serum concentration of mifepristone. Avoid combination.(Korlym November 2019, Mifeprex April 2019)

Mirodenafil: CYP3A4 inducers (moderate) may decrease the serum concentration of mirodenafil. Monitor therapy.(Shin 2009)

Mitapivat: CYP3A4 inducers (moderate) may decrease the serum concentration of mitapivat. Consider therapy modification.(Pyrukynd February 2022)

Mobocertinib: CYP3A4 inducers (moderate) may decrease serum concentrations of the active metabolite(s) of mobocertinib. CYP3A4 inducers (moderate) may decrease the serum concentration of mobocertinib. Avoid combination. (Exkivity September 2021, Zhang 2021)

Monoamine oxidase inhibitors (type B): Monoamine oxidase inhibitors (type B) may enhance the serotonergic effect of St John's wort. This could result in serotonin syndrome. Avoid combination.(Azilect December 2018, Beckman 2000, Boyer 2005, Dannawi 2002, Dunkley 2003, El-Okdi 2014, Garcia-Monco 1995, Hebant 2016, Hinds 2000, Hisham 2016, Lantz 1999, Parker 2001, Richard 1997, Sternbach 1991, Suphanklang 2015, Xadago June 2017, Zelapar July 2014)

Nadolol: P-glycoprotein/ABCB1 inducers may decrease the serum concentration of nadolol. No action needed.(Misak 2016, Misaka 2013)

Naldemedine: CYP3A4 inducers (moderate) may decrease the serum concentration of naldemedine. Monitor therapy. (Fukumura 2020, Symproic January 2018)

Naloxegol: St. John's wort may decrease the serum concentration of naloxegol. Avoid combination.(Movantik September 2014)

Nateglinide: CYP3A4 inducers (moderate) may decrease the serum concentration of nateglinide. No action needed. (Niemi 2003, Starlix March 2017)

Nelfinavir: CYP3A4 inducers (moderate) may decrease the serum concentration of nelfinavir. Monitor therapy.(Viracept September 2016)

Neratinib: CYP3A4 inducers (moderate) may decrease the serum concentration of neratinib. Avoid combination.(Nerlynx June 2021)

Netupitant: CYP3A4 inducers (moderate) may decrease the serum concentration of netupitant. Monitor therapy.(Akynzeo December 2020, Calcagnile 2013)

Nevirapine: St John's Wort may decrease the serum concentration of nevirapine. Avoid combination.(de Maat 2001, Viramune September 2018)

Nifedipine: CYP Inducers (moderate) may decrease the serum concentration of nifedipine. Monitor therapy.(Lang 2003, Procardia XL January 2015, Wang 2009)

Nilotinib: CYP3A4 inducers (moderate) may decrease the serum concentration of nilotinib. Monitor therapy.(Tanaka 2011, Tasigna December 2020)

Nilvadipine: CYP3A4 inducers (moderate) may decrease the serum concentration of nilvadipine. Monitor therapy.(Saima 2002, Yasui-Furukori 2002)

Nimodipine: St. John's wort may decrease the serum concentration of nimodipine. Avoid combination.(Nimodipine

December 2015, Nymalize December 2020, Tartara 1991)

Nintedanib: Inducers of CYP3A4 (Moderate) and P-gp may decrease the serum concentration of nintedanib. Avoid combination.(Ofev March 2020)

Nirmatrelvir and ritonavir: St John's wort may decrease the serum concentration of nirmatrelvir and ritonavir. Avoid combination.(Paxlovid August 2022)

Nisoldipine: CYP3A4 inducers (moderate) may decrease the serum concentration of nisoldipine. Avoid combination. (Michelucci 1996, Sular December 2016)

Nitrazepam: CYP3A4 inducers (moderate) may decrease the serum concentration of nitrazepam. No action needed. (Brockmeyer 1990, Luurila 1995, Mizuno 2009)

Olaparib: CYP3A4 inducers (moderate) may decrease the serum concentration of olaparib. Avoid combination.(Dirix 2016, Lynparza January 2018)

Oliceridine: CYP3A4 inducers (moderate) may decrease the serum concentration of oliceridine. Monitor therapy.(Olinvyk August 2020)

Olmutinib: CYP3A4 inducers (moderate) may decrease the serum concentration of olmutinib. Monitor therapy.(Olita May 2020)

Omeprazole: St. John's wort may decrease the serum concentration of omeprazole. Avoid combination.(Nexium August 2021, Wang 2004)

Opioid agonists: Opioid agonists may enhance the serotonergic effect of serotonergic agents (moderate risk). This could result in serotonin syndrome. No action needed.(Abadie 2015, Ailawadhi 2007, Alkhatib 2010, Altman 2007, Asch 1988, Brown 1996, Bush 2006, Das 2008, Davis 2013, Dilaudid February 2017, Dolophine September 2018, Dougherty 2002, Dunkley 2003, Duragesic September 2018, Egberts 1997, El-Okdi 2014, Falls 2014, FDA 2016, Filter 2007, Fluoxetine 2004, Gillman 1995, Gillman 2005, Gnanadesigan 2005, Gollapudy 2012, Guo 2009, Hansen 1990, Hillman 2015, Houlihan 2004, Hunter 2006, Insler 1994, Isenberg 2008, John 2007, Karunatilake 2006, Kesavan 1999, Kirschner 2010, Kitson 2005, Lamberg 2014, Lange-Asschenfeldt 2002, Lantz 1998, Larson 2015, Lee 2009, Mahlberg 2004, Marechal 2011, Martinez 2008, Mason 1997, Mateo-Carrasco 2015, Meyer 1981, Mittino 2004, Morphine sulfate December 2018, Noble 1992, Oxaydol September 2018, Ozkardesler 2008, Peacock 2011, Pedavally 2014, Rang 2008, Robles 2015, Rosebraugh 2001, Roy 2003, Shahani 2012, Shakoor 2014, Song 2013, Sternbach 1991, Tashakori 2010, Tissot 2003, Venlafaxine 2004, Vizcaychipi 2007, Zornberg 1991)

Osimertinib: CYP3A4 inducers (moderate) may decrease the serum concentration of osimertinib. Monitor therapy. (Reddy 2018, Tagrisso December 2020, Vishwanathan 2018)

Oxcarbazapine: CYP3A4 inducers (moderate) may decrease the serum concentration of oxcarbazepine. No action needed.(Oxtellar XR December 2018, Sigaroudi 2016, Trileptal November 2017)

Oxtriptan: Oxitriptan may enhance the serotonergic effect of serotonergic agents (moderate risk, miscellaneous). This could result in serotonin syndrome. Monitor therapy.(Baetz 1995, Beckman 2000, Boyer 2005, Dannawi 2002, Dunkley 2003, Fintepla June 2020, Goldberg 1992, Lantz 1999, Manos 2000, Morrison 2012, Parker 2001, Spigset 1997, Sternbach 1991)

Oxycodone: St. John's wort may decrease the serum concentration of oxycodone. Monitor therapy.(Nieminen 2010)

Paclitaxel (conventional): CYP3A4 inducers (moderate) may decrease the serum concentration of paclitaxel

(conventional). Monitor therapy.(Marzolini 2017, Paclitaxel May 2018, Rodon 2012)

Paclitaxel (protein bound): CYP3A4 inducers (,oderate) may decrease the serum concentration of paclitaxel (protein bound). Monitor therapy.(Abraxane August 2020, Marzolini 2017, Rodon 2012)

Pacritinib: CYP3A4 inducers (moderate) may decrease the serum concentration of pacritinib. Avoid combination.(Vonjo February 2022)

Palbociclib: St. John's wort may decrease the serum concentration of palbociclib. Avoid combination.(Ibrance September 2019, Ibrance November 2019, Yu 2017)

Paliperidone: St. John's wort may decrease the serum concentration of paliperidone. Monitor therapy. The management of this interaction differs between the extended-release injectable formulations of paliperidone and the extended-release tablet formulation.(Akamine 2015, Dresser 2003, Helland 2017, Invega January 2019, Invega Sustenna January 2019, Invega Trinza January 2019, Kerbusch-Herben 2014, Ono 2002, Piscitelli 2001, Schoretsanitis 2018, Spina 2000, Sugimoto 2001, Vermeulen 2007, Wang 2001, Yasui-Furukori 2013)

Palovarotene: St John's wort may decrease the serum concentration of palovarotene. Avoid combination.(Dresser 2003, Piscitelli 2000, Sohonos January 2022, Wang 2001)

Pazopanib: CYP3A4 Inducers (Moderate) may decrease the serum concentration of PAZOPanib. Monitor therapy. (Votrient July 2020)

Pemigatinib: CYP3A4 inducers (moderate) may decrease the serum concentration of pemigatinib. Avoid combination.(Ji 2021, Pemazyre February 2021)

Perampanel: CYP3A4 inducers (moderate) may decrease the serum concentration of perampanel. Consider therapy modification.(Fycompa May 2019, Ishikawa 2019, Patsalos 2016, Schuck 2020, Takenaka 2018, Villanueva 2016, Yomamoto)

Pexidartinib: St. John's wort may decrease the serum concentration of pexidartinib. Avoid combination.(Turalio August 2019, Zahir 2022)

Pimavanserin: CYP3A4 inducers (moderate) may decrease the serum concentration of pimavanserin. Avoid combination.(Nuplazid November 2020)

Piperaquine: St. John's wort may decrease the serum concentration of piperaquine. Avoid combination.(Banda 2018, Eurartesim March 2020, Hughes 2020, Kajubi 2017, Wallender 2018)

Pitolisant: CYP3A4 inducers (moderate) may decrease the serum concentration of pitolisant. No action needed.(Wakix October 2020)

Ponatinib: CYP3A4 inducers (moderate) may decrease the serum concentration of ponatinib. Monitor therapy.(Iclusig December 2020, Narasimhan 2015)

Porfimer: Photosensitizing agents may enhance the photosensitizing effect of porfimer. Monitor therapy.(Drucker 2011, Lankerani 2004, Naldi 1999, Photofrin June 2011)

Pralsetinib: CYP3A4 inducers (moderate) may decrease the serum concentration of pralsetinib. Monitor therapy.(Gavreto September 2020)

Praziquantel: CYP3A4 inducers (moderate) may decrease the serum concentration of praziquantel. Consider therapy modification.(Biltricide January 2019, Mutiti 2021)

Prednisolone (systemic): CYP3A4 inducers (moderate) may decrease the serum concentration of prednisolone (systemic). Monitor therapy.(Bartoszek 1987, Bergrem 1983, Bergrem 1983, Frey 1984, Lee 1993, McAllister 1983, Petereit 1977, Powell-Jackson 1983, Prednisolone September 2018)

Prednisone: CYP3A4 inducers (moderate) may decrease the serum concentration of prednisone. Monitor therapy. (Bartoszek 1987, Bell 2007, Bergrem 1983, Bergrem 1983, Brooks 1976, Carrie 1994, Dhanoa 1998, Frey 1984, Gambertoglio 1984, Hendrickse 1979, Honeybourne 1989, Kyriazopoulou 1984, Lee 1993, McAllister 1983, Olivesi 1986, Petereit 1977, Powell-Jackson 1983, Prednisone November 2012, Sehgal 1988, Udwadia 1993, Verma 1994, Wassner 1977)

Pretomanid: CYP3A4 inducers (moderate) may decrease the serum concentration of pretomanid. Avoid combination. (Dooley 2014, Pretomanid August 2019)

Propafenone: CYP3A4 inducers (moderate) may decrease the serum concentration of propafenone. No action needed. (Castel 1990, Dilger 1999, Dilger 2000)

Quetiapine: St. John's wort may decrease the serum concentration of quetiapine. Consider therapy modification.(Bakken 2011, Grimm 2006, Hasselstrom 2004, Seroquel September 2020, Seroquel XR September 2020, Thomas 2018, Wong 2001)

Quinidine: CYP3A4 inducers (moderate) may decrease the serum concentration of quinidine. Monitor therapy.(Ahmad 1979, Bachmann 1991, Bussey 1984, Damkier 1999, Data 1976, Kroboth 1983, Quinidine gluconate September 2009, Rakhit 1984, Rodgers 1983, Schwartz 1984, Twum-Barima 1981)

Quinine: CYP3A4 inducers (moderate) may decrease the serum concentration of quinine. Monitor therapy.(Fabre 2005, Pukrittayakamee 2003, Qualaquine June 2019, Saggers 1970, Wanwimolruk 1995)

Radotinib: St. John's wort may decrease the serum concentration of radotinib. Consider therapy modification.(Supect 2014)

Ramelteon: CYP3A4 inducers (moderate) may decrease the serum concentration of ramelteon. No action needed. (Rozerem December 2018)

Ranolazine: CYP3A4 inducers (moderate) may decrease the serum concentration of ranolazine. Avoid combination. (Ranexa December 2013)

Regorafenib: St John's wort may increase serum concentrations of the active metabolite(s) of regorafenib. St John's wort may decrease the serum concentration of regorafenib. Avoid combination.(Stivarga June 2020)

Relugolix: Inducers of CYP3A4 (moderate) and P-glycoprotein may decrease the serum concentration of relugolix. Monitor therapy.(Orgovyx December 2020)

Relugolix, estradiol, and norethindrone: Inducers of CYP3A4 (moderate) and P-glycoprotein may decrease the serum concentration of relugolix, estradiol, and norethindrone. Monitor therapy.(Myfembree May 2021)

Repaglinide: CYP3A4 inducers (moderate) may decrease the serum concentration of repaglinide. Monitor therapy.(Fan 2011, Marzolini 2017, Prandin January 2019)

Ribociclib: St. John's wort may decrease the serum concentration of ribociclib. Avoid combination.(Kisqali July 2020, Samant 2020)

Rifabutin: CYP3A4 inducers (moderate) may decrease the serum concentration of rifabutin. No action needed.(Atripla October 2019, Kakuda 2014, Sustiva October 2019, Symfi October 2019, Weiner 2005)

Rilpivirine: St John's wort may decrease the serum concentration of rilpivirine. Avoid combination.(Cabenuva January 2021, Complera November 2019, Edurant January 2021, Juluca July 2020, Odefsey March 2021, Rajoli 2019)

Rimegepant: CYP3A4 inducers (moderate) may decrease the serum concentration of rimegepant. Avoid combination. (Nurtec ODT February 2020)

Riociguat: CYP3A4 inducers (moderate) may decrease the serum concentration of riociguat. No action needed. (Adempas January 2018, Saleh 2016)

Ripretinib: CYP3A4 inducers (moderate) may decrease the serum concentration of ripretinib. Consider therapy modification.(Qinlock June 2021)

Risperidone: CYP3A4 inducers (moderate) may decrease serum concentrations of the active metabolite(s) of risperidone. CYP3A4 inducers (moderate) may decrease the serum concentration of risperidone. Monitor therapy. (Alfaro 2000, Darwish 2015, Kim 2008, Mahatthanatrakul 2007, Ono 2002, Perseris December 2019, Risperdal February 2021, Risperdal Consta February 2021, Spina 2000, Spina 2001, Strack 2009, Takahashi 2001, Vermeulen 2007)

Ritonavir: St John's wort may decrease the serum concentration of ritonavir. Avoid combination.(Aptivus June 2020, Dingemanse 2010, Kaletra October 2020, Norvir October 2020, Prezista December 2020, Reyataz September 2020)

Rivaroxaban: St. John’s wort may decrease the serum concentration of rivaroxaban. Avoid combination.(Huppertz 2018, Xarelto March 2017)

Roflumilast (systemic): CYP3A4 inducers (moderate) may decrease serum concentrations of the active metabolite(s) of roflumilast (systemic). CYP3A4 inducers (moderate) may decrease the serum concentration of roflumilast (systemic). Monitor therapy.(Daliresp June 2018, Daxas January 2018, Nassr 2009)

Rolapitant: CYP3A4 inducers (moderate) may decrease the serum concentration of rolapitant. Monitor therapy.(Varubi August 2020, Wang 2019)

Ruxolitinib (systemic): CYP3A4 inducers (moderate) may increase serum concentrations of the active metabolite(s) of ruxolitinib (systemic). CYP3A4 inducers (moderate) may decrease the serum concentration of ruxolitinib (systemic). No action needed.(Branco 2016, Jakafi January 2020, Shi 2012)

Samidorphan: CYP3A4 inducers (moderate) may decrease the serum concentration of samidorphan. Monitor therapy. (Lybalvi May 2021, Sun 2019, Sun 2021)

Saquinavir: St John's wort may decrease the serum concentration of saquinavir. Avoid combination.(Invirase September 2020, Moyle 2002, Zhang 2011)

Saxagliptin: CYP3A4 inducers (moderate) may decrease the serum concentration of saxagliptin. No action needed. (Onglyza February 2017, Upreti 2011)

Selpercatinib: CYP3A4 inducers (moderate) may decrease the serum concentration of selpercatinib. Avoid combination. (Retevmo May 2020)

Selumetinib: CYP3A4 inducers (moderate) may decrease the serum concentration of selumetinib. Avoid combination. (Dymond 2017, Koselugo April 2020)

Serotonergic agents (high risk): St John's wort may enhance the serotonergic effect of serotonergic agents (high risk). This could result in serotonin syndrome. St John's wort may decrease the serum concentration of serotonergic agents (high risk). Monitor therapy.(Beckman 2000, Boinpally 2014, Boyer 2005, Chen 2013, Dannawi 2002, Dunkley 2003, Khalili 2012, Kukoyi 2005, Lantz 1999, Leinonen 1996, Parker 2001, Remeron July 2016, Sternbach 1991)

Serotonin 5-HT1D receptor agonists (triptans): Serotonin 5-HT1D receptor agonists (triptans) may enhance the serotonergic effect of serotonergic agents (moderate risk). This could result in serotonin syndrome. No action needed. (Amerge November 2016, Axert December 2017, Bonetto 2007, Boyer 2005, Dunkley 2003, Evans 2008, Evans 2007, Evans 2010, Frova August 2018, Gardner 1998, Imitrex July 2018, Mathew 1996, Maxalt December 2011, Orlova 2018, Relpax September 2013, Soldin 2008, Sternbach 1991, Wooltorton 2006)

Sertraline: CYP3A4 inducers (moderate) may decrease the serum concentration of sertraline. Monitor therapy.(Alhadab 2019, Hanan 2019, Khan 2000, Markowitz 2000, Pihlsgard 2002, Rajasingham 2018, Rhein 2016, Sustiva October 2019)

Sildenafil: CYP3A4 inducers (moderate) may decrease the serum concentration of sildenafil. Monitor therapy.(Revatio February 2018, Viagra December 2017)

Simeprevir: CYP3A4 inducers (moderate) may decrease the serum concentration of simeprevir. Avoid combination. (Olysio November 2017)

Siponimod: CYP3A4 inducers (moderate) may decrease the serum concentration of siponimod. Avoid use of CYP3A4 inducers (moderate) and siponimod in patients with the CYP2C9*1/*3 or CYP2C9*2/*3 genotypes. No action needed. The combination of siponimod and strong CYP3A4 inducers should not be used in patients who are CYP2C9 intermediate or poor metabolizers.(Gardin 2018, Huth 2019, Mayzent January 2021)

Sirolimus (conventional): CYP3A4 inducers (moderate) may decrease the serum concentration of sirolimus (conventional). Monitor therapy.(Bates 2011, Fridell 2003, Hodges 2001, Ngo 2011, Tortorici 2014)

Sirolimus (protein bound): P-glycoprotein/ABCB1 inducers may decrease the serum concentration of sirolimus (protein bound). Avoid combination.(Bates 2011, Fridell 2003, Fyarro November 2021, Hodges 2001, Ngo 2011, Rapamune November 2015, Tortorici 2014)

Sofosbuvir: P-gp/ABCB1 inducers may decrease the serum concentration of sofosbuvir. Avoid combination.(Harvoni March 2020, Lutz 2018, Marcos-Rosch 2021, Sovaldi March 2020, Startk 2021)

Sonidegib: CYP3A4 inducers (moderate) may decrease the serum concentration of sonidegib. Avoid combination. (Odomzo July 2015)

Sorafenib: St. John's wort may decrease the serum concentration of sorafenib. Monitor therapy.(Harding 2020, Nexavar July 2020)

Sotorasib: CYP3A4 inducers (moderate) may decrease the serum concentration of sotorasib. Monitor therapy.(Lumakras May 2021)

Sunitinib: St. John's wort may decrease the serum concentration of sunitinib. Avoid combination.(Sutent May 2011)

Suvorexant: CYP3A4 inducers (moderate) may decrease the serum concentration of suvorexant. Monitor therapy. (Belsomra March 2021, Wrishko 2019)

Syrian rue: Syrian Rue may enhance the serotonergic effect of Serotonergic Agents (Moderate Risk). This could result in serotonin syndrome. No action needed.(Boyer 2005, Brush 2004, Callaway 1998, Dunkley 2003, Frison 2008, Sklerov 2005, Sternbach 1991)

Tacrolimus (systemic): St. John's wort may decrease the serum concentration of tacrolimus (systemic). Consider therapy modification.(Herbert 2004, Mai 2003)

Tadalafil: CYP3A4 inducers (moderate) may decrease the serum concentration of tadalafil. Monitor therapy.(Adcirca May 2017, Cialis May 2017, Grunig 2017, Kohno 2014, Nakau 2016, Small 2019, Wrishko 2008)

Tamoxifen: CYP3A4 inducers (moderate) may decrease serum concentrations of the active metabolite(s) of tamoxifen. CYP3A4 inducers (moderate) may decrease the serum concentration of tamoxifen. Monitor therapy.(Binkhorst 2012, Kivisto 1998, Soltamox April 2019, Targretin July 2015)

Tasimelteon: CYP3A4 inducers (moderate) may decrease the serum concentration of Tasimelteon. Monitor therapy. (Hetlioz December 2020, Ogilvie 2015)

Tazemetostat: CYP3A4 inducers (moderate) may decrease the serum concentration of tazemetostat. Avoid combination. (Tazverik January 2020)

Telithromycin: CYP3A4 inducers (moderate) may decrease the serum concentration of telithromycin. Monitor therapy. (Ketek December 2015)

Temsirolimus: CYP3A4 inducers (moderate) may decrease serum concentrations of the active metabolite(s) of temsirolimus. Specifically, sirolimus concentrations may be decreased. CYP3A4 inducers (moderate) may decrease the serum concentration of temsirolimus. Monitor therapy.(Boni 2007, Coriat 2011, Torisel March 2018)

Teniposide: CYP3A4 inducers (moderate) may decrease the serum concentration of teniposide. No action needed. (Baker 1992, Relling 2000)

Tenofovir alafenamide: St John's wort may decrease the serum concentration of tenofovir alafenamide. Avoid combination.(Descovy April 2016, Genvoya March 2021, Odefsey March 2021)

Tetrahydrocannabinol: CYP3A4 inducers (moderate) may decrease the serum concentration of tetrahydrocannabinol. Monitor therapy.(Stott 2013, Watanabe 2007)

Tetrahydrocannabinol and cannabidiol: St John's wort may decrease the serum concentration of tetrahydrocannabinol and cannabidiol. Consider therapy modification.(Sativex December 2019, Stott 2013)

Tezacaftor/Ivacaftor: St John's wort may decrease the serum concentration of tezacaftor and ivacaftor. Avoid combination.(Dresser 2003, Piscitelli 2000, Sugimoto 2001, Symdeko February 2018, Wang 2001)

Thiopental: St. John's wort may enhance the CNS depressant effect of thiopental. Monitor therapy.(Thiopental January 2014)

Thiotepa: CYP3A4 inducers (moderate) may increase serum concentrations of the active metabolite(s) of thiotepa. CYP3A4 inducers (moderate) may decrease the serum concentration of thiotepa. Monitor therapy.(de Jonge 2005, Ekhart 2009, Tepadina January 2017)

Tiagabine: CYP3A4 inducers (moderate) may decrease the serum concentration of tiagabine. No action needed.(Gabitril August 2016, So 1995)

Ticagrelor: CYP3A4 inducers (moderate) may decrease serum concentrations of the active metabolite(s) of ticagrelor. CYP3A4 inducers (moderate) may decrease the serum concentration of ticagrelor. Monitor therapy.(Brilinta May 2020, Teng 2013, Weeks 2014)

Tipranavir: St. John's wort may decrease the serum concentration of tipranavir. Avoid combination.(Aptivus June 2020)

Tivozanib: CYP3A4 inducers (moderate) may decrease the serum concentration of tivozanib. Monitor therapy.(Cotreau 2015, Fotivda March 2021)

Tofacitinib: CYP3A4 inducers (moderate) may decrease the serum concentration of tofacitinib. Monitor therapy.(Nam 2020, Xeljanz December 2019)

Tolvaptan: CYP3A4 Inducers (Moderate) may decrease the serum concentration of Tolvaptan. Monitor therapy.(Jynarque December 2020, Knooop 2013, Samsca April 2021, Shoaf 2012)

Toremifene: CYP3A4 inducers (moderate) may decrease serum concentrations of the active metabolite(s) of toremifene. CYP3A4 inducers (moderate) may decrease the serum concentration of toremifene. Monitor therapy.(Fareston May 2017, Kivisto 1998)

Trabectedin: St. John's wort may decrease the serum concentration of trabectedin. Avoid combination.(Machiels 2014, Yondelis July 2014)

Tramadol: St John's wort may enhance the serotonergic effect of tramadol. This could result in serotonin syndrome. St John's wort may decrease the serum concentration of tramadol. Monitor therapy.(Bonetto 2007, Boyer 2005, Dannawi 2002, Dunkley 2003, El-Okdi 2014, Lantz 1999, Mittino 2004, Parker 2001, Peacock 2011, Saaikoski 2013, Shakoor 2014, Sternbach 1991, Ultram August 2017)

Trazodone: CYP3A4 inducers (moderate) may decrease the serum concentration of trazodone. Monitor therapy.(Otani 1996, Trazodone October 2020)

Triazolam: CYP3A4 inducers (moderate) may decrease the serum concentration of triazolam. Monitor therapy. (Robertson 2002)

Tucatinib: CYP3A4 inducers (moderate) may decrease the serum concentration of tucatinib. Monitor therapy.(Topletz-Erickson 2022, Tukysa April 2020)

Ubrogepant: St John's wort may decrease the serum concentration of ubrogepant. Avoid combination.(Ubrelvy December 2019)

Ulipristal: CYP3A4 inducers (moderate) may decrease the serum concentration of ulipristal. Avoid combination.(Ella May 2018)

Upadacitinib: CYP3A4 inducers (moderate) may decrease the serum concentration of upadacitinib. Monitor therapy. (Mohamed 2017, Rinvoq August 2019)

Valbenazine: St. John's wort may decrease the serum concentration of valbenazine. Avoid combination.(Ingrezza April 2017)

Vandetanib: St. John's wort may decrease the serum concentration of vandetanib. Avoid combination.(Caprelsa June 2020, Martin 2011)

Velpatasvir: CYP3A4 inducers (moderate) may decrease the serum concentration of velpatasvir. Avoid combination. (Epclusa September 2019, Mogalian 2016, Vosevi September 2019)

Vemurafenib: CYP3A4 inducers (moderate) may decrease the serum concentration of vemurafenib. Monitor therapy. (Zelboraf May 2020, Zhang 2019)

Venetoclax: CYP3A4 inducers (moderate) may decrease the serum concentration of venetoclax. Avoid combination. (Venclexta April 2016)

Verapamil: CYP3A4 inducers (moderate) may decrease the serum concentration of verapamil. Monitor therapy.(Calan SR October 2019, Tannergren 2004, Verelan October 2019, Verelan PM October 2019)

Verteporfin: Photosensitizing agents may enhance the photosensitizing effect of verteporfin. Monitor therapy.(Drucker 2011, Lankerani 2004, Naldi 1999, Visudyne June 2012)

Vilazodone: CYP3A4 inducers (moderate) may decrease the serum concentration of vilazodone. Monitor therapy. (Boinpally 2014, Viibryd January 2020)

Vincristine (liposomal): P-glycoprotein/ABCB1 inducers may decrease the serum concentration of vincristine (liposomal). Avoid combination.(Marqibo June 2020, Villikka 1999)

Vinflunine: St. John's wort may decrease the serum concentration of vinflunine. Avoid combination.(Javlor September 2014, Zhao 2007)

Vitamin K antagonists: St. John's wort may increase the metabolism of vitamin K antagonists. Consider therapy modification.(De Smet 2000, Jiang 2004, Yue 2000)

Voclosporin: CYP3A4 inducers (moderate) may decrease the serum concentration of voclosporin. Avoid combination. (Ling 2014, Lupkynis January 2021)

Vonoprazan: CYP3A4 inducers (moderate) may decrease the serum concentration of vonoprazan. Avoid combination. (Voquezna Dual Pak May 2022, Voquezna Triple Pak May 2022)

Vorapaxar: St. John's wort may decrease the serum concentration of vorapaxar. Avoid combination.(Kosoglou 2013, Zontivity November 2019)

Voriconazole: St. John's wort may decrease the serum concentration of voriconazole. Avoid combination. (Rengelshausen 2005, Vfend April 2021)

Vortioxetine: CYP3A4 inducers (moderate) may decrease the serum concentration of vortioxetine. Monitor therapy. (Brintellix September 2013, Chen 2013)

Voxelotor: CYP3A4 inducers (moderate) may decrease the serum concentration of voxelotor. Consider therapy modification.(Oxbryta December 2021)

Voxilaprevir: CYP3A4 inducers (moderate) may decrease the serum concentration of voxilaprevir. Avoid combination. (Vosevi September 2019)

Zaleplon: CYP3A4 inducers (moderate) may decrease the serum concentration of zaleplon. Monitor therapy.(Sonata August 2019)

Zanubrutinib: CYP3A4 inducers (moderate) may decrease the serum concentration of zanubrutinib. Avoid combination. (Brukinsa November 2019, Mu 2020, Wang 2021)

Zolpidem: St. John's wort may decrease the serum concentration of zolpidem. Avoid combination.(Ambien August 2019, Ambien CR August 2019, Hojo 2011),

Zonisamide: CYP3A4 inducers (moderate) may decrease the serum concentration of zonisamide. No action needed. (Fukuoka 2003, Levy 2004, Okada 2008, Ragueneau-Majlessi 2004, Shinoda 1996, Wallander 2014, Zonegran April

2020)

Zopiclone: CYP3A4 inducers (moderate) may decrease the serum concentration of zopiclone. Monitor therapy.(Villikka 1997, Zopiclone April 2020)

St. john's wort drug interactions (more detail)

Medications for heart failure

St John's wort interacts significantly with digoxin, angiotensin-converting enzyme inhibitors, angiotensin receptor blockers, beta-blockers, calcium channel blockers, amiodarone, and warfarin; avoid use in patients with heart failure. (Page 2016)

Other interaction data

Some studies have reported insignificant pharmacokinetic drug interactions with natural products. Limited information, a lack of consistent use of standardized product formulations, as well as potentially high interpatient variability in clinical response warrants cautious interpretation and/or application of these data in practice.(Arold 2005)

Adverse Reactions

A systematic review of current evidence concluded that Hypericum extracts are well tolerated and safe, aside from the potential for unintended interactions with other drugs.Clauson 2008,, Knüppel 2004, Schulz 2006, Stevinson 1999 A number of studies report no serious adverse effects, and in a review of clinical trials, St. John's wort was associated with fewer and milder adverse reactions compared with conventional antidepressants.Stevinson 1999 Adverse effects from H. perforatum were rare and mild. The most frequently described adverse reactions in clinical trials were GI complaints (eg, dry mouth, nausea, change in bowel habits), itching, rash, photosensitization, fatigue, dizziness, confusion, jitteriness, restlessness, insomnia, sedation, sleep disorders, and headache, most of which are attributed to hypericin and pseudohypericin content.Knüppel 2004, Qaseem 2016, Russo 2014, Schulz 2006, Stevinson 1999 Induction of mania has been associated with St. John's wort.Moses 2000, Nierenberg 1999 The volatile oil of St. John's wort is an irritant.Newall 1996 A case report also associated use of St. John's wort with hyponatremia that resulted from syndrome of inappropriate secretion of antidiuretic hormone (SIADH), which has been reported with all classes of synthetic antidepressants.Jones 2014 The contribution of St. John's wort consumption could not be ruled out in a case of development of an extremely rare form of hepatocellular carcinoma in a patient with chronic alcoholism.Lampri 2014

One case report describes acute neuropathy after sun exposure in a patient using St. John's wort.Bove 1998 When ingested, hypericin can induce photosensitization characterized by inflammation of the skin and mucous membranes (including human keratinocytes and lens epithelial cells) following exposure to light, which generates reactive oxidative species that damage axonal membranes directly and activates a calcium-ion channel (transient receptor potential cation channel A1, TRPA1) expressed on peripheral sensory neurons. Pseudohypericin and hyperforin also act as photoirritants.Araya 1981, Beattie 2005, Bernd 1999, He 2004, Hohmann 2016, Kümper 1989, Schempp 1999 However, most reports of photosensitivity have been limited to patients taking excessive doses of H. perforatum, primarily to treat HIV.Murray 1997 For example, both IV (eg, 0.5 mg/kg twice weekly) and oral dosing (eg, 0.5 mg/kg/day) of H. perforatum caused phototoxicity in 30 patients with HIV, with 16 of 30 discontinuing treatment for this reason.Jacobson 2001 Adverse phototoxic neurological effects have also been shown to have a gender-specific association. Specifically 5 of 6 females, but 0 of 6 males, developed dermatologic and neurologic symptoms on sun-exposed areas of the back of the hands and perioral and nasal areas within 6 days of increasing the dose of St. John's wort from 300 mg to 600 mg (3 times daily). Gender specificity for neuropathic effects has also been noted in the German Federal Institute for Drugs and Medical Devices. Gender differences in the dermal expression of interleukins may be involved in this differential

response.Hohmann 2016 An interaction of constituents, as found in the whole plant, has been shown to reduce the toxicity of hypericum extracts.Hammer 2014

Long-term treatment (up to 21 days) with St. John's wort significantly increased 2-hour plasma glucose levels (by approximately 40%), total glucose AUC (by 18%), and incremental blood glucose AUC (by 48%) in 10 healthy men. This effect was not only sustained but increased at 6 weeks following the last dose (240 to 294 mg of dry extract and 900 mcg total hypericin twice daily). Six weeks after the last dose, total glucose AUC increased by an additional 17% and incrementally by an additional 31%. Insulin disposition indices suggest that St. John's wort reduces glucose-stimulated insulin secretion during the oral glucose tolerance test.Stage 2016

St. john's wort side effects (more detail)

Related/similar drugs

Lexapro

Lexapro is used to treat anxiety and major depressive disorder. Learn about side effects ...

Reviews & ratings

7.6 / 10

2,376 Reviews

View more

Zoloft

Zoloft is an antidepressant used to treat major depression, obsessive-compulsive disorder, panic ...

Reviews & ratings

7.3 / 10

1,972 Reviews

View more

FEATURED

Ozempic

Learn about Ozempic (semaglutide) for type 2 diabetes treatment, weight management, cardiovascular ...

Reviews & ratings

6.6 / 10

1,504 Reviews

View more

Seroquel

Seroquel is used to treat the symptoms of schizophrenia, bipolar disorder and major depressive ...

Reviews & ratings

7.0 / 10

694 Reviews

View more

Prozac

Prozac (fluoxetine) is an SSRI antidepressant used to treat depression, OCD, panic disorder ...

Reviews & ratings

7.2 / 10

1,239 Reviews

View more

Cymbalta

Cymbalta (duloxetine) is used to treat major depressive disorder, general anxiety disorder and ...

Reviews & ratings

6.3 / 10

1,899 Reviews

View more

Wellbutrin

Wellbutrin (bupropion) is used to treat major depressive disorder and seasonal affective disorder ...

Reviews & ratings

6.8 / 10

756 Reviews

View more

Celexa

Celexa (citalopram) is an

antidepressant in a group of drugs called selective serotonin reuptake ...

Reviews & ratings

7.3 / 10

866 Reviews

View more

Concerta

Concerta is used to treat attention deficit disorder (ADD) and attention deficit hyperactivity ...

Reviews & ratings

6.9 / 10

424 Reviews

View more

Citalopram

Citalopram is an antidepressant (selective serotonin reuptake inhibitor) and is used to treat ...

Reviews & ratings

7.4 / 10

2,231 Reviews

View more

Toxicology

Limited information on genotoxicity exists. Potent inhibition of sperm motility was observed in vitro.Ondrizek 1999

References

Disclaimer

This information relates to an herbal, vitamin, mineral or other dietary supplement. This product has not been reviewed by the FDA to determine whether it is safe or effective and is not subject to the quality standards and safety information collection standards that are applicable to most prescription drugs. This information should not be used to decide whether or not to take this product. This information does not endorse this product as safe, effective, or approved for treating any patient or health condition. This is only a brief summary of general information about this product. It does NOT include all information about the possible uses, directions, warnings, precautions, interactions, adverse effects, or risks that may

apply to this product. This information is not specific medical advice and does not replace information you receive from your health care provider. You should talk with your health care provider for complete information about the risks and benefits of using this product.

This product may adversely interact with certain health and medical conditions, other prescription and over-the-counter drugs, foods, or other dietary supplements. This product may be unsafe when used before surgery or other medical procedures. It is important to fully inform your doctor about the herbal, vitamins, mineral or any other supplements you are taking before any kind of surgery or medical procedure. With the exception of certain products that are generally recognized as safe in normal quantities, including use of folic acid and prenatal vitamins during pregnancy, this product has not been sufficiently studied to determine whether it is safe to use during pregnancy or nursing or by persons younger than 2 years of age.

Frequently asked questions

- Does St. John's Wort interact with any drugs?

More about st. john's wort

- Check interactions
- Compare alternatives
- Reviews (144)
- Side effects
- Drug class: herbal products
- Breastfeeding
- En español

Patient resources

- St. John's wort drug information

Related treatment guides

- Depression
- Night Terrors

Abadie D, Rousseau V, Logerot S, Cottin J, Montastruc JL, Montastruc F. Serotonin syndrome: analysis of cases registered in the French pharmacovigilance database. *J Clin Psychopharmacol*. 2015;35(4):382-388.26082973
Abel S, Jenkins TM, Whitlock LA, Ridgway CE, Muirhead GJ. Effects of CYP3A4 inducers with and without CYP3A4 inhibitors on the pharmacokinetics of maraviroc in healthy volunteers. *Br J Clin Pharmacol*. 2008;65(suppl 1):38-46.18333864
Abilify (aripiprazole) [prescribing information]. Princeton, NJ: Bristol-Myers Squibb; February 2011.
Abilify Maintena (aripiprazole) [prescribing information]. Rockville, MD: Otsuka America Pharmaceutical Inc; February 2013.
Abraxane (paclitaxel protein-bound particles for injectable suspension) [prescribing information]. Summit, NJ: Celegene Corporation; August 2020.
Acetaminophen and codeine phosphate oral solution [prescribing information]. Morton Grove, IL: Morton Grove

Pharmaceuticals Inc; November 2017.
Actiq (fentanyl) [prescribing information]. Frazer, PA: Cephalon, Inc; June 2012.
Activella (estradiol and norethindrone) [prescribing information]. Bridgewater, NJ: Amneal Pharmaceuticals LLC; August 2021.
Adaniya S, Takahashi M, Koyama K, Ogane K, Momose T. Two cases of decreased 123I-metaiodobenzylguanidine lung uptake in metaiodobenzylguanidine scintigraphy while taking selective serotonin reuptake inhibitor/serotonin noradrenaline reuptake inhibitor. *Clin Nucl Med*. 2021;46(4):329-331.33315681
Adcetris (brentuximab vedotin) [prescribing information]. Bothell, WA: Seattle Genetics Inc; November 2019.
Adcirca (tadalafil) [prescribing information]. Indianapolis, IN: Eli Lilly and Company; May 2017.
Adderall XR (dextroamphetamine and amphetamine) [prescribing information]. Lexington, MA: Shire US Inc; July 2019.
Addyi (flibanserin) [prescribing information]. Raleigh, NC: Sprout Pharmaceuticals Inc; August 2015.
Adempas (riociguat) [prescribing information]. Whippany, NJ: Bayer HealthCare Pharmaceuticals Inc; January 2018.
AdreView (iobenguane I 123) [prescribing information]. Arlington Heights, IL: GE Healthcare; March 2020.
Adriamycin (doxorubicin) [prescribing information]. Bedford, OH: Bedford Laboratories; March 2018.
Adzenys ER (amphetamine) [prescribing information]. Grand Prairie, TX: Neos Therapeutics Brands LLC; September 2017.
Afinitor [prescribing information]. East Hanover, NJ: Novartis Pharmaceuticals Corporation; October 2010.
Agrawal NGB, Matthews CZ, Mazenko RS, et al. The effects of modifying in vivo cytochrome P450 3A (CYP3A) activity on etoricoxib pharmacokinetics and of etoricoxib administration on CYP3A activity. *J Clin Pharmacol*. 2004;44(10):1125-1131.15342613
Ahmed SM, Banner NR and Dubrey SW. Low cyclosporin-A level due to Saint-John's-wort in heart transplant patients. *J Heart Lung Transplant*. 2001;20(7):795.11474706
Ahmad D, Mathur P, Ahuja S, Henderson R, Carruthers G. Rifampicin-quinidine interaction. *Br J Dis Chest*. 1979;73(4):409-411.554671
Ailawadhi S, Sung KW, Carlson LA, Baer MR. Serotonin syndrome caused by interaction between citalopram and fentanyl. *J Clin Pharm Ther*. 2007;32(2):199-202.17381671
Aitio ML, Mansury L, Tala E, et al. The effect of enzyme induction on the metabolism of disopyramide in man. *Br J Clin Pharmacol*. 1981;11(3):279-285.7213529
Aitio ML, Vuorenmaa T. Enhanced metabolism and diminished efficacy of disopyramide by enzyme induction? *Br J Clin Pharmacol*. 1980;9(2):149-152.7356902
Akamine Y, Miura M, Yasui-Furukori N, Kojima M, Uno T. Carbamazepine differentially affects the pharmacokinetics of fexofenadine enantiomers. *Br J Clin Pharmacol*. 2012;73(3):478-481.21950458
Akamine Y, Uehara H, Miura M, Yasui-Furukori N, Uno T. Multiple inductive effects of carbamazepine on combined therapy with paliperidone and amlodipine. *J Clin Pharm Ther*. 2015;40(4):480-482.26009790
Akingbola OA, Singh D. Dexmedetomidine to treat lisdexamfetamine overdose and serotonin toxidrome in a 6-year-old girl. *Am J Crit Care*. 2012;21(6):456-459.23117910
Akynzeo (fosnetupitant/netupitant and palonosetron) [prescribing information]. Iselin, NJ: Helsinn Therapeutics (U.S.), Inc.; October 2020.
Alacare (aminolevulinic acid) dermal patch [summary of product characteristics]. Warriewood, New South Wales, Australia: Link Medical Products; March 2015.
Alfaro CL, Nicolson R, Lenane M, Rapoport JL. Carbamazepine and/or fluvoxamine drug interaction with risperidone in a patient on multiple psychotropic medications. *Ann Pharmacother*. 2000;34(1):122-123.10669197
Alfentanil [prescribing information]. Lake Forest, IL: Akorn Inc; October 2019.
Alhadab AA, Rhein J, Tugume L, et al. Pharmacokinetics-pharmacodynamics of sertraline as an antifungal in HIV-infected Ugandans with cryptococcal meningitis. *J Pharmacokinet Pharmacodyn*. 2019;46(6):565-576.31584146
Aliqopa (copanlisib) [prescribing information]. Whippany, NJ: Bayer HealthCare Pharmaceuticals Inc; February 2020.
Alkhatib AA, Peterson KA, Tuteja AK. Serotonin syndrome as a complication of fentanyl sedation during esophagogastroduodenoscopy. *Dig Dis Sci*. 2010;55(1):215-216.19165596

Aloxi (palonosetron) [prescribing information]. Woodcliff Lake, NJ: Eisai Inc; September 2014.
Alscher DM, Klotz U. Drug interaction of herbal tea containing St. John's wort with cyclosporine. *Transpl Int*. 2003;16(7):543-544.12677367
Altman EM, Manos GH. Serotonin syndrome associated with citalopram and meperidine. *Psychosomatics*. 2007;48(4):361-363.17600178
Altman CS, Jahangiri MF. Serotonin syndrome in the perioperative period. *Anesth Analg*. 2010;110(2):526-528.19955502
Alunbrig (brigatinib) [prescribing information]. Cambridge, MA: Takeda Pharmaceutical Company Limited; April 2017.
Ambien (zolpidem) [prescribing information]. Bridgewater, NJ: Sanofi-Aventis US LLC; August 2019.
Ambien CR (zolpidem) extended-release tablets [prescribing information]. Bridgewater, NJ: Sanofi-Aventis US LLC; August 2019.
Ameluz (aminolevulinic acid) gel [prescribing information]. Wakefield, MA: Biofrontera Inc; May 2016.
Amerge (naratriptan) [prescribing information]. Research Triangle Park, NC: GlaxoSmithKline; November 2016.
Andreescu C, Mulsant BH, Emanuel JE. Complementary and alternative medicine in the treatment of bipolar disorder--a review of the evidence. *J Affect Disord*. 2008;110(1-2):16-26.18456339
Angeliq (estradiol and drospirenone) [prescribing information]. Whippany, NJ: Bayer HealthCare Pharmaceuticals Inc; November 2017.
Anzemet (dolasetron) [prescribing information]. Bridgewater, NJ: Sanofi-Aventis US LLC; September 2014.
Apadaz (benzhydrocodone and acetaminophen) [prescribing information]. Coralville, IA: KemPharm Inc; February 2018.
Apo-Cyproterone (cyproterone) [product labeling]. Macquarie Park, Australia: Apotex Pty Ltd; July 2018.
Aptivus (tipranavir) [prescribing information]. Ridgefield, CT: Boehringer Ingelheim Pharmaceuticals, Inc.; June 2020.
Araya OS, Ford EJ. An investigation of the type of photosensitization caused by the ingestion of St. John's wort (*Hypericum perforatum)* by calves. *J Comp Pathol*. 1981;91(1):135-141.7343570
Arold G, Donath F, Maurer A, et al. No relevant interaction with alprazolam, caffeine, tolbutamide, and digoxin by treatment with a low-hyperforin St John's wort extract. *Planta Med*. 2005;71(4):331-337.15856409
Arcoxia (etoricoxib) tablets [BR product information]. Sao Paulo, Brazil: Merck Sharp & Dohme Farmaceutica Ltda.; August 2020.
Arcoxia (etoricoxib) [United Kingdom summary of product characteristics]. Hertfordshire, United Kingdom: Merck Sharp & Dohme BV; September 2019.
Arditi M, Yogev R. In vitro interaction between rifampin and clindamycin against pathogenic coagulase-negative staphylococci. *Antimicrob Agents Chemother*. 1989;33(2):245-247.2719468
Aristada (aripiprazole lauroxil) [prescribing information]. Waltham, MA: Alkermes Inc.; June 2017.
Aristada Initio (aripiprazole lauroxil) [prescribing information]. Waltham, MA: Alkermes Inc; June 2018.
Arndt S, Haag SF, Kleemann A, Lademann J, Meinke MC. Radical protection in the visible and infrared by a hyperforin-rich cream--in vivo versus ex vivo methods. *Exp Dermatol.* 2013;22(5):354-357.23614743
Arold G, Donath F, Maurer A, et al. No relevant interaction with alprazolam, caffeine, tolbutamide, and digoxin by treatment with a low-hyperforin St John's wort extract. *Planta Med*. 2005;71(4):331-337.15856409
Aromasin (exemestane) [prescribing information]. New York, NY: Pfizer Inc; May 2018.
Asch DA, Parker RM. The Libby Zion case. One step forward or two steps backward? *N Engl J Med*. 1988;318(12):771-775.3347226
Asher GN, Gartlehner G, Gaynes BN, et al. Comparative benefits and harms of complementary and alternative medicine therapies for initial treatment of major depressive disorder: systematic review and meta-analysis. *J Altern Complement Med.* 2017;23(12):907-919.28700248
Atripla (efavirenz, emtricitabine, and tenofovir disoproxil fumarate) [prescribing information]. Foster City, CA: Gilead Sciences Inc; October 2019.
Aussedat M, Lavoie A, Bussieres JF, Kleiber N. Suspected overlap between serotonin syndrome and neuroleptic malignant syndrome in a child treated with metoclopramide? *J Pediatr Pharmacol Ther*. 2020;25(6):552-558.32839660
Awang D. St. John's wort. *Can Pharm J*. 1991;124:33-35.

Awortwe C, Bruckmueller H, Cascorbi I. Interaction of herbal products with prescribed medications: A systematic review and meta-analysis. *Pharmacol Res*. 2019;141:397-408.30660822
Axert (almotriptan) [prescribing information]. Titusville, NJ: Janssen Pharmaceuticals Inc; May 2017.
Ayvakit (avapritinib) [prescribing information]. Cambridge, MA: Blueprint Medicines Corporation; January 2020.
Azedra (iobenguane I 131) [prescribing information]. New York, NY: Progenics Pharmaceuticals Inc; July 2018.
Azilect (rasagiline) [prescribing information]. Overland Park, KS: Teva Neuroscience Inc; December 2018.
Azstarys (serdexmethylphenidate and dexmethylphenidate) [prescribing information]. Grand Rapids, MI: Corium Inc; March 2021.
Baatsch B, Zimmer S, Recchia DR, Bussing A. Complementary and alternative therapies in dentistry and characteristics of dentists who recommend them. *Complement Ther Med*. 2017;35:64-69.29154070
Bachmann F, Duthaler U, Krahenbuhl S. Effect of deglucuronidation on the results of the Basel phenotyping cocktail [published online April 23, 2021]. *Br J Clin Pharmacol*. doi:10.1111/bcp.14874.33890704
Bachmann F, Duthaler U, Meyer HE, et al. Metamizole is a moderate cytochrome P450 inducer via the constitutive androstane receptor and a weak inhibitor of CYP1A2 [published online December 17, 2020]. *Clin Pharmacol Ther*. doi:10.1002/cpt.2141.33336382
Bachmann KA, Nunlee M, Martin M, Jaregui L. The use of single sample clearance estimates to probe hepatic drug metabolism: handprinting the influence of phenobarbitone on human hepatic drug metabolism. *Xenobiotica*. 1991;21(10):1385-1392.1796615
Baetz M, Malcolm D. Serotonin syndrome from fluvoxamine and buspirone. *Can J Psychiatry*. 1995;40(7):428-429.8548727
Bakken GV, Rudberg I, Molden E, Refsum H, Hermann M. Pharmacokinetic variability of quetiapine and the active metabolite n-desalkylquetiapine in psychiatric patients. *Ther Drug Monit*. 2011;33(2):222-226.21383647
Baker DK, Relling MV, Pui CH, et al. Increased teniposide clearance with concomitant anticonvulsant therapy. *J Clin Oncol* 1992;10(2):311-315.1732431
Balogh MP, Li JB. HPLC analysis of hypericin with photodiode-array and MS detection: the advantages of multispectral techniques. *LC GC*. 1999;17(6):556,558,560-562.
Balversa (erdafitinib) [prescribing information]. Horsham, PA: Janssen Products LP; April 2019.
Banda CG, Dzinjalamala F, Mukaka M, et al. Pharmacokinetics of piperaquine and safety profile of dihydroartemisinin-piperaquine coadministered with antiretroviral therapy in malaria-uninfected HIV-positive Malawian adults. *Antimicrob Agents Chemother*. 2018;62(8):e00634-18.29784846
Barbagallo C, Chiari G. Antimicrobial activity of three *Hypericum* species. *Fitoterapia*. 1987;58:175.
Barditch-Crovo P, Trapnell CB, Ette E, et al. The effects of rifampin and rifabutin on the pharmacokinetics and pharmacodynamics of a combination oral contraceptive. *Clin Pharmacol Ther*. 1999;65(4):428-438.10223781
Barone GW, Gurley BJ, Ketel BL, Lightfoot ML, Abul-Ezz SR. Drug interaction between St. John's wort and cyclosporine. *Ann Pharmacother*. 2000;34(9):1013-1016.10981246
Barone GW, Gurley BJ, Ketel BL, Abul-Ezz SR. Herbal supplements: a potential for drug interactions in transplant recipients. *Transplantation*. 2001;71(2):239-241.11213066
Bartoszek M, Brenner AM, Szefler SJ. Prednisolone and methylprednisolone kinetics in children receiving anticonvulsant therapy. *Clin Pharmacol Ther*. 1987;42(4):424-432.3665340
Bates D, Burak KW, Coffin CS, Ying T, Enns EM. Phenytoin-induced reduction in sirolimus levels. *Can J Hosp Pharm*. 2011;64(4):271-274.22479070
Bauer S, Störmer E, Johne A, et al. Alterations in cyclosporin A pharmacokinetics and metabolism during treatment with St John's wort in renal transplant patients. *Br J Clin Pharmacol*. 2003;55(2):203-211.12580993
Beattie PE, Dawe RS, Traynor NJ, Woods JA, Ferguson J, Ibbotson SH. Can St. John's wort (hypericin) ingestion enhance the erythemal response during high-dose ultraviolet A1 therapy? *Br J Dermatol*. 2005;153(6):1187-1191.16307656
Beckman SE, Sommi RW, Switzer J. Consumer use of St. John's wort: a survey on effectiveness, safety, and tolerability. *Pharmacotherapy*. 2000;20(5):568-574.10809344

Béjaoui A, Ben Salem I, Rokbeni N, M'rabet Y, Boussaid M, Boulila A. Bioactive compounds from *Hypericum humifusum* and *Hypericum perfoliatum*: inhibition potential of polyphenols with acetylcholinesterase and key enzymes linked to type-2 diabetes. *Pharm Biol.* 2017;55(1):906-911.28147885
Belbuca (buprenorphine) buccal film [prescribing information]. Raleigh, NC: BioDelivery Sciences International, Inc.; October 2019.
Bell EC, Ravis WR, Chan HM, Lin YJ. Lack of pharmacokinetic interaction between St. John's wort and prednisone. *Ann Pharmacother*. 2007;41(11):1819-1824.17925494
Belsomra (suvorexant) [prescribing information]. Whitehouse Station, NJ: Merck & Co Inc; March 2021.
Belviq (lorcaserin) [prescribing information]. Woodcliff Lake, NJ: Eisai Inc; May 2017.
Benoist GE, van der Doelen MJ, Ter Heine R, van Erp NP, Mehra N. A clinically relevant decrease in abiraterone exposure associated with carbamazepine use in a patient with castration-resistant metastatic prostate cancer. *Br J Clin Pharmacol*. 2018;84(5):1064-1067.29384591
Bergrem H, Refvem OK. Altered prednisolone pharmacokinetics in patients treated with rifampicin. *Acta Med Scand*. 1983;213(5):339-343.6880856
Bergrem H, Refvem OK. Changes in prednisolone pharmacokinetics and protein binding during treatment with rifampicin. *Proc Eur Dial Transplant Assoc*. 1983;19:552-557.6878255
Bernard A, Kermarrec G, Parize P, et al. Dramatic reduction of clindamycin serum concentration in staphylococcal osteoarticular infection patients treated with the oral clindamycin-rifampicin combination. *J Infect*. 2015;71(2):200-206.25936632
Bernard A, Vaccaro N, Acharya M, et al. Impact on abiraterone pharmacokinetics and safety: Open-label drug-drug interaction studies with ketoconazole and rifampicin. *Clin Pharmacol Drug Dev*. 2015;4(1):63-73.27128004
Bernd A, Simon S, Ramirez Bosca A, et al. Phototoxic effects of *Hypericum* extract in cultures of human keratinocytes compared with those of psoralen. *Photochem Photobiol*. 1999;69(2):218-221.10048312
Berry-Bibee EN, Kim MJ, Tepper NK, Riley HE, Curtis KM. Co-administration of St. John's wort and hormonal contraceptives: a systematic review. *Contraception.* 2016;94(6):668-677.27444983
Bettoli V, Zauli S, Borghi A. Oral clindamycin and rifampicin in the treatment of hidradenitis suppurativa-acne inversa: a prospective study on 23 patients. *J Eur Acad Dermatol Venereol*. 2014;28(1):125-126.23451831
Biaxin (clarithromycin) [prescribing information]. North Chicago, IL: Abbott Laboratories; September 2019.
Biktarvy (bictegravir, emtricitabine, and tenofovir alafenamide) [prescribing information]. Foster City, CA: Gilead Sciences Inc.; February 2018.
Biktarvy (bictegravir, emtricitabine, and tenofovir alafenamide) [product monograph]. Mississauga, ON: Gilead Sciences Canada, Inc.; February 2020.
Biltricide (praziquantel) [prescribing information]. Whippany, NJ: Bayer HealthCare Pharmaceuticals Inc; January 2019.
Binkhorst L, van Gelder T, Loos WJ, et al. Effects of CYP induction by rifampicin on tamoxifen exposure. *Clin Pharmacol Ther*. 2012;92(1):62-67.22617226
Bodner RA, Lynch T, Lewis L, Kahn D. Serotonin syndrome. *Neurology*. 1995;45(2):219-223.7854515
Boinpally R, Gad N, Gupta S, Periclou A. Influence of CYP3A4 induction/inhibition on the pharmacokinetics of vilazodone in healthy subjects. *Clin Ther*. 2014;36(11):1638-1649.25236915
Bombardelli E, Morazzoni P. *Hypericum perforatum*. *Fitoterapia*. 1995;66(1):43-68.
Bonetto N, Santelli L, Battistin L, Cagnin A. Serotonin syndrome and rhabdomyolysis induced by concomitant use of triptans, fluoxetine and *Hypericum*. *Cephalalgia*. 2007;27(12):1421-1423.17868285
Boni J, Leister C, Burns J, et al. Pharmacokinetic profile of temsirolimus with concomitant administration of cytochrome P450-inducing medications. *J Clin Pharmacol*. 2007;47:1430-1439.17913896
Borrelli F, Izzo AA. Herb-drug interactions with St John's wort (*Hypericum perforatum*): an update on clinical observations. *AAPS J.* 2009;11(4):710-727.19859815
Bosak AR, Skolnik AB. Serotonin syndrome associated with metaxalone overdose. *J Med Toxicol*. 2014;10(4):402-405.24805103
Bosulif [prescribing information]. New York, NY: Pfizer Inc; September 2012.

Bove GM. Acute neuropathy after exposure to sun in a patient treated with St. John's wort. *Lancet*. 1998;352(9134):1121-1122.9798597
Boyd A, Bleakley C, Hurley DA, Gill C, Hannon-Fletcher M, Bell P, McDonough S. Herbal medicinal products or preparations for neuropathic pain. *Cochrane Database Syst Rev*. 2019;4:CD010528.30938843
Boyer EW, Shannon M. The serotonin syndrome. *N Engl J Med*. 2005;352(11):1112-1120.15784664
Braftovi (encorafenib) [prescribing information]. Boulder, CO: Array BioPharma Inc; June 2018.
Branco B, Metsu D, Dutertre M, et al. Use of rifampin for treatment of disseminated tuberculosis in a patient with primary myelofibrosis on ruxolitinib. *Ann Hematol*. 2016;95(7):1207-1209.27113251
Brattström A. Long-term effects of St. John's wort (*Hypericum perforatum*) treatment: a 1-year safety study in mild to moderate depression. *Phytomedicine*. 2009;16(4):277-283.19299116
Breidenbach T, Hoffmann MW, Becker T, Schlitt H, Klempnauer J. Drug interaction of St John's wort with cyclosporin. *Lancet.* 2000;355(9218):1912.10866469
Breidenbach T, Kliem V, Burg M, Radermacher J, Hoffmann MW, Klempnauer J. Profound drop of cyclosporin A whole blood trough levels caused by St. John's wort (*Hypericum perforatum*). *Transplantation*. 2000;69(10):2229-2230.10852634
Brexafemme (ibrexafungerp) [prescribing information]. Jersey City, NJ: Scynexis Inc; June 2021.
Breyer A, Elstner M, Gillessen T, Weiser D, Elstner E. Glutamate-induced cell death in neuronal HT22 cells is attenuated by extracts from St. John's wort (*Hypericum perforatum* L.). *Phytomedicine*. 2007;14(4):250-255.17346956
Brilinta (ticagrelor) [prescribing information]. Wilmington, DE: AstraZeneca Pharmaceuticals LP; May 2020.
Brinker FJ. *Herb Contraindications and Drug Interactions*. 2nd ed. Sandy, OR: Eclectic Medical Publications; 1998.
Brintellix (vortioxetine) [prescribing information]. Deerfield, IL: Takeda Pharmaceuticals America, Inc., September 2013.
Brockmeyer NH, Mertins L, Klimek K, Goos M, Ohnhaus EE. Comparative effects of rifampin and/or probenecid on the pharmacokinetics of temazepam and nitrazepam. *Int J Clin Pharmacol Ther Toxicol*. 1990;28(9):387-393.2228325
Brom (bromperidol) [KR prescribing information]. Accessed October 27, 2017. https://nedrug.mfds.go.kr/pbp/CCBBB01/getItemDetail?itemSeq=198800802.
Brooks PM, Buchanan WW, Grove M, Downie WW. Effects of enzyme induction on metabolism of prednisolone. Clinical and laboratory study. *Ann Rheum Dis*. 1976;35(4):339-343.970991
Brooks SM, Werk EE, Ackerman SJ, Sullivan I, Thrasher K. Adverse effects of phenobarbital on corticosteroid metabolism in patients with bronchial asthma. *N Engl J Med*. 1972;286(21):1125-1128.4553339
Brown LS, Sawyer RC, Li R, Cobb MN, Colborn DC, Narang PK. Lack of a pharmacologic interaction between rifabutin and methadone in HIV-infected former injecting drug users. *Drug Alcohol Depend*. 1996;43(1-2):71-77.8957145
Brown TM, Skop BP. Nitroglycerin in the treatment of the serotonin syndrome. *Ann Pharmacother*. 1996;30(2):191-192.8835057
Bruderer S, Aanismaa P, Homery MC, et al. Effect of cyclosporine and rifampin on the pharmacokinetics of macitentan, a tissue-targeting dual endothelin receptor antagonist. *AAPS J*. 2012;14(1):68-78.22189899
Brukinsa (zanubrutinib) [prescribing information]. San Mateo, CA: BeiGene USA, Inc.; November 2019.
Brush DE, Bird SB, Boyer EW. Monoamine oxidase inhibitor poisoning resulting from Internet misinformation on illicit substances. *J Toxicol Clin Toxicol*. 2004;42(2):191-195.15214625
Buprenex (buprenorphine) injection [prescribing information]. North Chesterfield, VA: Indivior Inc.; October 2019.
Burstein AH, Horton RL, Dunn T, Alfaro RM, Piscitelli SC, Theodore W. Lack of effect of St John's wort on carbamazepine pharmacokinetics in healthy volunteers. *Clin Pharmacol Ther*. 2000;68(6):605-612.11180020
Bush E, Miller C, Friedman I. A case of serotonin syndrome and mutism associated with methadone. *J Palliat Med*. 2006;9(6):1257-1259.17187532
Bussey HI, Merritt GJ, Hill EG. The influence of rifampin on quinidine and digoxin. *Arch Intern Med*. 1984;144(5):1021-1023.6712395
Butrans (buprenorphine) film, extended release [prescribing information]. Stamford, CT: Purdue Pharma L.P.; October 2019.
Butterweck V, Jürgenliemk G, Nahrstedt A, Winterhoff H. Flavonoids from *Hypericum perforatum* show antidepressant

activity in the forced swimming test. *Planta Med*. 2000;66(1):3-6.10705724
Butterweck V, Schmidt M. St. John's wort: role of active compounds for its mechanism of action and efficacy. *Wien Med Wochenschr*. 2007;157(13-14):356-361. doi 10.1007/s10354-007-0440-817704987
Cabenuva (cabotegravir and rilpivirine) extended-release injectable suspension [prescribing information]. Research Triangle Park, NC: ViiV Healthcare; January 2021.
Cabometyx (cabozantinib) tablets [prescribing information]. South San Francisco, CA: Exelixis Inc; April 2016.
Cabrelle A, Dell'Aica I, Melchiori L, et al. Hyperforin down-regulates effector function of activated T lymphocytes and shows efficacy against Th1-triggered CNS inflammatory-demyelinating disease. *J Leukoc Biol*. 2008;83(1):212-219.17947392
Calan SR (verapamil hydrochloride) [prescribing information]. New York, NY: Pfizer; October 2019.
Calcagnile S, Lanzarotti C, Rossi G, Henriksson A, Kammerer KP, Timmer W. Effect of netupitant, a highly selective NK1 receptor antagonist, on the pharmacokinetics of palonosetron and impact of the fixed dose combination of netupitant and palonosetron when coadministered with ketoconazole, rifampicin, and oral contraceptives. *Support Care Cancer*. 2013;21(10):2879-2887.23748441
Callaway JC, Grob CS. Ayahuasca preparations and serotonin reuptake inhibitors: a potential combination for severe adverse interactions. *J Psychoactive Drugs*. 1998;30(4):367-369.9924842
Calquence (acalabrutinib) [prescribing Information]. Wilmington, DE: AstraZeneca Pharmaceuticals LP; November 2019.
Camfield DA, Scholey AB, Pipingas A, et al. The neurocognitive effects of *Hypericum perforatum* special extract (Ze 117) during smoking cessation. *Phytother Res*. 2013;27(11):1605-1613.23280675
Camptosar (irinotecan) [prescribing information]. New York, NY: Pharmacia & Upjohn Co; January 2020.
Camzyos (mavacamten) [prescribing information]. Brisbane, CA: MyoKardia, Inc.; April 2022.
Canning S, Waterman M, Orsi N, Ayres J, Simpson N, Dye L. The efficacy of *Hypericum perforatum* (St John's wort) for the treatment of premenstrual syndrome: a randomized, double-blind, placebo-controlled trial. *CNS Drugs*. 2010;24(3):207-225.20155996
Caplyta (lumateperone) [prescribing information]. New York, NY: Intra-Cellular Therapies Inc; December 2019.
Caprelsa (vandetanib) [prescribing information]. Cambridge, MA: Genzyme Corporation; June 2020.
Caraco Y, Sheller J, Wood AJ. Pharmacogenetic determinants of codeine induction by rifampin: the impact on codeine's respiratory, psychomotor and miotic effects. *J Pharmacol Exp Ther*. 1997;281(1):330-336.9103514
Carbatrol (carbamazepine) extended-release capsules [prescribing information]. Lexington, MA: Shire US Inc.; August 2018.
Cardizem CD (diltiazem) [prescribing information]. Bridgewater, NJ: Bausch Health US LLC; March 2020.
Carrie F, Roblot P, Bouquet S, Delon A, Roblot F, Becq-Giraudon B. Rifampin-induced nonresponsiveness of giant cell arteritis to prednisone treatment. *Arch Intern Med*. 1994;154(13):1521-1524.8018008
Castberg I, Spigset O. Effects of comedication on the serum levels of aripiprazole: evidence from a routine therapeutic drug monitoring service. *Pharmacopsychiatry*. 2007;40(3):107-110.17541885
Castel JM, Cappiello E, Leopaldi D, Latini R. Rifampicin lowers plasma concentrations of propafenone and its antiarrhythmic effect. *Br J Clin Pharmacol*. 1990;30(1):155-156.2390428
Cenestin (synthetic conjugated estrogens, A) [prescribing information]. North Wales, PA: Teva Pharmaceuticals USA Inc; November 2020.
Cerdelga (eliglustat) [prescribing information]. Waterford, Ireland: Genzyme Ireland Ltd; August 2018.
Chalk JB, Ridgeway K, Brophy T, Yelland JD, Eadie MJ. Phenytoin impairs the bioavailability of dexamethasone in neurological and neurosurgical patients. *J Neurol Neurosurg Psychiatry*. 1984;47(10):1087-1090.6502166
Chang SH, Chou IJ, Yeh YH, et al. Association between use of non-vitamin K oral anticoagulants with and without concurrent medications and risk of major bleeding in nonvalvular atrial fibrillation. *JAMA*. 2017;318(13):1250-1259.28973247
Chang TK, Yu L, Maurel P, Waxman DJ. Enhanced cyclophosphamide and ifosfamide activation in primary human hepatocyte cultures: response to cytochrome P-450 inducers and autoinduction by oxazaphosphorines. *Cancer Res*. 1997;57(10):1946-1954.9157990

Chaobal HN, Kharasch ED. Single-point sampling for assessment of constitutive, induced, and inhibited cytochrome P450 3A activity with alfentanil or midazolam. *Clin Pharmacol Ther*. 2005;78(5):529-539.16321619
Charrois TL, Sadler C, Vohra S; American Academy of Pediatrics Provisional Section on Complementary, Holistic, and Integrative Medicine. Complementary, holistic, and integrative medicine: St. John's wort. *Pediatr Rev*. 2007;28(2):69-72.17272523
Chateal EQ (ethinyl estradiol and levonorgestrel) [prescribing information]. Charleston, SC: Afaxys Pharma, LLC; June 2021.
Chatterjee SS, Erdelmeier C, Noeldner M. Use of hyperforin and hyperforin-containing extracts in the treatment and prophylaxis of dementia. *PCT Int Appl*. 1999.
Chen G, Lee R, Hojer AM, Buchbjerg JK, Serenko M, Zhao Z. Pharmacokinetic drug interactions involving vortioxetine (Lu AA21004), a multimodal antidepressant. *Clin Drug Investig*. 2013;33(10):727-36.23975654
Chi JD, Franklin M. Determination of hypericin in plasma by high-performance liquid chromatography. *J Chromatogr B Biomed Sci Appl*. 1999;724(1):195-198.10202973
Chi JD, Franklin M. Measurement of hyperforin a constituent of St. John's wort in plasma by high-performance liquid chromatography. *J Chromatogr B Biomed Sci Appl*. 1999;735(2):285-288.10670742
Chin PK, Wright DF, Zhang M, et al. Correlation between trough plasma dabigatran concentrations and estimates of glomerular filtration rate based on creatinine and cystatin C. *Drugs R D*. 2014;14(2):113-123.24797400
Chrubasik-Hausmann S, Vlachojannis J, McLachlan AJ. Understanding drug interactions with St John's wort (*Hypericum perforatum* L.): impact of hyperforin content [published online ahead of print February 7, 2018]. *J Pharm Pharmacol*.29411879
Cialis (tadalafil) [prescribing information]. Indianapolis, IN: Lilly USA, LLC; May 2017.
Cicali B, Lingineni K, Cristofoletti R, et al. Quantitative assessment of levonorgestrel binding partner interplay and drug-drug interactions using physiologically based pharmacokinetic modeling. *CPT Pharmacometrics Syst Pharmacol*. 2021;10(1):48-58.33217171
Citrome L, Macher Jean-Paul, Salazar D, Mallikaarjun S, Boulton DW. Pharmacokinetics of aripiprazole and concomitant carbamazepine. *J Clin Psychopharm*. 2007;27(3):279-283.17502775
Clarissa Samara V, Warner J. Rare case of severe serotonin syndrome leading to bilateral compartment syndrome. *BMJ Case Rep*. 2017; pii: bcr2016218842.28258180
Clarke SM, Mulcahy FM, Tjia J, Reynolds HE, Gibbons SE, Barry MG, Back DJ. The pharmacokinetics of methadone in HIV-positive patients receiving the non-nucleoside reverse transcriptase inhibitor efavirenz. *Br J Clin Pharmacol*. 2001;51(3):213-217.11298066
Clauson KA, Santamarina ML, Rutledge JC. Clinically relevant safety issues associated with St. John's wort product labels. *BMC Complement Altern Med*. 2008;8:42.18637192
Clima Pro (estradiol and levonorgestrel) transdermal system [prescribing information]. Whippany, NJ: Bayer HealthCare Pharmaceuticals Inc; November 2021.
Clindamycin [prescribing information]. Deerfield, IL: Baxter Healthcare Corporation; February 2021.
Clonazepam ODT [prescribing information]. North Wales, PA: Teva Pharmaceuticals USA Inc; January 2021.
Coartem (artemether and lumefantrine). East Hanover, NJ: Novartis Pharmaceuticals Corporation; August 2019.
Cobin RH, Goodman NF; AACE Reproductive Endocrinology Scientific Committee. American Association of Clinical Endocrinologists and American College Of Endocrinology position statement on menopause-2017 update [published correction appears in *Endocr Pract*. 2017;23 (12):1488]. *Endocr Pract*. 2017;23(7):869-880. doi:10.4158/EP171828.PS28703650
Codeine phosphate injection [product monograph]. Boucherville, Quebec, Canada: Sandoz Canada Inc.; December 2019.
Codipin (benidipine hydrochloride) tablets [Korea KR prescribing information]. Accessed October 26, 2017. https://nedrug.mfds.go.kr/pbp/CCBBB01/getItemDetail?itemSeq=199300958.
Cometriq [prescribing information]. San Francisco, CA: Exelixis, Inc; December 2012.
Complera (emtricitabine, rilpivirine, tenofovir disoproxil fumarate) [prescribing information]. Foster City, CA: Gilead

Sciences Inc; November 2019.
Concerta (methylphenidate) [prescribing information]. Titusville, NJ: Janssen Pharmaceuticals Inc; January 2017.
Conjupri (levamlodipine) [prescribing information]. CSPC Ouyi Pharmaceutical Co., Ltd.; December 2019.
Constantine GH, Karchesy J. Variations in hypericin concentrations in *Hypericum perforatum* L. and commercial products. *Pharm Biol*. 1998;36(5):365-367.
Copiktra (duvelisib) [prescribing information]. Needham, MA: Verastem Inc; September 2021
Coriat R, Mir O, Ropert S, Loulergue P, Billemont B, Goldwasser F. Reactivation of tuberculosis during temsirolimus therapy. *Invest New Drugs*. 2011;29(6):1494-1496.20623161
Corlanor (ivabradine) [prescribing information]. Thousand Oaks, CA: Amgen Inc.; May 2019.
Cotellic (cobimetinib) [prescribing information]. South San Francisco, CA: Genetech USA Inc; November 2015.
Cotreau MM, Siebers NM, Miller J, Strahs AL, Slichenmyer W. Effects of ketoconazole or rifampin on the pharmacokinetics of tivozanib hydrochloride, a vascular endothelial growth factor receptor tyrosine kinase inhibitor. *Clin Pharmacol Drug Dev*. 2015;4(2):137-142.27128217
Courlet P, Guidi M, Saldanha SA, et al. Population pharmacokinetic modelling to quantify the magnitude of drug-drug interactions between amlodipine and antiretroviral drugs. *Eur J Clin Pharmacol*. 2021;77(7):979-987.33452585
Cresemba (isavuconazonium sulfate) [prescribing information]. Northbrook, IL: Astellas Pharma US Inc: December 2019.
Crixivan [prescribing information]. Whitehouse Station, NJ: Merck & Co Inc; September 2016.
Crowe S, McKeating K. Delayed emergence and St. John's wort. *Anesthesiology*. 2002;96(4):1025-1027.11964615
Curis E, Pestre V, Jullien V, et al. Pharmacokinetic variability of clindamycin and influence of rifampicin on clindamycin concentration in patients with bone and joint infections. *Infection*. 2015;43(4):473-481.25837442
Czekaj J, Dinh A, Moldovan A, et al. Efficacy of a combined oral clindamycin-rifampicin regimen for therapy of staphylococcal osteoarticular infections. *Scand J Infect Dis*. 2011;43(11-12):962-967.21916775
Dailly E, Tribut O, Tattevin P, et al. Influence of tenofovir, nevirapine and efavirenz on ritonavir-boosted atazanavir pharmacokinetics in HIV-infected patients. *Eur J Clin Pharmacol*. 2006;62(7):523-526.16763827
Daklinza (daclatasvir) [prescribing information]. Princeton, NJ: Bristol-Myers Squibb Company; October 2019.
Daliresp (roflumilast) [prescribing information]. Wilmington, DE: AstraZeneca Pharmaceuticals LP; January 2018.
Damkier P, Hansen LL, Brosen K. Rifampicin treatment greatly increases the apparent oral clearance of quinidine. *Pharmacol Toxicol*. 1999;85(6):257-262.10628900
Dannawi M. Possible serotonin syndrome after combination of buspirone and St John's Wort. *J Psychopharmacol*. 2002;16(4):401.12503845
Darwish M, Bond M, Yang R, Hellriegel ET, Robertson P Jr. Evaluation of potential pharmacokinetic drug-drug interaction between armodafinil and aripiprazole in healthy adults. *Pharmacopsychiatry*. 2015;48(4-5):170-175.26181194
Darwish M, Bond M, Yang R, Hellriegel ET, Robertson P. Evaluation of potential pharmacokinetic drug-drug interaction between armodafinil and risperidone in healthy adults. *Clin Drug Investig*. 2015;35(11):725-733. doi:10.1007/s40261-015-0330-626387027
Das PK, Warkentin DI, Hewko R, Forrest DL. Serotonin syndrome after concomitant treatment with linezolid and meperidine. *Clin Infect Dis*. 2008;46(2):264-265.18171260
Dasgupta A, Tso G, Szelei-Stevens K. St. John's wort does not interfere with therapeutic drug monitoring of 12 commonly monitored drugs using immunoassays. *J Clin Lab Anal*. 2006;20(2):62-67.16538644
Data JL, Wilkinson GR, Nies AS. Interaction of quinidine with anticonvulsant drugs. *N Engl J Med*. 1976;294(13):699-702.1250281
Daurismo (glasdegib) [prescribing information]. New York, NY: Pfizer Labs; March 2020.
Davis JJ, Buck NS, Swenson JD, Johnson KB, Greis PE. Serotonin syndrome manifesting as patient movement during total intravenous anesthesia with propofol and remifentanil. *J Clin Anesth*. 2013;25(1):52-54.23391344
Daxas (roflumilast) [product monograph]. Mississauga, Ontario, Canada: AstraZeneca Canada Inc; January 2017.
Day LT, Jeanmonod RK. Serotonin syndrome in a patient taking Lexapro and Flexeril: a case report. *Am J Emerg Med*. 2008;26(9):1069.e1-1069.e3.19091289
Dayvigo (lemborexant) [prescribing information]. Woodcliff Lake, NJ: Eisai Inc; December 2019.

Decadron (dexamethasone) [prescribing information]. Whitehouse Station, NJ: Merck & Co Inc; April 2018.
de Jong J, Skee D, Murphy J, et al. Effect of CYP3A perpetrators on ibrutinib exposure in healthy participants. *Pharmacol Res Perspect*. 2015;3(4):e00156.26171235
de Jonge ME, Huitema AD, van Dam SM, Beijnen JH, and Rodenhuis S. Significant induction of cyclophosphamide and thiotepa metabolism by phenytoin. *Cancer Chemother Pharmacol*. 2005;55(5):507-510.15685452
Delstrigo (doravirine/lamivudine/tenofovir disoproxil) [prescribing information]. Whitehouse Station, NJ: Merck & Co Inc; August 2018.
de Maat M, Hoetelmans RM, Mathot RA, et al. Drug interaction between St John's wort and nevirapine. *AIDS*. 2001;15(3):420-421.11273226
Demerol (meperidine) [prescribing information]. Lake Forest, IL: Hospira, Inc.; April 2019.
Depas (etizolam) [Japan Pharmaceutical Reference]. Osaka, Japan: Mitsubishi Tanabe Pharma Corporation; March 2017.
Depas (etizolam) [KR prescribing information]. Updated November 6, 2006. Accessed July 28, 2022. https://nedrug.mfds.go.kr/pbp/CCBBB01/getItemDetail?itemSeq=200610866.
Dennehy C, Tsourounis C, Bui L, King TL. The use of herbs by California midwives. *J Obstet Gynecol Neonatal Nurs*. 2010;39(6):684-693.21044150
Depo-Provera (medroxyprogesterone acetate) [prescribing information]. New York, NY: Pfizer Inc; September 2020.
Descovy (emtricitabine/tenofovir alafenamide) [prescribing information]. Foster City, CA: Gilead Sciences Inc; April 2016.
De Smet PA, Touw DJ. Safety of St John's wort (*Hypericum perforatum*). *Lancet*. 2000;355(9203):575-576.10683028
Desnoyer A, Kaie FA, Descamps D, et al. Deleterious pharmacokinetic interaction between bexarotene and efavirenz. *AIDS*. 2010;24(14):2296-2298.20736686
Destilbenol (diethylstilbestrol) tablets [prescribing information]. Sao Paulo, Brazil: Pharmaceutical Aspens S/A.
Detweiler MB, Harpold GJ. Bupropion-induced acute dystonia. *Ann Pharmacother*. 2002;36(2):251-254.11847943
De Vry J, Maurel S, Schreiber R, de Beun R, Jentzsch KR. Comparison of *Hypericum* extracts with imipramine and fluoxetine in animal models of depression and alcoholism. *Eur Neuropsychopharmacol*. 1999;9(6):461-468.10625112
Dexedrine (dextroamphetamine) [prescribing information]. Winchester, KY: Catalent Pharma Solutions; February 2018.
Dexilant (dexlansoprazole) [prescribing information]. Deerfield IL, Takeda Pharmaceuticals America Inc; June 2018.
de Zwart L, Snoeys J, De Jong J, Sukbuntherng J, Mannaert E, Monshouwer M. Ibrutinib dosing strategies based on interaction potential of CYP3A4 perpetrators using physiologically based pharmacokinetic modeling. *Clin Pharmacol Ther*. 2016;100(5):548-557.27367453
D.H.E. 45 (dihydroergotamine mesylate) [prescribing information]. Aliso Viejo, CA: Valeant Pharmaceuticals North America; September 2009.
Dhanoa J, Natu M, Massey S. Worsening of steroid depending bronchial asthma following rifampicin administration. *J Assoc Physicians India*. 1998;46(2):242.11273129
Di YM, Li CG, Xue CC, Zhou SF. Clinical drugs that interact with St. John's wort and implication in drug development. *Curr Pharm Des*. 2008;14(17):1723-1742.18673195
Diamicron (gliclazide) [product monograph]. Laval, Quebec, Canada: Servier Canada Inc; July 2016.
Dilaudid (hydromorphone) [prescribing information]. Lake Zurich, IL: Fresenius-Kabi; February 2017.
Dilger K, Greiner B, Fromm MF, Hofmann U, Kroemer HK, Eichelbaum M. Consequences of rifampicin treatment on propafenone disposition in extensive and poor metabolizers of CYP2D6. *Pharmacogenetics*. 1999;9(5):551-559.10591535
Dilger K, Hofmann U, Klotz U. Enzyme induction in the elderly: effect of rifampin on the pharmacokinetics and pharmacodynamics of propafenone. *Clin Pharmacol Ther*. 2000;67(5):512-520.10824630
Dingemanse J, van Giersbergen PLM, Patat A, Nilsson PN. Mutual pharmacokinetic interactions between bosentan and lopinavir/ritonavir in healthy participants. *Antivir Ther*. 2010;15(2):157-163.20386070
Dirix L, Swaisland H, Verheul HM, et al. Effect of itraconazole and rifampin on the pharmacokinetics of olaparib in patients with advanced solid tumors: results of two phase I open-label studies. *Clin Ther*. 2016;38(10):2286-

2299.27745744
Dolophine (methadone) [prescribing information]. Eatontown, NJ: West-Ward Pharmaceuticals Corp.; September 2018.
Dooley KE, Luetkemeyer AF, Park JG, et al. Phase I safety, pharmacokinetics, and pharmacogenetics study of the antituberculosis drug PA-824 with concomitant lopinavir-ritonavir, efavirenz, or rifampin. *Antimicrob Agents Chemother*. 2014;58(9):5245-5252.24957823
Dooley KE, Park JG, Swindells S, et al; ACTG 5267 Study Team. Safety, tolerability, and pharmacokinetic interactions of the antituberculous agent TMC207 (bedaquiline) with efavirenz in healthy volunteers: AIDS Clinical Trials Group Study A5267. *J Acquir Immune Defic Syndr*. 2012;59(5):455-462.22126739
Dougherty JA, Young H, Shafi T. Serotonin syndrome induced by amitriptyline, meperidine, and venlafaxine. *Ann Pharmacother*. 2002;36(10):1647-1648.12243617
Dovato (dolutegravir and lamivudine) [product monograph]. Laval, Quebec, Canada: ViiV Healthcare ULC; August 2019.
Dresser GK, Schwarz UI, Wilkinson GR, Kim RB. Coordinate induction of both cytochrome P4503A and MDR1 by St John's wort in healthy subjects. *Clin Pharmacol Ther*. 2003;73(1):41-50.12545142
Drucker AM, Rosen CF. Drug-induced photosensitivity: culprit drugs, management and prevention. *Drug Saf*. 2011;34(10):821-837.21879777
Dugoua JJ, Mills E, Perri D, Koren G. Safety and efficacy of St. John's wort (*Hypericum*) during pregnancy and lactation. *Can J Clin Pharmacol*. 2006;13(3):e268-e276.17085775
Dunkley EJ, Isbister GK, Sibbritt D, Dawson AH, Whyte IM. The hunter serotonin toxicity criteria: simple and accurate diagnostic decision rules for serotonin toxicity. *QJM*. 2003;96(9):635-642.12925718
Duphaston (dydrogesterone) tablets [IL prescribing information]. Tel Aviv, Israel; Abbott Medical Laboratories Ltd; July 2018.
Duragesic (fentanyl) [prescribing information]. Titusville, NJ: Janssen Pharmaceuticals, Inc.; September 2018
Durr D, Stieger B, Kullak-Ublick GA, et al. St. John's wort induces intestinal P-glycoprotein/MDR1 and intestinal and hepatic CYP3A4. *Clin Pharmacol Ther*. 2000;68(6):598-604.11180019
Dutreix C, Munarini F, Lorenzo S, Roesel J, Wang Y. Investigation into CYP3A4-mediated drug-drug interactions on midostaurin in healthy volunteers. *Cancer Chemother Pharmacol*. 2013;72(6):1223-1234.24085261
Dy P, Arcega V, Ghali W, Wolfe W. Serotonin syndrome caused by drug to drug interaction between escitalopram and dextromethorphan. *BMJ Case Rep*. 2017; pii: bcr-2017-221486.28784915
Dymond AW, So K, Martin P, et al. Effects of cytochrome P450 (CYP3A4 and CYP2C19) inhibition and induction on the exposure of selumetinib, a MEK1/2 inhibitor, in healthy subjects: results from two clinical trials. *Eur J Clin Pharmacol*. 2017;73(2):175-184.27889832
Eap CB, Yasui N, Kaneko S, Baumann P, Powell K, Otani K. Effects of carbamazepine coadministration on plasma concentrations of the enantiomers of mianserin and of its metabolites. *Ther Drug Monit*. 1999;21(2):166-170.10217335
Eatemadnia A, Ansari S,Abedi P, Najar S. The effect of *Hypericum perforatum* on postmenopausal symptoms and depression: a randomized controlled trial. *Complement Ther Med*. 2019;45:109-113.31331546
Ebastel (ebastine) [Brazilian product monograph]. Barcelona, Spain: Almirall SA; April 2021.
Ebrahimie M, Bahmani M, Shirzad H, Rafieian-Kopaei M, Saki K. A review study on the effect of Iranian herbal medicines on opioid withdrawal syndrome. *J Evid Based Complementary Altern Med.* 2015;20(4):302-309.25818661
Edurant (rilpivirine) [prescribing information]. Titusville, NJ: Janssen Products LP; January 2021.
Egberts AC, ter Borgh J, Brodie-Meijer CC. Serotonin syndrome attributed to tramadol addition to paroxetine therapy. *Int Clin Psychopharmacol*. 1997;12(3):181-182.9248876
Eggertsen R, Andreasson A, Andren L. Effects of treatment with a commercially available St John's Wort product (Movina) on cholesterol levels in patients with hypercholesterolemia treated with simvastatin. *Scand J Prim Health Care*. 2007;25(3):154-159.17846933
Eich-Hochli D, Oppliger R, Golay KP, Baumann P, Eap CB. Methadone maintenance treatment and St. John's wort- a case report. *Pharmacopsychiatry*. 2003;36(1):35-37.12649774
Ekhart C, Rodenhuis S, Beijnen JH, and Huitema AD. Carbamazepine induces bioactivation of cyclophosphamide and thiotepa. *Cancer Chemother Pharmacol*. 2009;63(3):543-547.18437385

Eliquis (apixaban) [prescribing information]. New York, NY: Pfizer Inc; December 2012.
Eliquis (apixaban) [prescribing information]. Kirkland, QC: Pfizer Canada Inc., November 2012.
Ella (ulipristal acetate) [prescribing information]. Charleston, SC: Afaxys Pharma LLC; May 2018.
Ellison C, Lyndon S. Staying topical: an unusual case of serotonin syndrome. J Clin Psychopharmacol. 2017;37(5):633-635.28806389
Elmets CA, Korman NJ, Prater EF, et al. Joint AAD-NPF Guidelines of care for the management and treatment of psoriasis with topical therapy and alternative medicine modalities for psoriasis severity measures [published online ahead of print, 2020 Jul 30]. J Am Acad Dermatol. 2020;S0190-9622(20)32288-X. doi:10.1016/j.jaad.2020.07.08732738429
El-Okdi NS, Lumbrezer D, Karanovic D, Ghose A, Assaly R. Serotonin syndrome after the use of tramadol and ziprasidone in a patient with a deep brain stimulator for Parkinson disease. Am J Ther. 2014;21(4):e97-e99.24158007
Emend (aprepitant) [prescribing information]. Whitehouse Station, NJ: Merck & Co Inc; November 2019.
Emflaza (deflazacort) [prescribing information]. Northbrook, IL: Marathon Pharmaceuticals, LLC; February 2017.
Enjuvia (synthetic conjugated estrogens, B) [prescribing information]. North Wales, PA: Teva Pharmaceuticals USA Inc; March 2010.
Epclusa (sofosbuvir and velpatasvir) [prescribing information]. Foster City, CA: Gilead Sciences Inc; September 2019
Epidiolex (cannabidiol) oral solution [prescribing information]. Carlsbad, CA: Greenwich Biosciences Inc; October 2020.
Equetro (carbamazepine) extended-release capsules [prescribing information]. Parsippany, NJ: Validus Pharmaceuticals LLC; September 2016.
Erdelmeier CA. Hyperforin, possibly the major non-nitrogenous secondary metabolite of Hypericum perforatum L. Pharmacopsychiatry. 1998;31(suppl 1):2-6.9684941
Erleada (apalutamide) [prescribing information]. Horsham, PA: Janssen Products LP; September 2019.
Ernst E. Herbal medicinal products during pregnancy: are they safe? BJOG. 2002;109(3):227-235.11950176
Esteban J, de la Cruz Pellin M, Gimeno C, Barril J, Gemenez J, Mora E, Garcia-Perez AG. Increase of R-/S-methadone enantiomer concentration ratio in serum of patients treated with either nevirapine or efavirenz. Drug Metab Lett. 2008;2(4):269-279.19356104
Estorch M, Carrio I, Mena E, et al. Challenging the neuronal MIBG uptake by pharmacological intervention: effect of a single dose of oral amitriptyline on regional cardiac MIBG uptake. Eur J Nucl Med Mol Imaging. 2004;31(12):1575-1580.15221292
Estrace (estradiol) [prescribing information]. Princeton, NJ: Bristol-Myers Squibb Co.; March 2005.
Estragyn (estrone) vaginal cream [prescribing information]. Montreal, Quebec, Canada: Searchlight Pharma Inc; August 2016.
Etogo-Asse F, Boemer F, Sempoux C, Geubel A. Acute hepatitis with prolonged cholestasis and disappearance of interlobular bile ducts following tibolone and Hypericum perforatum (St. John's wort). Case of drug interaction? Acta Gastroenterol Belg. 2008;71(1):36-38.18396749
Eurartesim (piperaquine and artenimol) tablets [UK EMA summary of product characteristics]. Milan, Italy: Alfasigma S.p.A; March 2020.
Evans RW. Concomitant triptan and SSRI or SNRI use: what is the risk for serotonin syndrome? Headache. 2008;48(4):639-640.18377388
Evans RW. The FDA alert on serotonin syndrome with combined use of SSRIs or SNRIs and Triptans: an analysis of the 29 case reports. MedGenMed. 2007;9(3):48.18092054
Evans RW. Triptans and serotonin syndrome. Cephalalgia. 2008;28(5):573-574.18355351
Evans RW, Tepper SJ, Shapiro RE, Sun-Edelstein C, Tietjen GE. The FDA alert on serotonin syndrome with use of triptans combined with selective serotonin reuptake inhibitors or selective serotonin-norepinephrine reuptake inhibitors: American Headache Society position paper. Headache. 2010;50(6):1089-1099.20618823
Evastin (ebastine) [South Korean product monograph]. Boryeong Pharmaceutical Co., LTd.; April 2020.
Evotaz (atazanavir and cobicistat) [prescribing information]. Princeton, NJ: Bristol-Myers Squibb Company; July 2020.

Evstifeeva TA, Sibiriak SV. The immunotropic properties of biologically active products obtained from Klamath weed (Hypericum perforatum L.) [in Russian]. Eksp Klin Farmakol. 1996;59(1):51-54.8704635
Exkivity (mobocertinib) [prescribing information]. Lexington, MA: Takeda Pharmaceuticals Inc; September 2021.
Fabre C, Criddle J, Nolder D, Klein JL. Recrudescence of imported falciparum malaria after quinine therapy: potential drug interaction with phenytoin. Trans R Soc Trop Med Hyg. 2005;99(11):871-873. [PubMed 16099004]16099004
Falcao A, Vaz-da-Silva M, Gama H, Nunes T, Almeida L, Soares-da-Silva P. Effect of eslicarbazepine acetate on the pharmacokinetics of a combined ethinylestradiol/levonorgestrel oral contraceptive in healthy women. Epilepsy Res. 2013;105(3):368-376.23570863
Falk H. From the photosensitizer hypericin to the photoreceptor stentorin—the chemistry of phenanthroperylene quinones. Angew Chem Int Ed Engl. 1999;38(21):3116-3136.10556884
Falls BA, Gurrera RJ. Serotonin syndrome in a patient on tramadol, bupropion, trazodone, and oxycodone. Psychosomatics. 2014;55(3):305-309.24360532
Fan L, Zhou G, Guo D, et al. The pregnane X receptor agonist St John's Wort has no effects on the pharmacokinetics and pharmacodynamics of repaglinide. Clin Pharmacokinet. 2011;50(9):605-611.21827215
Fareston (toremifene) [prescribing information]. Bedminster, NJ: Kyowa Kirin Inc; May 2017.
Felodipine [prescribing information]. Carlsbad, CA: Carlsbad Technology Inc; December 2020.
Fexinidazole [prescribing information]. Bridgewater, NJ: Sanofi-Aventis US LLC; July 2021.
Fibristal (ulipristal acetate) [product monograph]. Mississauga, ON: Actavis Specialty Pharmaceuticals Co; June 2013.
Fidan I, Ozkan S, Gurbuz I, et al. The efficiency of Viscum album ssp. album and Hypericum perforatum on human immune cells in vitro. Immunopharmacol Immunotoxicol. 2008;30(3):519-528.18668395
Filter ER, Gorczynski L, Fernandes JR. Fatal intoxication with a selective serotonin reuptake inhibitor, lorazepam, and codeine. Am J Forensic Med Pathol. 2007;28(4):361-363.18043028
Fintepla (fenfluramine) [prescribing information]. Emeryville, CA: Zogenix, Inc.; June 2020.
Fisher AA, Davis MW. Serotonin syndrome caused by selective serotonin reuptake-inhibitors-metoclopramide interaction. Ann Pharmacother. 2002;36(1):67-71.11816261
Flexeril (cyclobenzaprine) [prescribing information]. Titusville, NJ: McNeil Pediatrics; April 2013.
Fluoxetine and hydromorphone: serotonin syndrome? Prescrire Int. 2004;13(70):57.15148975
Focalin XR (dexmethylphenidate) [prescribing information]. East Hanover, NJ: Novartis Pharmaceuticals Corporation; January 2019.
Fotivda (tivozanib) [prescribing information]. Boston, MA: AVEO Pharmaceuticals, Inc.; March 2021.
Fourneron JD, Herbette G, Caloprisco E. Pseudohypericin and hypericin in St. John's wort extracts. C R Acad Sci II. 1999;2:127-131.
Francis J, Barnes KI, Workman L, et al. An individual participant data population pharmacokinetic meta-analysis of drug-drug interactions between lumefantrine and commonly used antiretroviral treatment. Antimicrob Agents Chemother. 2020;64(5):e02394-19.32071050
Freeman MP. Complementary and alternative medicine for perinatal depression. J Affect Disord. 2009;112(1-3):1-10.18692251
Frey BM, Frey FJ. Phenytoin modulates the pharmacokinetics of prednisolone and the pharmacodynamics of prednisolone as assessed by the inhibition of the mixed lymphocyte reaction in humans. Eur J Clin Invest. 1984;14(1):1-6.6230241
Fridell JA, Jain AK, Patel K, et al. Phenytoin decreases the blood concentrations of sirolimus in a liver transplant recipient: a case report. Ther Drug Monit. 2003;25(1):117-119.12548156
Frison G, Favretto D, Zancanaro F, Fazzin G, Ferrara SD. A case of beta-carboline alkaloid intoxication following ingestion of Peganum harmala seed extract. Forensic Sci Int. 2008;179(2-3):e37-e43.18603389
Frova (frovatriptan) [prescribing information]. Malvern, PA: Endo Pharmaceuticals Inc; August 2018.
Frye RF, Fitzgerald SM, Lagattuta TF, Hruska MW, Egorin MJ. Effect of St John's wort on imatinib mesylate pharmacokinetics. Clin Pharmacol Ther. 2004;76(4):323-329.15470331

Fukuoka N, Tsukamoto T, Uno J, Kimura M, Morita S. Influence of coadministered antiepileptic drugs on serum zonisamide concentrations in epileptic patients: quantitative analysis based on suitable transforming factor. Biol Pharm Bull. 2003;26(12):1734-1738.14646181
Fukuda R. Factors affecting serum haloperidol level assessed by longitudinal therapeutic monitoring. Prog Neuropsychopharmacol Biol Psychiatry. 2000;24(8):1299-1318.11125855
Fukumura K, Kawaguchi N, Ishibashi T, Kubota R, Tada Y, Ogura E. Clinical drug-drug interaction studies to evaluate the effects of a P-glycoprotein inhibitor, CYP3A4 inhibitors, and a CYP3A4 inducer on the pharmacokinetics of naldemedine in healthy subjects. Clin Drug Investig. 2020;40(6):529-540.32323104
Furukori H, Otani K, Yasui N, et al. Effect of carbamazepine on the single oral dose pharmacokinetics of alprazolam. Neuropsychopharmacology. 1998;18(5):364-369.9536449
Fyarro (sirolimus) protein-bound [prescribing information]. Pacific Palisades, CA: Aadi Bioscience Inc; November 2021.
Fycompa (perampanel) [prescribing information]. Woodcliff Lake, NJ: Eisai Inc; May 2019.
Gabitril (tiagabine) [prescribing information]. North Wales, PA: Teva Pharmaceuticals USA Inc; August 2016.
Gagliardini R, Fabbiani M, Fortuna S, et al. Pharmacokinetics of etravirine in HIV-infected patients concomitantly treated with rifampin for tuberculosis. Infection. 2014;42(4):775-778.24531907
Gambertoglio JG, Holford NH, Kapusnik JE, et al. Disposition of total and unbound prednisolone in renal transplant patients receiving anticonvulsants. Kidney Int. 1984;25(1):119-123.6374250
Ganetsky M, Babu KM, Boyer EW. Serotonin syndrome in dextromethorphan ingestion responsive to propofol therapy. Pediatr Emerg Care. 2007;23(11):829-831.18007217
Garcia-Monco JC, Padierna A, Gomez Beldarrain M. Selegiline, fluoxetine, and depression in Parkinson's disease. Mov Disord. 1995;10(3):352.7651457
Gardin A, Gray C, Neelakantham S, et al. Siponimod pharmacokinetics, safety, and tolerability in combination with rifampin, a CYP2C9/3A4 inducer, in healthy subjects. Eur J Clin Pharmacol. 2018;74(12):1593-1604.30105453
Gardner DM, Lynd LD. Sumatriptan contraindications and the serotonin syndrome. Ann Pharmacother. 1998;32(1):33-38.9475817
Gashaw I, Kirchheiner J, Goldammer M, et al. Cytochrome P450 3A4 messenger ribonucleic acid induction by rifampin in human peripheral blood mononuclear cells: correlation with alprazolam pharmacokinetics. Clin Pharmacol Ther. 2003;74(5):448-457.14586385
Gavreto (pralsetinib) [prescribing information]. Cambridge, MA: Blueprint Medicines Corporation; September 2020.
Gehin M, Wierdak J, Sabattini G, Sidharta PN, Dingemanse J. Effect of gastric pH and of a moderate CYP3A4 inducer on the pharmacokinetics of daridorexant, a dual orexin receptor antagonist. Br J Clin Pharmacol. 2022;88(2):810-819. doi:10.1111/bcp.1502934371524
Gelenberg AJ, Freeman MP, Markowitz JC, et al. American Psychiatric Association. Practice guideline for the treatment of patients with major depressive disorder. 3rd Edition. https://psychiatryonline.org/pb/assets/raw/sitewide/practice_guidelines/guidelines/mdd.pdf. Published 2010. Accessed August 1, 2018.
Gener B, Burns JM, Griffin S, Boyer EW. Administration of ondansetron is associated with lethal outcome. Pediatrics. 2010;125(6):e1514-e1517.20439600
Genvoya (elvitegravir, cobicistat, emtricitabine, and tenofovir alafenamide) [prescribing information]. Foster City, CA: Gilead Sciences Inc; March 2021.
George M, Al-Duaij N, O'Donnell KA, Shannon MW. Obtundation and seizure following ondansetron overdose in an infant. Clin Toxicol (Phila). 2008;46(10):1064-1066.18803119
Gex-Fabry M, Balant-Gorgia AE, Balant LP. Therapeutic drug monitoring databases for postmarketing surveillance of drug-drug interactions: evaluation of a paired approach for psychotropic medication. Ther Drug Monit. 1997;19(1):1-10.9029739
Ghazanfarpour M, Kaviani M, Asadi N, et al. Hypericum perforatum for the treatment of premenstrual syndrome. Int J Gynaecol Obstet. 2011;113(1):84-85.21315349

Gillman PK. Possible serotonin syndrome with moclobemide and pethidine. Med J Aust. 1995;162(10):554.7776924
Gillman PK. Monoamine oxidase inhibitors, opioid analgesics and serotonin toxicity. Br J Anaesth. 2005;95(4):434-441.16051647
Giotrif (afatinib) [product monograph]. Ridgefield, CT: Boehringer Ingelheim Pharmaceuticals Inc; January 2018.
Gleevec (imatinib) [prescribing information]. East Hanover, NJ: Novartis Pharmaceuticals Corporation; August 2020.
Gleolan (aminolevulinic acid) for oral solution [prescribing information]. Lexington, KY: NX Development Corp.; February 2019.
Glyxambi (empagliflozin and linagliptin) [prescribing information]. Ridgefield, CT: Boehringer Ingelheim Pharmaceuticals Inc; January 2020.
Gnanadesigan N, Espinoza RT, Smith R, Israel M, Reuben DB. Interaction of serotonergic antidepressants and opioid analgesics: is serotonin syndrome going undetected? J Am Med Dir Assoc. 2005;6(4):265-269.16005413
Goey AK, Meijerman I, Rosing H, et al. The effect of St John's wort on the pharmacokinetics of docetaxel. Clin Pharmacokinet. 2014;53(1):103-110.24068654
Goldberg RJ, Huk M. Serotonin syndrome from trazodone and buspirone. Psychosomatics. 1992;33(2):235-236.1557493
Gollapudy S, Kumar V, Dhamee MS. A case of serotonin syndrome precipitated by fentanyl and ondansetron in a patient receiving paroxetine, duloxetine, and bupropion. J Clin Anesth. 2012;24(3):251-252.22537574
Gorski JC, Vannaprasaht S, Hamman MA, et al. The effect of age, sex, and rifampin administration on intestinal and hepatic cytochrome P450 3A activity. Clin Pharmacol Ther. 2003;74(3):275-287. [PubMed 12966371]12966371
Greene SA, Kwak C, Kamin M, et al. Effect of cenobamate on the single-dose pharmacokinetics of multiple cytochrome P450 probes using a cocktail approach in healthy subjects. Clin Transl Sci. 2022;15(4):899-911.34877801
Gregoretti B, Stebel M, Candussio L, Crivellato E, Bartoli F, Decorti G. Toxicity of Hypericum perforatum (St. John's wort) administered during pregnancy and lactation in rats. Toxicol Applied Pharmacol. 2004;200(3):201-205.15504456
Grimm SW, Richtand NM, Winter HR, Stams KR, Reele SB. Effects of cytochrome P450 3A modulators ketoconazole and carbamazepine on quetiapine pharmacokinetics. Br J Clin Pharmacol. 2006;61(1):58-69.16390352
Gronich N, Stein N, Muszkat M. Association between use of pharmacokinetic interacting drugs and effectiveness and safety of direct acting oral anticoagulants: nested case-control study. Clin Pharmacol Ther. 2021;110(6):1526-1536.34287842
Grunig E, Ohnesorge J, Benjamin N, et al. Plasma drug concentrations in patients with pulmonary arterial hypertension on combination therapy. Respiration. 2017;94(1):26-37.28494463
Gu H, Dutreix C, Rebello S, et al. Simultaneous physiologically based pharmacokinetic (PBPK) modeling of parent and active metabolites to investigate complex CYP3A4 drug-drug interaction potential: a case example of midostaurin. Drug Metab Dispos. 2019;46(2):109-121.29117990
Gulick RM, McAuliffe V, Holden-Wiltse J, et al. Phase I studies of hypericin, the active compound in St. John's wort, as an antiretroviral agent in HIV-infected adults. AIDS Clinical Trials Group Protocols 150 and 258. Ann Intern Med. 1999;130(6):510-514.10075619
Guo SL, Wu TJ, Liu CC, Ng CC, Chien CC, Sun HL. Meperidine-induced serotonin syndrome in a susceptible patient. Br J Anaesth. 2009;103(3):369-370.19556270
Gupta N, Hanley MJ, Venkatakrishnan K, et al. Effects of strong CYP3A inhibition and induction on the pharmacokinetics of ixazomib, an oral proteasome inhibitor: results of drug-drug interaction studies in patients with advanced solid tumors or lymphoma and a physiologically based pharmacokinetic analysis. J Clin Pharmacol. 2018;58(2):180-192.28800141
Hafner R, Bethel J, Power M, et al. Tolerance and pharmacokinetic interactions of rifabutin and clarithromycin in human immunodeficiency virus-infected volunteers. Antimicrob Agents Chemother. 1998;42(3):631-639.9517944
Hager N, Bolt J, Albers L, Wojcik W, Duffy P, Semchuck W. Development of left atrial thrombus after coadministration of dabigatran etexilate and phenytoin. Can J Cardiol. 2017;33(4):554.e13-554.e14.28063739
Hahn G. Hypericum perforatum (St. John's wort) — a medicinal herb used in antiquity and still of interest today. J Naturopathic Med. 1992;3(1):94-96.

Haldol (haloperidol) [prescribing information]. Titusville, NJ: Janssen Pharmaceuticals Inc; November 2020.
Hall SD, Wang Z, Huang SM, et al. The interaction between St John's wort and an oral contraceptive. Clin Pharmacol Ther. 2003;74(6):525-535.14663455
Hamilton M, Wolf JL, Drolet DW, et al. The effect of rifampicin, a prototypical CYP3A4 inducer, on erlotinib pharmacokinetics in healthy subjects. Cancer Chemother Pharmacol. 2014;73(3):613-621.24474302
Hamman MA, Bruce MA, Haehner-Daniels BD, Hall SD. The effect of rifampin administration on the disposition of fexofenadine. Clin Pharmacol Ther. 2001;69(3):114-1121.11240975
Hammer KD, Birt DF. Evidence for contributions of interactions of constituents to the anti-inflammatory activity of Hypericum perforatum. Crit Rev Food Sci Nutr. 2014;54(6):781-789.24345048
Han TH, Gopal AK, Ramchandren R, et al. CYP3A-mediated drug-drug interaction potential and excretion of brentuximab vedotin, an antibody-drug conjugate, in patients with CD30-positive hematologic malignancies. J Clin Pharmacol. 2013;53(8):866-877.23754575
Hanan NJ, Paul ME, Huo Y, et al. Sertraline pharmacokinetics in HIV-infected and uninfected children, adolescents, and young adults. Front Pediatr. 2019;7:16.30788337
Hansen TE, Dieter K, Keepers GA. Interaction of fluoxetine and pentazocine. Am J Psychiatry. 1990;147(7):949-950.2356884
Haque N, Thrasher K, Werk EE Jr, Knowles HC Jr, Sholiton LJ. Studies on dexamethasone metabolism in man: effect of diphenylhydantoin. J Clin Endocrinol Metab. 1972;34(1):44-50.5008232
Harada T, Hirosawa T, Morinaga K, Shimizu T. Metoclopramide-induced serotonin syndrome. Intern Med. 2017;56(6):737-739.28321081
Harding JJ, Kelley RK, Tan B, et al. Phase Ib study of enzalutamide with or without sorafenib in patients with advanced hepatocellular carcinoma. Oncologist. 2020;25(12):e1825-e1836.32548867
Harvoni (ledipasvir and sofosbuvir) [prescribing information]. Foster City, CA: Gilead Sciences Inc; March 2020.
Hasselstrøm J, Linnet K. Quetiapine serum concentrations in psychiatric patients: the influence of comedication. Ther Drug Monit. 2004;26(5):486-491.15385830
He YY, Chignell CF, Miller DS, Andley UP, Roberts JE. Phototoxicity in human lens epithelial cells promoted by St. John's Wort. Photochem Photobiol. 2004;80(3):583-586.15623347
Healan AM, Griffiss JM, Proskin HM, et al. Impact of rifabutin or rifampin on bedaquiline safety, tolerability, and pharmacokinetics assessed in a randomized clinical trial with healthy adult volunteers. Antimicrob Agents Chemother. 2017;62(1):pii:e00855-17.29061739
Hebant B, Guillaume M, Desbordes M, Gaillon G, Maltete D, Lefaucheur R. Combination of paroxetine and rasagiline induces serotonin syndrome in a parkinsonian patient. Rev Neurol (Paris). 2016;172(12):788-789.27838092
Helland A, Spigset O. Serum concentrations of paliperidone after administration of the long-acting injectable formulation. Ther Drug Monit. 2017;39(6):659-662.29040230
Hemady (dexamethasone) [prescribing information]. Or-Akiva, Israel: Dexcel Pharma Technologies Ltd; October 2019.
Hendrickse W, McKiernan J, Pickup M, Lowe J. Rifampicin-induced non-responsiveness to corticosteroid treatment in nephrotic syndrome. Br Med J. 1979;1(6159):306.421090
Herbert M, Park J, Chen YL, et al. Effects of St. John's Wort (Hypericum Perforatum) on tacrolimus pharmacokinetics in healthy volunteers. J Clin Pharmacol. 2004;44(1):89-94.14681346
Hetlioz (tasimelteon) [prescribing information]. Washington, DC: Vanda Pharmaceuticals Inc; December 2020.
Hicks SM, Walker AF, Gallagher J, Middleton RW, Wright J. The significance of "nonsignificance" in randomized controlled studies: a discussion inspired by a double-blinded study on St. John's wort (Hypericum perforatum L.) for premenstrual symptoms. J Altern Complement Med. 2004;10(6):925-932.15673985
Hillman AD, Witenko CJ, Sultan SM, Gala G. Serotonin syndrome caused by fentanyl and methadone in a burn injury. Pharmacotherapy. 2015;35(1):112-117.25615513
Hinds NP, Hillier CE, Wiles CM. Possible serotonin syndrome arising from an interaction between nortriptyline and selegiline in a lady with parkinsonism. J Neurol. 2000;247(10):811.11127542

Hirokane G, Someya T, Takahashi S, Morita S, Shimoda K. Interindividual variation of plasma haloperidol concentrations and the impact of concomitant medications: the analysis of therapeutic drug monitoring data. Ther Drug Monit. 1999;21(1):82-86.10051058
Hisham M, Sivakumar MN, Nandakumar V, Lakshmikanthcharan S. Linezolid and rasagiline - a culprit for serotonin syndrome. Indian J Pharmacol. 2016;48(1):91-92.26997732
Hodges CB, Maxwell H, Beattie TJ, Murphy AV, Jindal RM. Use of rapamycin in a transplant patient who developed cyclosporin neurotoxicity. Pediatr Nephrol. 2001;16(10):777-778.11605780
Hohmann MS, Cardoso RD, Fattori V, et al. Hypericum perforatum reduces paracetamol-induced hepatotoxicity and lethality in mice by modulating inflammation and oxidative stress. Phytother Res. 2015;29(7):1097-1101.25851311
Hohmann N, Maus A, Carls A, Haefeli WE, Mikus G. St. John's wort treatment in women bears risks beyond pharmacokinetic drug interactions. Arch Toxicol. 2016;90(4):1013-1015.25963330
Hojo Y, Echizenya M, Ohkubo T, Shimizu T. Drug interaction between St John's wort and zolpidem in healthy subjects. J Clin Pharm Ther. 2011;36(6):711-715.21058968
Honeybourne D, Longworth S, Shaffer J. Rifampicin causing an exacerbation of pemphigus. Br J Clin Pract. 1987;41(9):937-938.3451779
Hostanska K, Reichling J, Bommer S, Weber M, Saller R. Hyperforin a constituent of St. John's wort (Hypericum perforatum L.) extract induces apoptosis by triggering activation of caspases and with hypericin synergistically exerts cytotoxicity towards human malignant cell lines. Eur J Pharm Biopharm. 2003;56(1):121-132.12837490
Houlihan DJ. Serotonin syndrome resulting from coadministration of tramadol, venlafaxine, and mirtazapine. Ann Pharmacother. 2004;38(3):411-413.14970364
Hsu O, Hill CJ, Kim M, Tan B, O'Brien JG. Decreased plasma efavirenz concentrations in a patient receiving rifabutin. Am J Health Syst Pharm. 2010;67(19):1611-1614.20852162
Hsueh CH, Anderson K, Shen G, Yun C, Qin A, Othman AA. Evaluation of the potential drug interactions mediated through P-gp, OCT2, MATE1/2k with filgotinib in healthy subjects. Clin Transl Sci. 2022;15(2):361-370.34498807
Huet E, Hadji C, Hulin A, Botterel F, Bretagne S, Levy Y. Therapeutic monitoring is necessary for the association itraconazole and efavirenz in a patient with AIDS and disseminated histoplasmosis. AIDS. 2008;22(14):1885-1886.18753868
Hughes E, Imperial M, Wallender E, et al. Piperaquine exposure is altered by pregnancy, HIV, and nutritional status in Ugandan women. Antimicrob Agents Chemother. 2020;64(12):e01013-20.33020153
Hughes JR, Stead LF, Hartmann-Boyce J, Cahill K, Lancaster T. Antidepressants for smoking cessation. Cochrane Database Syst Rev. 2014:1:CD000031.24402784
Hunter B, Kleinert MM, Osatnik J, Soria E. Serotonergic syndrome and abnormal ocular movements: worsening of rigidity by remifentanil? Anesth Analg. 2006;102(5):1589.16632855
Huppertz A, Werntz L, Meid AD, et al. Rivaroxaban and macitentan can be coadministered without dose adjustment but the combination of rivaroxaban and St John's wort should be avoided. Br J Clin Pharmacol. 2018;84(12):2903-2913.30192025
Huth F, Gardin A, Umehara K, He H. Prediction of the impact of cytochrome P450 2C9 genotypes on the drug-drug interaction potential of siponimod with physiologically-based pharmacokinetic modeling: a comprehensive approach for drug label recommendations. Clin Pharmacol Ther. 2019;106(5):1113-1124.31199498
Ibrance (palbociclib) [prescribing information]. New York, NY: Pfizer Inc; February 2016.
Ibrance (palbociclib) capsule [prescribing information]. New York, NY: Pfizer Inc; September 2019.
Ibrance (palbociclib) tablet [prescribing information]. New York, NY: Pfizer Inc; November 2019.
Iclusig (ponatinib) [prescribing information]. Cambridge, MA: Millennium Pharmaceuticals; December 2020.
Ifex (ifosfamide) [prescribing information]. Deerfield, IL: Baxter Healthcare Corporation; March 2012.
Imai H, Kotegawa T, Tsutsumi K, et al. The recovery time-course of CYP3A after induction by St. John's wort administration. Br J Clin Pharmacol. 2008;65(5):701-707.18294328
Imbruvica (ibrutinib) [prescribing information]. Horsham, PA: Janssen Biotech Inc; August 2017.
Imitrex (sumatriptan) [prescribing information]. Research Triangle Park, NC: GlaxoSmithKline; July 2018.

Ingrezza (valbenazine) [prescribing information]. San Diego, CA: Neurocrine Biosciences Inc; April 2017.
Inlyta (axitinib) [prescribing information]. New York, NY: Pfizer Inc; January 2012.
Inrebic (fedratinib) [prescribing information]. Summit, NJ: Celgene Corporation; August 2019.
Insler SR, Kraenzler EJ, Licina MG, Savage RM, Starr NJ. Cardiac surgery in a patient taking monoamine oxidase inhibitors: an adverse fentanyl reaction. Anesth Analg. 1994;78(3):593-597.8109782
Inspra (eplerenone) [prescribing information]. New York, NY: Pfizer Inc; May 2018.
Intelence (etravirine) [prescribing information]. Titusville, NJ: Janssen Therapeutics; July 2019.
Intuniv (guanfacine) [prescribing information]. Wayne, PA: Shire US Inc; December 2019.
Invega (paliperidone) extended-release tablets [prescribing information]. Titusville, NJ: Janssen Pharmaceuticals Inc; January 2019.
Invega Sustenna (paliperidone) extended-release injectable suspension [prescribing information]. Titusville, NJ: Janssen Pharmaceuticals Inc; January 2019.
Invega Trinza (paliperidone) extended-release injectable suspension [prescribing information]. Titusville, NJ: Janssen Pharmaceuticals Inc; January 2019.
Invirase (saquinavir) [prescribing information]. South San Francisco, CA: Genentech, Inc.; September 2020.
Iressa (gefitinib) [prescribing information]. Wilmington, DE: AstraZeneca Pharmaceuticals LP; August 2018.
Isenberg D, Wong SC, Curtis JA. Serotonin syndrome triggered by a single dose of suboxone. Am J Emerg Med. 2008;26(7):840.e3-840.e5.18774063
Ishii M, Tatsuzawa Y, Yoshino A, Nomura S. Serotonin syndrome induced by augmentation of SSRI with methylphenidate. Psychiatry Clin Neurosci. 2008;62(2):246.18412855
Ishikawa N, Tateishi Y, Tani H, Kobayashi Y, Kobayashi M. Clinical profiles associated with serum perampanel concentrations in children with refractory epilepsy. Epilepsy Behav. 2019;94:82-86.30897534
Isradipine [prescribing information]. Mahwah, NJ: Glenmark Pharmaceuticals Inc USA; October 2018.
Ixempra [prescribing information]. Princeton, NJ: Bristol-Myers Squibb Company; May 2010.
Izzo AA, Ernst E. Interactions between herbal medicines and prescribed drugs: an updated systematic review. Drugs. 2009;69(13):1777-1798.19719333
Izzo AA, Hoon-Kim S, Radhakrishnan R, Williamson EM. A Critical approach to evaluating clinical efficacy, adverse events and drug interactions of herbal remedies. Phytother Res. 2016;30(5):691-700. doi:10.1002/ptr.5591.26887532
Jacobson JM, Feinman L, Liebes L, et al. Pharmacokinetics, safety, and antiviral effects of hypericin, a derivative of St. John's wort plant, in patients with chronic hepatitis C virus infection. Antimicrob Agents Chemother. 2001;45(2):517-524.11158749
Jakafi (ruxolitinib) [prescribing information]. Wilmington, DE: Incyte Corporation; January 2020.
Jain NK, Madan A, Jhamaria JP, Sharma TN, Mathur DK, Singh DP. Rifampicin induced non-responsiveness to steroids in bronchial asthma. Indian J Chest Dis Allied Sci. 1989;31(4):271-274.2638668
James AJ, Smith CC, Litzow M, et al. Pharmacokinetic profile of gilteritinib: a novel FLT-3 tyrosine kinase inhibitor. Clin Pharmacokinet. 2020;59(10):1273-1290.32304015
Jang SH, Nam JH, Lee J, Chang MC. Takotsubo cardiomyopathy associated with serotonin syndrome in a patient with stroke: A case report. Medicine (Baltimore). 2019;98(13):e15057.30921235
Javlor (vinflunine) [summary of product characteristics]. St Leonards, New South Wales, Australia: Pierre Fabre Australia Pty Limited; September 2014.
Jentadueto (linagliptin and metformin) [prescribing information]. Ridgefield, CT: Boehringer Ingelheim Pharmaceuticals Inc; July 2019.
Ji P, Damle B, Xie J, Unger SE, Grasela DM, Kaul S. Pharmacokinetic interaction between efavirenz and carbamazepine after multiple-dose administration in healthy subjects. J Clin Pharmacol. 2008;48(8):948-956.18519918
Ji T, Rockich K, Epstein N, et al. Evaluation of drug-drug interactions of pemigatinib in healthy participants [published online July 19, 2021]. Eur J Clin Pharmacol. Doi: 10.1007/s00228-021-03184-z34282472
Jiang X, Williams KM, Liauw WS, et al. Effect of St John's wort and ginseng on the pharmacokinetics and

pharmacodynamics of warfarin in healthy subjects. Br J Clin Pharmacol. 2004;57(5):592-599.15089812
Jiang R, Yamaori S, Takeda S, Yamamoto I, Watanabe K. Identification of cytochrome P450 enzymes responsible for metabolism of cannabidiol by human liver microsomes. Life Sci. 2011;89(5-6):165-170.21704641
Jin F, Robeson M, Zhou H, et al. Clinical drug interaction profile of idelalisib in healthy subjects. J Clin Pharmacol. 2015;55(8):909-919.25760671
John AP, Koloth R. Severe serotonin toxicity and manic switch induced by combined use of tramadol and paroxetine. Aust N Z J Psychiatry. 2007;41(2):192-193.17484083
Johne A, Brockmöller J, Bauer S, Maurer A, Langheinrich M, Roots I. Pharmacokinetic interaction of digoxin with an herbal extract from St John's wort (Hypericum perforatum). Clin Pharmacol Ther. 1999;66(4):338-345.10546917
Johne A, Schmider J, Brockmöller J, et al. Decreased plasma levels of amitriptyline and its metabolites on comedication with an extract from St. John's wort (Hypericum perforatum). J Clin Psychopharmacol. 2002;22(1):46-54.11799342
Johne A, Perloff ES, Bauer S, et al. Impact of cytochrome P-450 inhibition by cimetidine and induction by carbamazepine on the kinetics of hypericin and pseudohypericin in healthy volunteers. Eur J Clin Pharmacol. 2004;60(9):617-622.15372129
Join-Lambert O, Ribadeau-Dumas F, Jullien V, et al. Dramatic reduction of clindamycin plasma concentration in hidradenitis suppurativa patients treated with the rifampin-clindamycin combination. Eur J Dermatol. 2014;24(1):94-95.24445967
Jones D, Tourian L Jr, Margolese HC. Possible association of syndrome of inappropriate secretion of antidiuretic hormone with St John's wort use. J Clin Psychopharmacol. 2014;34(6):759-760.25203466
Jouinot A, Royer B, Chatelut E, et al. Pharmacokinetic interaction between mitotane and etoposide in adrenal carcinoma: a pilot study. Endocr Connect. 2018;7(12):1409-1414.30533000
Juluca (dolutegravir/rilpivirine) [prescribing information]. Research Triangle Park, NC: GlaxoSmithKline; July 2020.
Jynarque (tolvaptan) [prescribing information]. Rockville, MD: Otsuka America Pharmaceutical, Inc.; October 2020.
Jyseleca (filgotinib) [summary of product characteristics]. Mechelen, Belgium: Galapagos NV; January 2022.
Kaewpoowat Q, Chaiwarith R, Yasri S, et al. Drug-drug interaction between itraconazole capsule and efavirenz in adults with HIV for talaromycosis treatment. J Antimicrob Chemother. 2021;76(4):1041-1045.33349869
Kajubi R, Huang L, Jagannathan P, et al. Antiretroviral therapy with efavirenz accentuates pregnancy-associated reduction of dihydroartemisinin-piperaquine exposure during malaria chemoprevention. Clin Pharmacol Ther. 2017;102(3):520-528.28187497
Kakuda TN, Abel S, Davis J, et al. Pharmacokinetic interactions of maraviroc with darunavir-ritonavir, etravirine, and etravirine-darunavir-ritonavir in healthy volunteers: results of two drug interaction trials. Antimicrob Agents Chemother. 2011;55(5):2290-2296.21383098
Kakuda TN, Woodfall B, De Marez T, et al. Pharmacokinetic evaluation of the interaction between etravirine and rifabutin or clarithromycin in HIV-negative, healthy volunteers: results from two phase 1 studies. J Antimicrob Chemother. 2014;69(3):728-734.24155058
Kakuda TN, Van Solingen-Ristea RM, Onkelinx J, et al. The effect of single- and multiple-dose etravirine on a drug cocktail of representative cytochrome P450 probes and digoxin in healthy subjects. J Clin Pharmacol. 2014;54(4):422-431.24165884
Kaletra (lopinavir/ritonavir) [prescribing information]. North Chicago, IL: AbbVie Inc.; October 2020.
Kalra S, Born L, Sarkar M, Einarson A. The safety of antidepressant use in pregnancy. Expert Opin Drug Saf. 2005;4(2):273-284.15794719
Kalydeco [prescribing information]. Cambridge, MA: Vertex Pharmaceuticals Incorporated; July 2017.
Kapil RP, Axelson JE, Mansfield IL, et al. Disopyramide pharmacokinetics and metabolism: effect of inducers. Br J Clin Pharmacol. 1987;24(6):781-791.3440098
Karliova M, Treichel U, Malago M, et al. Interaction of Hypericum perforatum (St. John's wort) with cyclosporin A metabolism in a patient after liver transplantation. J Hepatol. 2000;33(5):853-855.11097498
Karunatilake H, Buckley NA. Serotonin syndrome induced by fluvoxamine and oxycodone. Ann Pharmacother.

2006;40(1):155-157.16368927
Kasper S, Gastpar M, Müller WE, et al. Efficacy of St. John's wort extract WS 5570 in acute treatment of mild depression: a reanalysis of data from controlled clinical trials. Eur Arch Psychiatry Clin Neurosci. 2008;258(1):59-63.18084790
Kasper S, Volz HP, Möller HJ, Dienel A, Kieser M. Continuation and long-term maintenance treatment with Hypericum extract WS 5570 after recovery from an acute episode of moderate depression--a double-blind, randomized, placebo controlled long-term trial. Eur Neuropsychopharmacol. 2008;18(11):803-813.18694635
Kasper S. Phytopharmaceutical treatment of anxiety, depression, and dementia in the elderly: evidence from randomized, controlled clinical trials. Wien Med Wochenschr. 2015;165(11-12):217-228.26092515
Karliova M, Treichel U, Malagò M, Frilling A, Gerken G, Broelsch CE. Interaction of Hypericum perforatum (St. John's wort) with cyclosporin A metabolism in a patient after liver transplantation. J Hepatol. 2000;33(5):853-855.11097498
Keegan MT, Brown DR, Rabinstein AA. Serotonin syndrome from the interaction of cyclobenzaprine with other serotoninergic drugs. Anesth Analg. 2006;103(6):1466-1468.17122225
Kerbusch T, Jansen RL, Mathot RA, et al. Modulation of the cytochrome P450-mediated metabolism of ifosfamide by ketoconazole and rifampin. Clin Pharmacol Ther. 2001;70(2):132-141.11503007
Kerbusch-Herben V, Cleton A, Berwaerts J, Vandebosch A, Remmerie B. Effect of carbamazepine on the pharmacokinetics of paliperidone extended-release tablets at steady-state. Clin Pharmacol Drug Dev. 2014;3(5):371-377.27129010
Kerendia (finerenone) [prescribing information]. Whippany, NJ: Bayer HealthCare Pharmaceuticals Inc.; July 2021.
Kesavan S, Sobala GM. Serotonin syndrome with fluoxetine plus tramadol. J R Soc Med. 1999;92(9):474-475.10645303
Kessler JM, Keys PW, Stafford RW. Disopyramide and phenytoin interaction. Clin Pharm. 1982;1(3):263-264.7185523
Ketek (telithromycin) [prescribing information]. Bridgewater, NJ: Sanofi-Aventis US LLC; October 2015.
Ketoconazole [prescribing information]. Morgantown WV: Mylan Pharmaceuticals Inc; March 2018.
Khalili H, Dashti-Khavidaki S, Amini S, Mousavi M. Recurrence of panic attacks after brucellosis treatment--highly probable citalopram and rifampin drug interaction. J Clin Psychopharmacol. 2012;32(6):842-844.23131874
Khan A, Shad MU, Preskorn SH. Lack of sertraline efficacy probably due to an interaction with carbamazepine. J Clin Psychiatry. 2000:61(7):526-527.10937612
Kharasch ED, Whittington D, Ensign D, et al. Mechanism of efavirenz influence on methadone pharmacokinetics and pharmacodynamics. Clin Pharmacol Ther. 2012;91(4):673-684.22396970
Kharasch ED, Whittington D, Hoffer C. Influence of hepatic and intestinal cytochrome P4503A activity on the acute disposition and effects of oral transmucosal fentanyl citrate. Anesthesiology. 2004;101(3):729-737.15329598
Khoo KC, Mendels J, Rothbart M, et al. Influence of phenytoin and phenobarbital on the disposition of a single oral dose of clonazepam. Clin Pharmacol Ther. 1980;28(3):368-375.7408397
Khwaja T, Friedman EP. Pharmaceutical grade St. John's wort. PCT Int Appl. 1999:104.
Kim YH, Cha IJ, Shim JC, et al. Effect of rifampin on the plasma concentration and the clinical effect of haloperidol concomitantly administered to schizophrenic patients. J Clin Psychopharmacol. 1996;16(3):247-252.8784658
Kim KA, Park PW, Liu KH, et al. Effect of rifampin, an inducer of CYP3A and P-glycoprotein, on the pharmacokinetics of risperidone. J Clin Pharmacol. 2008;48(1):66-72.18094221
Kinoshita H, Ohkubo T, Yasuda M, Yakushiji F. Serotonin syndrome induced by dextromethorphan (Medicon) administrated at the conventional dose. Geriatr Gerontol Int. 2011;11(1):121-122.21166968
Kirschner R, Donovan JW. Serotonin syndrome precipitated by fentanyl during procedural sedation. J Emerg Med. 2010;38(4):477-480.18757161
Kisqali (ribociclib) [prescribing information]. East Hanover, NJ: Novartis Pharmaceuticals Corporation; July 2020.
Kitson R, Carr B. Tramadol and severe serotonin syndrome. Anaesthesia. 2005;60(9):934-935.16115263
Kivisto KT, Lamberg TS, Neuvonen PJ. Interactions of buspirone with itraconazole and rifampicin: effects on the pharmacokinetics of the active 1-(2-pyrimidinyl)-piperazine metabolite of buspirone. Pharmacol Toxicol. 1999;84(2):94-97.10068153

Kivistö KT, Niemi M, Fromm MF. Functional interaction of intestinal CYP3A4 and P-glycoprotein. Fundam Clin Pharmacol. 2004;18(6):621-626.15548232
Kivisto KT, Villikka K, Nyman L, Anttila M, Neuvonen PJ. Tamoxifen and toremifene concentrations in plasma are greatly decreased by rifampin. Clin Pharmacol Ther. 1998;64(6):648-654.9871429
Klier CM, Schmid-Siegel B, Schäfer MR, et al. St. John's wort (Hypericum perforatum) and breastfeeding: plasma and breast milk concentrations of hyperforin for 5 mothers and 2 infants. J Clin Psychiatry. 2006;67(2):305-309.16566628
Knoop H, Knoop U, Behr J, et al. Syndrome of inadequate antidiuretic hormone secretion in pulmonary tuberculosis-a therapeutic challenge. Pneumologie. 2013;67(4):219-222.23420227
Knüppel L, Linde K. Adverse effects of St. John's wort: a systematic review. J Clin Psychiatry. 2004;65(11):1470-1479.15554758
Kobak(a) KA, Taylor LV, Bystritsky A, et al. St John's wort versus placebo in obsessive-compulsive disorder: results from a double-blind study. Int Clin Psychopharmacol. 2005;20(6):299-304. doi:10.1097/00004850-200511000-0000316192837
Kobak(b) KA, Taylor LV, Warner G, Futterer R. St. John's wort versus placebo in social phobia: results from a placebo-controlled pilot study. J Clin Psychopharmacol. 2005;25(1):51-58. doi:10.1097/01.jcp.0000150227.61501.0015643100
Kohno H, Ichida F, Hirono K, et al. Plasma concentrations of tadalafil in children with pulmonary arterial hypertension. Ther Drug Monit. 2014;36(5):576-583.24872209
Kolding L, Pedersen LH, Henriksen TB, Olsen J, Grzeskowiak LE. Hypericum perforatum use during pregnancy and pregnancy outcome. Reprod Toxicol. 2015;58:234-237.26536653
Kondo S, Fukasawa T, Yasui-Furukori N, et al. Induction of the metabolism of etizolam by carbamazepine in humans. Eur J Clin Pharmacol. 2005;61(3):185-188.15776275
Koo HL, Hamill RJ, Andrade RA. Drug-drug interaction between itraconazole and efavirenz in a patient with AIDS and disseminated histoplasmosis. Clin Infect Dis. 2007;45(6):e77-e79.17712747
Korlym (mifepristone) [prescribing information]. Menlo Park, CA: Corcept Therapeutics Incorporated; November 2019.
Koselugo (selumetinib) [prescribing information]. Wilmington, DE: AstraZeneca Pharmaceuticals LP; April 2020.
Kosoglou T, Statkevich P, Kumar B, et al. The effect of multiple doses of ketoconazole or rifampin on the single- and multiple-dose pharmacokinetics of vorapaxar. J Clin Pharmacol. 2013;53(5):540-549.23426761
Kroboth FJ, Kroboth PD, Logan T. Phenytoin-theophylline-quinidine interactions. N Engl J Med. 1983;308(12):724-725.6828116
Kukoyi O, Argo TR, Carnahan RM. Exacerbation of panic disorder with rifampin therapy in a patient receiving citalopram. Pharmacotherapy. 2005;25(3):435-437.15843291
Kummer O, Hammann F, Haschke M, Krähenbühl S. Reduction of hyperbilirubinemia with hypericum extract (St. John's Wort) in a patient with Crigler-Najjar syndrome type II. Br J Clin Pharmacol. 2016;81(5):1002-1004.26692114
Kümper H. Hypericum poisoning in sheep [in German]. Tierarztl Prax. 1989;17(3):257-261.2815063
Kurth H, Spreeman R. Phytochemical characterization of various St. John's wort extracts. Adv Ther. 1998;15(2):117-128.10180998
Kyriazopoulou V, Parparousi O, Vagenakis AG. Rifampicin-induced adrenal crisis in addisonian patients receiving corticosteroid replacement therapy. J Clin Endocrinol Metab. 1984;59(6):1204-1206.6490796
Ladner DP, Klein SD, Steiner RA, Walt H. Synergistic toxicity of delta-aminolaevulinic acid-induced protoporphyrin IX used for photodiagnosis and hypericum extract, a herbal antidepressant. Br J Dermatol. 2001;144(4):916-918.11298571
Lamberg JJ, Gordin VN. Serotonin syndrome in a patient with chronic pain polypharmacy. Pain Med. 2014;15(8):1429-1431.22925399
Lamberg TS, Kivisto KT, Neuvonen PJ. Concentrations and effects of buspirone are considerably reduced by rifampin. Br J Clin Pharmacol. 1998;45(4):381-385.9578186
Lampri ES, Ioachim E, Harissis H, Balasi E, Mitselou A, Malamou-Mitsi V. Pleomorphic hepatocellular carcinoma following consumption of hypericum perforatum in alcoholic cirrhosis. World J Gastroenterol. 2014;20(8):2113-

2116.24587684
Lamorde M, Byakika-Kibwika P, Mayito J, et al. Lower artemether, dihydroartemisinin and lumefantrine concentrations during rifampicin-based tuberculosis treatment. AIDS. 2013;27(6):961-965.23698061
Landry I, Aluri J, Nakai K, et al. Evaluation of the CYP3A and CYP2B6 drug-drug interaction potential of lemborexant. Clin Pharmcol Drug Dev. 2021;10(6):681-690.33455055
Lang CC, Jamal SK, Mohamed Z, Mustafa MR, Mustafa AM, Lee TC. Evidence of an interaction between nifedipine and nafcillin in humans. Br J Clin Pharmacol. 2003;55(6):588-590.12814453
Lange-Asschenfeldt C, Weigmann H, Hiemke C, Mann K. Serotonin syndrome as a result of fluoxetine in a patient with tramadol abuse: plasma level-correlated symptomatology. J Clin Psychopharmacol. 2002;22(4):440-441.12172351
Lankerani L, Baron ED. Photosensitivity to exogenous agents. J Cutan Med Surg. 2004;8(6):424-431.15988550
Lantz MS, Buchalter EN, Giambanco V. Serotonin syndrome following the administration of tramadol with paroxetine. Int J Geriatr Psychiatry. 1998;13(5):343-345.9658268
Lantz MS, Buchalter E, Giambanco V. St. John's wort and antidepressant drug interactions in the elderly. J Geriatr Psychiatry Neurol. 1999;12(1):7-10.10447148
Larson KJ, Wittwer ED, Nicholson WT, Weingarten TN, Price DL, Sprung J. Myoclonus in patient on fluoxetine after receiving fentanyl and low-dose methylene blue during sentinel lymph node biopsy. J Clin Anesth. 2015;27(3):247-251.25499271
Latuda (lurasidone) [prescribing information]. Marlborough, MA: Sunovion Pharmaceuticals Inc; January 2017.
Laureano M, Crowther M, Eikelboom J, Boonyawat K. Measurement of dabigatran drug levels to manage patients taking interacting drugs: a case report. Am J Med. 2016;129(10):e247-e248.27401948
Lawvere S, Mahoney MC, Cummings KM, et al. A phase II study of St. John's Wort for smoking cessation. Complement Ther Med. 2006;14(3):175-184.16911897
LeBel M, Masson E, Guilbert E, et al. Effects of rifabutin and rifampicin on the pharmacokinetics of ethinylestradiol and norethindrone. J Clin Pharmacol. 1998;38(11):1042-1050.9824786
Lee A, Minhas R, Matsuda N, Lam M, Ito S. The safety of St. John's wort (Hypericum perforatum) during breastfeeding. J Clin Psychiatry 2003;64(8):966-968.12927015
Lee J, Franz L, Goforth HW. Serotonin syndrome in a chronic-pain patient receiving concurrent methadone, ciprofloxacin, and venlafaxine. Psychosomatics. 2009;50(6):638-639.19996237
Lee KH, Shin JG, Chong WS, et al. Time course of the changes in prednisolone pharmacokinetics after co-administration or discontinuation of rifampin. Eur J Clin Pharmacol. 1993;45(3):287-289.8276057
Lei HP, Yu XY, Xie HT, et al. Effect of St. John's wort supplementation on the pharmacokinetics of bupropion in healthy male Chinese volunteers. Xenobiotica. 2010;40(4):275-281.20102294
Leinonen E, Lepola U, Koponen H. Substituting carbamazepine with oxcarbazepine increases citalopram levels. A report on two cases. Pharmacopscyhiatry. 1996:29(4):156-158.8858715
Leinonen E, Lillsunde P, Laukkanen V, Ylitalo P. Effects of carbamazepine on serum antidepressant concentrations in psychiatric patients. J Clin Psychopharmacol. 1991;11(5):313-318.1765574
Lendormin (brotizolam) [summary of product characteristics]. Brussels, Belgium: SCS Boehringer Ingelheim Comm. V.; January 2021.
Lendormin (brotizolam) [summary of product characteristics]. Ingelheim am Rhein, Germany: Boehringer Ingelheim International GmbH; September 2021.
L'Espérance S, Frenette S, Dionne A, Dionne JY, Comité de l'évolution des pratiques en oncologie (CEPO). Pharmacological and non-hormonal treatment of hot flashes in breast cancer survivors: CEPO review and recommendations. Support Care Cancer. 2013;21(5):1461-1474.23435567
Levulan (aminolevulinic acid) topical solution [prescribing information]. Wilmington, MA: DUSA Pharmaceuticals Inc; March 2010.
Levy RH, Ragueneau-Majlessi I, Garnett WR, et al. Lack of a clinically significant effect of zonisamide on phenytoin steady-state pharmacokinetics in patients with epilepsy. J Clin Pharmacol. 2004;44(11):1230-1234.15496640

Lexiva [prescribing information]. Research Triangle Park, NC: GlaxoSmithKline; March 2019.
Li A, Yeo K, Welty D, Rong H. Development of guanfacine extended-release dosing strategies in children and adolescents with ADHD using a physiologically based pharmacokinetic model to predict drug-drug interactions with moderate CYP3A4 inhibitors or inducers. Paediatr Drugs. 2018;20(2):181-194.29098603
Li TY, Liu W, Chen K, Liang SY, Liu F. The influence of combination use of CYP450 inducers on the pharmacokinetics of voriconazole: a systematic review. J Clin Pharm Ther. 2017;42(2):135-146.28177134
Lilja JJ, Niemi M, Neuvonen PJ. Rifampicin reduces plasma concentrations of celiprolol. Eur J Clin Pharmacol. 2004;59(11):819-824.14614579
Linde K, Mulrow CD. St. John's wort for depression. Cochrane Database Syst Rev. 2000(2):CD000448.10796719
Linde K, Berner M, Egger M, Mulrow C. St. John's wort for depression: meta-analysis of randomised controlled trials. Br J Psychiatry. 2005;186:99-107.15684231
Linde K, Kriston L, Rücker G, et al. Efficacy and acceptability of pharmacological treatments for depressive disorders in primary care: systematic review and network meta-analysis. Ann Fam Med. 2015;13(1):69-79.25583895
Ling SY, Huizinga RB, Mayo PR, et al. Cytochrome P450 3A and P-glycoprotein drug-drug interactions with voclosporin. Br J Clin Pharmacol. 2014;77(6):1039-1050.24330024
Linnoila M, Viukari M, Vaisanen K, Auvinen J. Effect of anticonvulsants on plasma haloperidol and thioridazine levels. Am J Psychiatry. 1980;137(7):819-821.6770696
Liu F, Ang CY; Springer D. High-performance liquid chromatography determination of biologically active components in extracts of St. John's wort leaves and dietary supplements. In: Proceedings from the 217th ACS National Meeting; March 21-25, 1999; Anaheim, CA: AGFD-102.
Liu WZ, Hu ZH. The secretory structure of Hypericum perforatum and its relation to hypericin accumulation. Zhi Wu Fen Lei Xue Bao. 1999;41(4):369-372.
Liu YR, Jiang YL, Huang RQ, et al. Hypericum perforatum L. preparations for menopause: a meta-analysis of efficacy and safety. Climacteric. 2014;17(4):325-335.16875586
Liu Y, Zhou S, Wan Y, Wu A, Palmisano M. The impact of co-administration of ketoconazole and rifampin on the pharmacokinetics of apremilast in healthy volunteers. Br J Clin Pharmacol. 2014;78(5):1050-1057.24962564
Livtencity (maribavir) [prescribing information]. Lexington, MA: Takeda Pharmaceuticals America Inc; November 2021.
Lorbrena (lorlatinib) [prescribing information]. New York, NY: Pfizer Inc; February 2021.
Lorusso G, Vannini N, Sogno I, et al. Mechanisms of Hyperforin as an anti-angiogenic angioprevention agent. Eur J Cancer. 2009;45(8):1474-1484.19223175
Lumakras (sotorasib) [prescribing information]. Thousand Oaks, CA: Amgen Inc; May 2021.
Lumin (mianserin) [Australian product information]. Millers Point, Australia: Mylan; December 2019.
Lupaneta Pak (leuprolide and norethindrone) [prescribing information]. North Chicago, IL: AbbVie Inc; October 2013.
Lupkynis (voclosporin) [prescribing information]. Rockville, MD: Aurinia Pharma US Inc; January 2021.
Lutz JD, Kirby BJ, Wang L, et al. Cytochrome P450 3A induction predicts P-glycoprotein induction; part 2: prediction of decreased substrate exposure after rifabutin or carbamazepine. Clin Pharmacol Ther. 2018;104(6):1191-1198.29569712
Luurila H, Olkkola KT, Neuvonen PJ. Interaction between erythromycin and nitrazepam in healthy volunteers. Pharmacol Toxicol. 1995;76(4):255-258. [PubMed]7617555
Lybalvi (olanzapine and samidorphan) [prescribing information]. Waltham, MA: Alkermes, Inc; May 2021.
Lynparza (olaparib) [prescribing information]. Wilmington, DE: AstraZeneca Pharmaceuticals LP; January 2018.
Lytgobi (futibatinib) [prescribing information]. Princeton, NJ: Taiho Oncology Inc; September 2022.
Machiels JP, Staddon A, Herremans C, et al. Impact of cytochrome P450 3A4 inducer and inhibitor on the pharmacokinetics of trabectedin in patients with advanced malignancies: open-label, multicenter studies. Cancer Chemother Pharmacol. 2014;74(4):729-737.25100135
Macrelin (macimorelin) [prescribing information]. Frankfurt am Main, Germany; Aeterna Zentaris GmbH: December 2017.
Mahlberg R, Kunz D, Sasse J, Kirchheiner J. Serotonin syndrome with tramadol and citalopram. Am J Psychiatry.

2004;161(6):1129.15169709
Magni LR, Purgato M, Gastaldon C, et al. Fluoxetine versus other types of pharmacotherapy for depression. Cochrane Database Syst Rev. 2013;(7):CD004185.24353997
Mahatthanatrakul W, Nontaput T, Ridtitid W, Wongnawa M, Sunbhanich M. Rifampin, a cytochrome P450 3A inducer, decreases plasma concentrations of antipsychotic risperidone in healthy volunteers. J Clin Pharm Ther. 2007;32(2):161-167.17381666
Mai I, Bauer S, Perloff ES, et al. Hyperforin content determines the magnitude of the St John's wort-cyclosporine drug interaction. Clin Pharmacol Ther. 2004;76(4):330-340.15470332
Mai I, Krüger H, Budde K, et al. Hazardous pharmacokinetic interaction of Saint John's wort (Hypericum perforatum) with the immunosuppressant cyclosporine. Int J Clin Pharmacol Ther. 2000;38(10):500-502.11073292
Mai I, Störmer E, Bauer S, Krüger H, Budde K, Roots I. Impact of St John's wort treatment on the pharmacokinetics of tacrolimus and mycophenolic acid in renal transplant patients. Nephrol Dial Transplant. 2003;18(4):819-822.12637655
Mallikaarjun S, Wells C, Petersen C, et al. Delamanid coadministration with antiretroviral drugs or antituberculosis drugs shows no clinically relevant drug-drug interactions in healthy subjects. Antimicrob Agents Chemother. 2016;60(10):5976-5985.27458223
Manaboriboon B, Chomchai C. Dextromethorphan abuse in Thai adolescents: a report of two cases and review of literature. J Med Assoc Thai. 2005;88(Suppl 8):S242-S245.16856446
Mandelbaum A, Pertzborn F, Martin-Facklam M, Wiesel M. Unexplained decrease of cyclosporin trough levels in a compliant renal transplant patient. Nephrol Dial Transplant. 2000;15(9):1473-1474.10978415
Mannel M. Drug interactions with St. John's wort: mechanisms and clinical implications. Drug Saf. 2004;27(11):773-797.15350151
Mannel M, Kuhn U, Schmidt U, Ploch M, Murck H. St. John's wort extract LI160 for the treatment of depression with atypical features - a double-blind, randomized, and placebo-controlled trial. J Psychiatr Res. 2010;44(12):760-767. doi:10.1016/j.jpsychires.2010.01.01020181361
Manos GH. Possible serotonin syndrome associated with buspirone added to fluoxetine. Ann Pharmacother. 2000;34(7):871-874.10928399
Marcos-Fosch C, Cabezas J, Crespo J, Buti M. Anti-epileptic drugs and hepatitis C therapy: real-world experience. J Hepatol. 2021;75(4):984-985.34126106
Marechal C, Honorat R, Claudet I. Serotonin syndrome induced by tramadol intoxication in an 8-month-old infant. Pediatr Neurol. 2011;44(1):72-74.21147393
Marinol (dronabinol) [prescribing information]. North Chicago, IL: AbbVie Inc; August 2017.
Markert C, Kastner IM, Hellwig R, et al. The effect of induction of CYP3A4 by St John's wort on ambrisentan plasma pharmacokinetics in volunteers of known CYP2C19 genotype. Basic Clin Pharmacol Toxicol. 2015;116(5):423-428.25286744
Markert C, Ngui P, Hellwig R, et al. Influence of St. John's wort on the steady-state pharmacokinetics and metabolism of bosentan. Int J Clin Pharmacol Ther. 2014;52(4):328-336.24472406
Markowitz JS, DeVane CL, Boulton DW, Carson SW, Nahas Z, Risch SC. Effect of St. John's wort (Hypericum perforatum) on cytochrome P-450 2D6 and 3A4 activity in healthy volunteers. Life Sci. 2000;66(9):PL133-PL139.10698361
Markowitz JS, DeVane CL. Rifampin-induced selective serotonin reuptake inhibitor withdrawal syndrome in a patient treated with sertraline. J Clin Psychopharmacol. 2000;20(1):109-110.10653222
Markowitz JS, Donovan JL, DeVane CL, et al. Effect of St. John's wort on drug metabolism by induction of cytochrome P450 3A4 enzyme. JAMA. 2003;290(11):1500-1504.13129991
Marqibo (vincristine liposomal) [prescribing information]. East Windsor, NJ: Acrotech Biopharma LLC; June 2020.
Martin P, Gillen M, Millson D, et al. Effects of CYP3A4 inhibitors ketoconazole and verapamil and the CYP3A4 inducer rifampicin on the pharmacokinetic parameters of fostamatinib: results from in vitro and phase I clinical studies. Drugs R D. 2016;16(1):81-92.26739683
Martin P, Oliver S, Robertson J, Kennedy SJ, Read J, Duvauchelle T. Pharmacokinetic drug interactions with

vandetanib during coadministration with rifampicin or itraconazole. Drugs R D. 2011;11(1):37-51.21410294
Martinez B, Kasper S, Ruhrmann S, Möller HJ. Hypericum in the treatment of seasonal affective disorders. J Geriatr Psychiatry Neurol. 1994;7(suppl 1):S29-S33.7857504
Martinez TT, Martinez DN. A case of serotonin syndrome associated with methadone overdose. Proc West Pharmacol Soc. 2008;51:42-44.19544673
Martini DI, Nacca N, Haswell D, Cobb T, Hodgman M. Serotonin syndrome following metaxalone overdose and therapeutic use of a selective serotonin reuptake inhibitor. Clin Toxicol (Phila). 2015;53(3):185-187.25671244
Marzolini C, Rajoli R, Battegay M, Elzi L, Back D, Siccardi M. Physiologically based pharmacokinetic modeling to predict drug-drug interactions with efavirenz involving simultaneous inducing and inhibitory effects on cytochromes. Clin Pharmacokinet. 2017;56(4):409-420.27599706
Marzolini C, Troillet N, Telenti A, Baumann P, Decosterd LA, Eap CB. Efavirenz decreases methadone blood concentrations. AIDS. 2000;14(9):1291-1292.10894303
Mason BJ, Blackburn KH. Possible serotonin syndrome associated with tramadol and sertraline coadministration. Ann Pharmacother. 1997;31(2):175-177.9034418
Mason D, Kelley RB. The quantity and isolation of hypericin and pseudohypericin from over-the-counter preparations. In: Proceedings from the 217th ACS National Meeting; March 21-25, 1999; Anaheim, CA: CHED-454.
Mateo-Carrasco H, Munoz-Aguilera EM, Garcia-Torrecillas JM, Abu Al-Robb H. Serotonin syndrome probably triggered by a morphine-phenelzine interaction. Pharmacotherapy. 2015;35(6):e102-e105.25903219
Mathew NT, Tietjen GE, Lucker C. Serotonin syndrome complicating migraine pharmacotherapy. Cephalalgia. 1996;16(5):323-327.8869767
Mathijssen RH, Verweij J, de Bruijn P, Loos WJ, Sparreboom A.. Effects of St. John's wort on irinotecan metabolism. J Natl Cancer Inst. 2002;94(16):1247-1249.12189228
Mauri P, Pietta P. High performance liquid chromatography/electrospray mass spectometry of Hypericum perforatum extracts. Rapid Commun Mass Spectrom. 2000;14(2):95-99.10623936
Maury W, Price JP, Brindley MA, et al. Identification of light-independent inhibition of human immunodeficiency virus-1 infection through bioguided fractionation of Hypericum perforatum. Virol J. 2009;6:101.19594941
Mavenclad (cladribine) [prescribing information]. Rockland, MA: EMD Serono Inc; March 2019.
Mavyret (glecaprevir and pibrentasvir) [prescribing information]. North Chicago, IL: AbbVie Inc; August 2017.
Maxalt (rizatriptan) [prescribing information]. Whitehouse Station, NJ: Merck & Co Inc; December 2011.
Mayzent (siponimod) [prescribing information]. East Hanover, NJ: Novartis Pharmaceuticals Corporation; January 2021.
Mazhar H, Foster BC, Necyk C, Gardiner PM, Harris CS, Robaey P. Natural health product-drug interaction causality assessment in pediatric adverse event reports associated with attention-deficit/hyperactivity disorder medication. J Child Adolesc Psychopharmacol. 2020;30(1):38-47.31670573
McAllister WA, Thompson PJ, Al-Habet SM, Rogers HJ. Rifampicin reduces effectiveness and bioavailability of prednisolone. Br Med J (Clin Res Ed). 1983;286(6369):923-925.6403136
McCance-Katz EF, Moody DE, Morse GD. Interactions between buprenorphine and antiretrovirals. I. The nonnucleoside reverse-transcriptase inhibitors efavirenz and delavirdine. Clin Infect Dis 2006;43(Suppl 4):S224-S234.17109309
McCance-Katz E, Moody DE, Prathikanti S, Friedland G, Rainey PM. Rifampin, but not rifabutin, may produce opiate withdrawal in buprenorphine-maintained patients. Drug Alcohol Depend. 2011;118(2-3):326-334.21596492
McDonnell AM, Rybak I, Wadleigh M, Fisher DC. Suspected serotonin syndrome in a patient being treated with methylene blue for ifosfamide encephalopathy. J Oncol Pharm Pract. 2012;18(4):436-439.22235061
Mefloquine [prescribing information]. North Wales, PA: Teva Pharmaceuticals USA Inc; August 2017.
Melzer M, Fuhrken D, Kolkmann R. Hyperforin in St. John's wort. Dtsch Apoth Ztg. 1998;138,4754,57-60.
Mendell J, Chen S, He L, Desai M, Parasramupria DA. The effect of rifampin on the pharmacokinetics of edoxaban in healthy adults. Clin Drug Investig. 2015;35(7):447-453.26068927
Mendonca CO, Griffiths CE. Clindamycin and rifampicin combination therapy for hidradenitis suppurativa. Br J

Dermatol. 2006;154(5):977-978.16634904
Menegazzi M, Novelli M, Beffy P,et al. Protective effects of St. John's wort extract and its component hyperforin against cytokine-induced cytotoxicity in a pancreatic beta-cell line. Int J Biochem Cell Biol. 2008;40(8):1509-1521.18226577
Meneses-Lorente G, Fowler S, Guerini E, et al. In vitro and clinical investigations to determine the drug-drug interaction potential of entrectinib, a small molecule inhibitor of neurotrophic tyrosine receptor kinase (NTRK). Invest New Drugs. 2022;40(1):68-80.34417912
Menest (esterified estrogens) [prescribing information]. New York, NY: Pfizer Inc; April 2019.
Menon RM, Badri PS, Wang T, et al. Drug-drug interaction profile of the all-oral anti-hepatitis C virus regimen of paritaprevir/ritonavir, ombitasvir, and dasabuvir. J Hepatol. 2015;63(1):20-29.25646891
Methadone [prescribing information]. Largo, FL: VistaPharm; June 2021.
Metozolv ODT [prescribing information]. Raleigh, NC: Salix Pharmaceuticals, Inc; October 2011.
Meyer D, Halfin V. Toxicity secondary to meperidine in patients on monoamine oxidase inhibitors: a case report and critical review. J Clin Psychopharmacol. 1981;1(5):319-321.7334144
Michelitsch A, Biza B, Wurglics M, Schubert-Zsilavecz M, Baumeister A, Likussar W. Determination of hypericin in herbal medicine products by different pulse polarography. Phytochem Anal. 2000;11(1):41-44.
Michelucci R, Cipolla G, Passarelli D, et al. Reduced plasma nisoldipine concentrations in phenytoin-treated patients with epilepsy. Epilepsia. 1996;37(11):1107-1110.8917062
Mifeprex (mifepristone) [prescribing information]. New York, NY: Danco Laboratories, LLC; April 2019.
Mikus G, Heinrich T, Bodigheimer J, et al. Semisimultaneous midazolam administration to evaluate the time course of CYP3A activation by a single dose of efavirenz. J Clin Pharmacol. 2017;57(7):899-905.28194792
Mills E, Montori VM, Wu P, Gallicano K, Clarke M, Guyatt G. Interaction of St. John's wort with conventional drugs: systematic review of clinical trials. BMJ. 2004;329(7456):27-30.15231618
Milton JC, Abdulla A. Prolonged oro-facial dystonia in a 58 year old female following therapy with bupropion and St. John's Wort. Br J Clin Pharmacol. 2007;64(5):717-718.17578477
Mirochnick M, Cooper E, Capparelli E, et al. Population pharmacokinetics of dapsone in children with human immunodeficiency virus infection. Clin Pharmacol Ther. 2001;70(1):24-32.11452241
Misak S, Knop J, Singer K, et al. The nonmetabolized beta-blocker nadolol is a substrate of OCT1, OCT2, MATE1, MATE2-k, and P-glycoprotein, but not of OATP1B1 and OATP1B3. Mol Pharm. 2016;13(2):512-519.26702643
Misaka S, Miyazaki N, Yatabe MS, et al. Pharmacokinetic and pharmacodynamic interaction of nadolol with itraconazole, rifampicin and grapefruit juice in healthy volunteers. J Clin Pharmacol. 2013;53(7):738-745.23677858
Mittino D, Mula M, Monaco F. Serotonin syndrome associated with tramadol-sertraline coadministration. Clin Neuropharmacol. 2004;27(3):150-151.15190240
Mizuno K, Katoh M, Okumura H, et al. Metabolic activation of benzodiazepines by CYP3A4. Drug Metab Dispos. 2009;37(2):345-351.19005028
Mogalian E, German P, Kearney BP, et al. Use of multiple probes to assess transporter- and cytochrome P450-mediated drug-drug interaction potential of the pangenotypic HCV NS5A inhibitor velpatasvir. Clin Pharmacokinet. 2016;55(5):605-613.26519191
Mohamed MF, Jungerwirth S, Asatryan A, Jiang P, Othman AA. Assessment of effect of CYP3A inhibition, CYP induction, OATP1B inhibition, and high-fat meal on pharmacokinetics of the JAK1 inhibitor upadacitinib. Br J Clin Pharmacol. 2017;83(10):2242-2248.28503781
Molto J, Curran A, Miranda C, et al. Pharmacokinetics of darunavir/cobicistat and etravirine alone and co-administered in HIV-infected patients. J Antimicrob Chemother. 2018;73(3):732-737.29237008
Molto J, Rajoli R, Back D, et al. Use of a physiologically based pharmacokinetic model to simulate drug-drug interactions between antineoplastic and antiretroviral drugs. J Antimicrob Chemother. 2017;72(3):805-811.27999009
Moody DE, Chang Y, Huang W, et al. The in vivo response of novel buprenorphine metabolites, M1 and M3, to antiretroviral inducers and inhibitors of buprenorphine metabolism. Basic Clin Pharmacol Toxicol. 2009;104(3):211-215.19500085

Moon SM, Jhun BW, Lee H, et al. Effect of a 150 mg dose of rifabutin on serum itraconazole levels in patients with coexisting chronic pulmonary aspergillosis and Mycobacterium avium complex lung disease. J Infect Chemother. 2017;23(9):658-660.28284662
Moon SM, Park HY, Jeong BH, Jeon K, Lee SY, Koh WJ. Effect of rifampin and rifabutin on serum itraconazole levels in patients with chronic pulmonary aspergillosis and coexisting nontuberculous mycobacterial infection. Antimicrob Agents Chemother. 2015;59(1):663-665.25313207
Morii H, Chiba M, Konishi H, Endo Y, Yamaji A. Failure of pain control using transdermal fentanyl during rifampicin treatment. J Pain Symptom Manage. 2007;33(1):5-6.17196900
Morphine sulfate [prescribing information]. Lake Forest, IL: Hospira, Inc.; December 2018.
Morrison EK, Rowe AS. Probable drug-drug interaction leading to serotonin syndrome in a patient treated with concomitant buspirone and linezolid in the setting of therapeutic hypothermia. J Clin Pharm Ther. 2012;37(5):610-613.22452676
Moschella C, Jaber BL. Interaction between cyclosporine and Hypericum perforatum (St. John's wort) after organ transplantation. Am J Kidney Dis. 2001;38(5):1105-1107.11684566
Moses EL, Mallinger AG. St. John's wort: three cases of possible mania induction. J Clin Psychopharmacol. 2000;20(1):115-117.10653226
Movantik (naloxegol) [prescribing information]. Wilmington, DE: AstraZeneca Pharmaceuticals LP; September 2014.
Moyle GJ, Buss NE, Goggin T, Snell P, Higgs C, Hawkins DA. Interaction between saquinavir soft-gel and rifabutin in patients infected with HIV. Br J Clin Pharmacol. 2002;54(2):178-182.12207638
Mu S, Tang Z, Novotny W, et al. Effect of rifampin and itraconazole on the pharmacokinetics of zanubrutinib (a Bruton's tyrosine kinase inhibitor) in Asian and non-Asian healthy subjects. Cancer Chemother Pharmacol. 2020;85(2):391-399.31875923
Mueller SC, Uehleke B, Woehling Het al. Effect of St. John's wort dose and preparations on the pharmacokinetics of digoxin. Clin Pharmacol Ther. 2004;75(6):546-557.15179409
Mueller SC, Majcher-Peszynska J, Mundkowski RGet al. No clinically relevant CYP3A induction after St. John's wort with low hyperforin content in healthy volunteers. Eur J Clin Pharmacol. 2009;65(1):81-87.18762932
Mukai M, Uchimura T, Zhang X, Greene D, Vergeire M, Cantillon M. Effects of rifampin on the pharmacokinetics of a single dose of istradefylline in healthy subjects. J Clin Pharmacol. 2018;58(2):193-201.28881378
Mukerjee R, Deshmane SL, Darbinian N, et al. St. John's Wort protein, p27SJ, regulates the MCP-1 promoter. Mol Immunol. 2008;45(15):4028-4035.18649942
Mulinacci N, Bardazzi C, Romani A, Pinelli P, Vincieri FF, Costantini A. HPLC-DAD and TLC-densitometry for quantification of hypericin in Hypericum perforatum L. extracts. Chromatographia. 1999;49(3-4):197-201.
Müller T, Mannel M, Murck H, Rahlfs VW. Treatment of somatoform disorders with St. John's wort: a randomized, double-blind and placebo-controlled trial. Psychosom Med. 2004;66(4):538-547.15272100
Multaq [prescribing information]. Bridgewater, NJ: Sanofi-Aventis U.S. LLC; November 2020.
Murakami Y, Tanaka T, Murakami H, Tsujimoto M, Ohtani H, Sawada Y. Pharmacokinetic modelling of the interaction between St John’s wort and ciclosporin A. Br J Clin Pharmacol. 2006;61(6):671-676.16722827
Muraoka T, Oku E, Sugataka S, Yamada S. A case of severe parkinsonism associated with short-term treatment with milnacipran. Clin Neuropharmacol. 2008;31(5):299-300.18836350
Murphy PA, Kern SE, Stanczyk FZ, Westhoff CL. Interaction of St. John's Wort with oral contraceptives: effects on the pharmacokinetics of norethindrone and ethinyl estradiol, ovarian activity and breakthrough bleeding. Contraception. 2005;71(6):402-408.15914127
Murray MT. Common questions about St. John's wort extract. Am J Nat Med. 1997;4(2):14-19.
Mutiti CS, Kapungu NN, Kanji CR, et al. Clinically relevant enantiomer specific R- and S-praziquantel pharmacokinetic drug-drug interactions with efavirenz and ritonavir. Pharmacol Res Perspect. 2021;9(3):e00769.33929078
Mycobutin (rifabutin) [prescribing information]. New York, NY: Pfizer Inc; May 2015.
Myfembree (relugolix, estradiol, norethindrone) [prescribing information]. Brisbane, CA: Myovant Sciences, Inc.; May 2021.

Najafizadeh P, Hashemian F, Mansouri P, Farshi S, Surmaghi MS, Chalangari R. The evaluation of the clinical effect of topical St. John's wort (Hypericum perforatum L.) in plaque type psoriasis vulgaris: a pilot study. Australas J Dermatol. 2012;53(2):131-135.22571563

Nakajo M, Shapiro B, Sisson JC, Swanson DP, Beierwaltes WH. Salivary gland accumulation of meta-[131I]iodobenzylguanidine. J Nucl Med. 1984;25(1):2-6.6726418

Nakamura A, Mihara K, Nagai G, Suzuki T, Kondo T. Pharmacokinetic and pharmacodynamic interactions between carbamazepine and aripiprazole in patients with schizophrenia. Ther Drug Monit. 2009;31(5):575-578.19701114

Nakau K, Sugimoto M, Oka H, et al. Pharmacokinetics of drugs for pediatric pulmonary hypertension. Pediatr Int. 2016;58(11):1112-1117.27038140

Naldi L, Conforti A, Venegoni M, et al. Cutaneous reactions to drugs. An analysis of spontaneous reports in four Italian regions. Br J Clin Pharmacol. 1999;48(6):839-846.10594488

Nam SH, Oh JS, Hong S, et al. Early discontinuation of tofacitinib in patients with rheumatoid arthritis co-treated with rifampin for latent tuberculosis [published online, May 7, 2020]. Joint Bone Spine. doi: 10.1016/j.jbspin.2020.04.010.32387584

Narasimhan NI, Dorer DJ, Davis J, Turner CD, Sonnichsen D. Evaluation of the effect of multiple doses of rifampin on the pharmacokinetics and safety of ponatinib in healthy subjects. Clin Pharmacol Drug Dev. 2015;4(5):354-360.27137144

Nassr N, Huennemeyer A, Herzog R, et al. Effects of rifampicin on the pharmacokinetics of roflumilast and roflumilast N-oxide in healthy subjects. Br J Clin Pharmacol. 2009;68(4):580-587.19843061

Natali KM, Jimenez HR, Slim J. When coadministration cannot be avoided: real world experience of direct acting antivirals for the treatment of hepatitis C virus infection in patients on first generation anticonvulsants [published online December 15, 2020]. J Pharm Pract. doi: 10.1177/0897190020977762.33317381

Navarro A, Perry C, Bobo WV. A case of serotonin syndrome precipitated by abuse of the anticough remedy dextromethorphan in a bipolar patient treated with fluoxetine and lithium. Gen Hosp Psychiatry. 2006;28(1):78-80.16377370

Nayzilam (midazolam) nasal spray [prescribing information]. Smyrna, GA: UCB Inc; February 2021.

Neoral (cyclosporine) [prescribing information]. East Hanover, NJ: Novartis Pharmaceuticals Corporation; March 2015.

Nerlynx (neratinib) [prescribing information]. Los Angeles, CA: Puma Biotechnology Inc; July 2020, June 2021.

Newall CA, Anderson LA, Phillipson JD. St. John's wort. In: Herbal Medicines: A Guide for Health-Care Professionals. London, England: Pharmaceutical Press; 1996:250-252.

Newman JV, Zhou J, Izmailyan S, Tsai L. Mass balance and drug interaction potential of intravenous eravacycline administered to healthy subjects. Antimicrob Agents Chemother. 2019;63(3):e01810-e01818.30559132

Nexavar (sorafenib) [prescribing information]. West Haven, CT: Bayer Pharmaceuticals Corporation; July 2020.

Nexium (esomeprazole) [prescribing information]. Wilmington, DE: AstraZeneca Pharmaceuticals LP; August 2021.

Nexterone (amiodarone) [prescribing information]. Deerfield, IL: Baxter Healthcare Corporation; November 2016.

Ng QX, Venkatanarayanan N, Ho CY. Clinical use of Hypericum perforatum (St John's wort) in depression: a meta-analysis. J Affect Disord. 2017;210:211-221.28064110

Ngo BT, Pascoe M, Khan D. Drug interaction between rifampicin and sirolimus in transplant patients. Saudi J Kidney Dis Transpl. 2011;22(1):112-115.21196624

Niederhofer H. St. John's wort treating patients with autistic disorder. Phytother Res. 2009;23(11):1521-1523.19274686

Niemi M, Backman JT, Neuvonen M, Neuvonen PJ. Effect of rifampicin on the pharmacokinetics and pharmacodynamics of nateglinide in healthy subjects. Br J Clin Pharmacol. 2003;56(4):427-432.12968988

Nieminen TH, Hagelberg NM, Saari TI, et al. St John's wort greatly reduces the concentrations of oral oxycodone. Eur J Pain. 2010;14(8):854-859.20106684

Nieminen TH, Hagelberg NM, Saari TI, et al. Rifampin greatly reduces the plasma concentrations of intravenous and oral oxycodone. Anesthesiology. 2009;110(6):1371-1378.19417618

Nierenberg AA, Burt T, Matthews J, Weiss AP. Mania associated with St. John's wort. Biol Psychiatry. 1999;46(12):1707-1708.10624554
Nierenberg DW, Semprebon M. The central nervous system serotonin syndrome. Clin Pharmacol Ther. 1993;53(1):84-88.8257462
Nightingale J, Nappi JM. Effect of phenytoin on serum disopyramide concentrations. Clin Pharm. 1987;6(1):46-50.3816106
Nimodipine [prescribing information]. Montvale, NJ: Ascend Laboratories LLC; December 2015.
Ninlaro (ixazomib) [prescribing information]. Cambridge, MA: Takeda Pharmaceutical Company Limited; March 2021.
Nisijima K. Abnormal monoamine metabolism in cerebrospinal fluid in a case of serotonin syndrome. J Clin Psychopharmacol. 2000;20(1):107-108.10653221
Noble WH, Baker A. MAO inhibitors and coronary artery surgery: a patient death. Can J Anaesth. 1992;39(10):1061-1066.1464133
Noh YH, Lim HS, Jin SJ, et al. Effects of ketoconazole and rifampicin on the pharmacokinetics of gemigliptin, a dipeptidyl peptidase-IV inhibitor: a crossover drug-drug interaction study in healthy male Korean volunteers. Clin Ther. 2012;34(5):1182-1194.22534255
Nolan Jr PE, Marcus FI, Karol MD, Hoyer GL, Gear K. Effect of phenytoin on the clinical pharmacokinetics of amiodarone. J Clin Pharmacol. 1990;30(12):1112-1119.2273084
Noopers I, Olofsen E, Niesters M, et al. Effect of rifampicin on S-ketamine and S-norketamine plasma concentrations in healthy volunteers after intravenous S-ketamine administration. Anesthesiology. 2011;114(6):1435-1445.21508826
Norpace (disopyramide) [prescribing information]. New York, NY: Pfizer Inc; October 2020.
Norvasc (amlodipine) [prescribing information]. New York, NY: Pfizer Inc; October 2017.
Norvir (ritonavir) [prescribing information]. North Chicago, IL: AbbVie Inc.; October 2020.
Notelovitz M, Tjapkes J, Ware M. Interaction between estrogen and dilantin in a menopausal woman. N Engl J Med. 1981;304(13):788-789.6258075
Nourianz (istradefylline) [prescribing information]. Bedminster, NJ: Kyowa Kirin Inc; August 2019.
Nowack R. Review article: cytochrome P450 enzyme, and transport protein mediated herb-drug interactions in renal transplant patients: grapefruit juice, St. John's Wort - and beyond! Nephrology (Carlton). 2008;13(4):337-347.18363644
Nozari A, Akeju O, Mirzakhani H, et al. Prolonged therapy with the anticonvulsant carbamazepine leads to increased plasma clearance of fentanyl. J Pharm Pharmacol. 2019;71(6):982-987. doi:10.1111/jphp.1307930793320
Nubeqa (darolutamide) [prescribing information]. Whippany, NJ; Bayer HealthCare Pharmaceuticals Inc; July 2019.
Nuplazid (pimavanserin) [prescribing information]. San Diego, CA: Acadia Pharmaceuticals Inc; November 2020.
Nurtec ODT (rimegepant) [prescribing information]. New Haven, CT: Biohaven Pharmaceuticals, Inc.; February 2020.
NuvaRing (etonogestrel and ethinyl estradiol) vaginal ring [prescribing information]. Whitehouse Station, NJ: Merck & Co Inc; January 2020.
Nymalize (nimodipine) oral solution [prescribing information]. Atlanta, GA: Arbor Pharmaceuticals, LLC; December 2020.
Ochs HR, Greenblatt DJ, Roberts GM, Dengler HJ. Diazepam interaction with antituberculosis drugs. Clin Pharmacol Ther. 1981;29(5):671-678.7214796
Odefsey (emtricitabine/rilpivirine/tenofovir alafenamide) [prescribing information]. Foster City, CA: Gilead Sciences Inc; March 2021.
Odomzo (sonidegib) [prescribing information]. East Hanover, NJ: Novartis Pharmaceuticals Corporation; July 2015.
Ofev (nintedanib) [prescribing information]. Ridgefield, CT: Boehringer Ingelheim Pharmaceuticals Inc; March 2020.
Ogasawara K, Kam J, Thomas M, et al. Effects of strong and moderate CYP3A4 inducers on the pharmacokinetics of fedratinib in healthy adult participants. Cancer Chemother Pharmacol. 2021;88(3):369-377.34019108
Ogen (estropipate) [prescribing information]. New York, NY: Pfizer Inc; May 2019.
Ogilvie BW, Torres R, Dressman MA, Kramer WG, Baroldi P. Clinical assessment of drug-drug interactions of tasimelteon, a novel dual melatonin receptor agonist. J Clin Pharmacol. 2015;55(9):1004-1011.25851638

Ohgami M, Kaburagi T, Kurosawa A, Homma M. Drug interaction between erlotinib and phenytoin for brain metastases in a patient with nonsmall cell lung cancer. Lung Cancer. 2016;101:9-10.27794414
Ohnhaus EE, Brockmeyer N, Dylewicz P, Habicht H. The effect of antipyrine and rifampin on the metabolism of diazepam. Clin Pharmacol Ther. 1987;42(2):148-156.3608348
Okada Y, Seo T, Ishitsu T, et al. Population estimation regarding the effects of cytochrome P450 2C19 and 3A5 polymorphisms on zonisamide clearance. Ther Drug Monit. 2008;30(4):540-543.18641551
Olinvyk (oliceridine) [prescribing information]. Chesterbrook, PA: Trevena, Inc.; August 2020.
Olita (olmutinib) tablet [KR prescribing information]. Available at: https://nedrug.mfds.go.kr/pbp/CCBBB01/getItemDetail?itemSeq=201602641. Accessed May 8, 2020.
Olivesi A. Modified elimination of prednisolone in epileptic patients on carbamazepine monotherapy, and in women using low-dose oral contraceptives. Biomed Pharmacother. 1986;40(8):301-308.3814762
Olysio (simeprevir) [prescribing information]. Titusville, NJ: Janssen Products LP; November 2017.
Omarova MA, Artomonova NA. Liposoluble pigments from the herb Hypericum perforatum. Chem Nat Compd. 1998;1997;33(6):691-692.
Ondrizek RR, Chan PJ, Patton WC, King A. Inhibition of human sperm motility by specific herbs used in alternative medicine. J Assist Reprod Genet. 1999;16(2):87-91.10079411
Onglyza (saxagliptin) [prescribing information]. Wilmington, DE: AstraZeneca Pharmaceuticals LP; February 2017.
Onivyde (irinotecan liposomal) [prescribing information]. Cambridge, MA: Merrimack Pharmaceuticals Inc; October 2015.
Ono S, Mihara K, Suzuki A, et al. Significant pharmacokinetic interaction between risperidone and carbamazepine: its relationship with CYP2D6 genotypes. Psychopharmacology (Berl). 2002;162(1):50-54.12107617
Opsumit (macitentan) [prescribing information]. South San Francisco, CA: Actelion Pharmaceuticals US Inc; April 2019.
Orgovyx (relugolix) [prescribing information]. Brisbane, CA: Myovant Sciences Inc; December 2020.
Orkambi (ivacaftor/lumacaftor) [prescribing information]. Boston, MA: Vertex Pharmaceuticals Incorporated; August 2018.
Orladeyo (berotralstat) [prescribing information]. Durham, NC: BioCryst Pharmaceuticals Inc; December 2020.
Orlova Y, Rizzoli P, Loder E. Association of coprescription of triptan antimigraine drugs and selective serotonin reuptake inhibitor or selective norepinephrine reuptake inhibitor antidepressants with serotonin syndrome. JAMA Neurol. 2018;75(5):566-572.29482205
Orth HC, Rentel C, Schmidt PC. Isolation, purity analysis and stability of hyperforin as a standard material from Hypericum perforatum L. J Pharm Pharmacol. 1999;51(2):193-200.10217319
Otani K, Ishida M, Kaneko S, Mihara K, Ohkubo T, Osanai T, Sugawara K. Effects of carbmazepine coadministration on plasma concentrations of trazodone and its active metabolite, m-chlorophenylpiperazine. Ther Drug Monit. 1996;18(2):164-167.8721280
Otani K, Ishida M, Yasui N, et al. Interaction between carbamazepine and bromperidol. Eur J Clin Pharmacol. 1997;52(3):219-222.9218929
Otezla (apremilast) [prescribing information]. Thousand Oaks, CA: Amgen Inc; April 2020.
Oude Munnink TH, Demmer A, Slenter RHJ, Movig KLL. Amiodarone rifampicin drug-drug interaction management with therapeutic drug monitoring. Ther Drug Monit. 2018;40(2):159-161.29470228
Ovestin Ovula [prescibing information]. St. Leonards, Australia: Aspen Pharmacare; July 2016.
Ovestrion (estriol) tablets [prescribing information]. Sao Paulo Brazil: Schering-Plough Pharmaceutical Industry Ltda; July 2015.
Oxaydo (oxycodone) tablets [prescribing information]. Wayne, PA: Zyla Life Sciences US Inc.; March 2021.
Oxaydol (oxycodone) [prescribing information]. Wayne, PA: Egalet US Inc.; September 2018.
Oxbryta (voxelotor) [prescribing information]. South San Francisco, CA: Global Blood Therapeutics, Inc.; December 2021.
Oxsoralen-Ultra (methoxsalen) capsules [prescribing information]. Costa Mes, CA: ICN Pharmaceuticals, Inc.; March

2003.
Oxtellar XR (oxcarbazepine) extended release [prescribing information]. Rockville, MD: Supernus Pharmaceuticals, Inc.; December 2018.
OxyContin (oxycodone) extended-release tablets [prescribing information]. Stamford, CT: Purdue Pharma L.P.; March 2021.
Ozkardesler S, Gurpinar T, Akan M, et al. A possible perianesthetic serotonin syndrome related to intrathecal fentanyl. J Clin Anesth. 2008;20(2):143-145.18410872
Paclitaxel [prescribing information]. Lake Forest, IL: Hospira Inc.; May 2018.
Padda SK, Chhatwani L, Zhou L, Jacobs CD, Lopez-Anaya A, Wakelee HA. Phase I and pharmacokinetic study of bexarotene in combination with gefitinib in the third-line treatment of non-small-cell lung cancer: brief report. Anticancer Drugs. 2013;24(7):731-735.23552470
Page RL 2nd, O'Bryant CL, Cheng D, et al. Drugs that may cause or exacerbate heart failure: a scientific statement from the American Heart Association. Circulation. 2016;134(6):e32-e69.27400984
Papakostas GI, Crawford CM, Scalia MJ, Fava M. Timing of clinical improvement and symptom resolution in the treatment of major depressive disorder. A replication of findings with the use of a double-blind, placebo-controlled trial of Hypericum perforatum versus fluoxetine. Neuropsychobiology. 2007;56(2-3):132-137.18259086
Park YM, Jung YK. Manic switch and serotonin syndrome induced by augmentation of paroxetine with methylphenidate in a patient with major depression. Prog Neuropsychopharmacol Biol Psychiatry. 2010;34(4):719-720.20298736
Parker V, Wong AH, Boon HS, Seeman MV. Adverse reactions to St John's Wort. Can J Psychiatry. 2001;46(1):77-79.11221494
Parsons A, Ingram J, Inglis J, et al. A proof of concept randomised placebo controlled factorial trial to examine the efficacy of St. John's wort for smoking cessation and chromium to prevent weight gain on smoking cessation. Drug Alcohol Depend. 2009;102(1-3):116-122.19328636
Patsalos PN, Gougoulaki M, Sander JW. Perampanel serum concentrations in adults with epilepsy: effect of dose, age, sex, and concomitant anti-epileptic drugs. Ther Drug Monit. 2016;38(3):358-364.26727625
Paxlovid (nirmatrelvir/ritonavir) [Emergency Use Authorization fact sheet for healthcare providers]. New York, NY: Pfizer Inc.; August 2022.
Peacock LE, Wright F. Serotonin syndrome secondary to tramadol and citalopram. Age Ageing. 2011;40(4):528.21414947
Pedavally S, Fugate JE, Rabinstein AA. Serotonin syndrome in the intensive care unit: clinical presentations and precipitating medications. Neurocrit Care. 2014;21(1):108-113.24052457
Pelet A, Favrat B, Cavassini M, Eap CB, Besson J, Monnat M. Usefulness of methadone plasma concentration measurement in patients receiving nevirapine or efavirenz. Am J Drug Alcohol Abuse. 2011;37(4):264-268.21699349
Peltoniemi MA, Saari TI, Hagelberg NM, Laine K, Neuvonen PJ, Olkkola KT. St John's wort greatly decreases the plasma concentrations of oral S-ketamine. Fundam Clin Pharmacol. 2012;26(6):743-750.21635359
Peltoniemi MA, Saar TI, Hagelberg NM, et al. Rifampicin has a profound effect on the pharmacokinetics of oral S-ketamine and less on intravenous S-ketamine. Basic Clin Pharmacol Toxicol. 2012;111(5):325-332.22676424
Pemazyre (pemigatinib) [prescribing information]. Wilmington, DE: Incyte Corporation; February 2021.
Pereira JC Jr, Pradella-Hallinan M, Alves RC. Saint John's wort, an herbal inducer of the cytochrome P4503A4 isoform, may alleviate symptoms of Willis-Ekbom's disease. Clinics (Sao Paulo). 2013;68(4):469-474.23778343
Perlman A, Goldstein R, Cohen LC, et al. Effect of enzyme-inducing antiseizure medications on the risk of sub-therapeutic concentrations of direct oral anticoagulants: a retrospective cohort study. CNS Drugs. 2021;35(3):305-316.33595834
Perseris (risperidone) extended-release subcutaneous injection [prescribing information]. North Chesterfield, VA: Indivior Inc; December 2019.
Petereit LB, Meikle AW. Effectiveness of prednisolone during phenytoin therapy. Clin Pharmacol Ther. 1977;22(6):912-916.923186

Peyre H, Delorme R. A case of severe hyperthermia after administration of methylphenidate. J Clin Psychopharmacol. 2012;32(2):299-300.22388166
Pfrunder A, Schiesser M, Gerber S, Haschke M, Bitzer J, Drewe J. Interaction of St John's wort with low-dose oral contraceptive therapy: a randomized controlled trial. Br J Clin Pharmacol. 2003;56(6):683-690.14616430
Photofrin (porfimer) [prescribing information]. Bannockburn, IL: Pinnacle Biologics, Inc.; June 2011.
Pifeltro (doravirine) [prescribing information]. Whitehouse Station, NJ: Merck & Co Inc; August 2018.
Pihlsgard M, Eliasson E. Significant reduction of sertraline plasma levels by carbamazepine and phenytoin. Eur J Clin Pharmacol. 2002:57(12):915-916.11936714
Piscitelli SC, Burstein AH, Chaitt D, Alfaro RM, Falloon J. Indinavir concentrations and St John's wort. Lancet. 2000;355(9203):547-548.10683007
Pithavala YK, Tortorici M, Toh M, et al. Effect of rifampin on the pharmacokinetics of axitinib (AG-013736) in Japanese and Caucasian healthy volunteers. Cancer Chemother Pharmacol. 2010;65(3):563-570.19603168
Podany AT, Bao Y, Swindells S, et al. Efavirenz pharmacokinetics and pharmacodynamics in HIV-infected persons receiving rifapentine and isoniazid for tuberculosis prevention. Clin Infect Dis. 2015;61(8):1322-1327.26082504
Polamidone (levomethadone) [summary of product characteristics]. Frankfurt, Germany: Sanofi-Aventis Germany GmbH; May 2018.
Polepally AR, Ng JW, Salem AH, et al. Assessment of clinical drug-drug interactions of elagolix, a gonadotropin-releasing hormone receptor antagonist. J Clin Pharmacol. 2020;60(12):1606-1616.33045114
Portolés A, Terleira A, Calvo A, Martínez I, Resplandy G. Effects of Hypericum perforatum on ivabradine pharmacokinetics in healthy volunteers: an open-label, pharmacokinetic interaction clinical trial. J Clin Pharmacol. 2006;46(10):1188-1194.16988208
Potdar R, Gartrell BA, Given R, et al. Concomitant use of oral anticoagulants in patients with advanced prostate cancer receiving apalutamide: A post-hoc analysis of TITAN and SPARTAN studies. Am J Cancer Res. 2022;12(1):445-450.35141028
Powell-Jackson PR, Gray BJ, Heaton RW, Costello JF, Williams R, English J. Adverse effect of rifampicin administration on steroid-dependent asthma. Am Rev Respir Dis. 1983;128(2):307-310.6349444
Pozniak AL, Boffito M, Russell D, Ridgway CE, Muirhead GJ. A novel probe drug interaction study to investigate the effect of selected antiretroviral combinations on the pharmacokinetics of a single oral dose of maraviroc in HIV-positive subjects. Br J Clin Pharmacol. 2008;65(suppl 1):54-59.18333866
Pradax [product monograph]. Burlington, Ontario, Canada: Boehringer Ingelheim Canada Ltd, June 2008.
Pradaxa (dabigatran etexilate) [prescribing information]. Ridgefield, CT: Boehringer Ingelheim Pharmaceuticals, Inc; March 2018.
Prakash C, Fan B, Ke A, Le K, Yang H. Physiologically based pharmacokinetic modeling and simulation to predict drug-drug interactions of ivosidenib with CYP3A perpetrators in patients with acute myeloid leukemia. Cancer Chemother Pharmacol. 2020;86(5):619-632.32978634
Prakash R, Reed RM, Bass AD. Combination of phenobarbital and haloperidol in resistant schizophrenia. J Clin Psychopharmacol. 1984;4(6):362-363.6512009
Prandin (repaglinide) [prescribing information]. Bridgewater, NJ: Gemini Laboratories LLC; January 2019.
Prednisolone [prescribing information]. Greenville, SC: Pharmaceutical Associates, Inc.; September 2018.
Prednisone [prescribing information]. Columbus, OH: Roxane Laboratories Inc; November 2012.
Premarin (conjugated estrogens) [prescribing information]. Philadelphia, PA: Wyeth Pharmaceuticals, Inc.; December 2014.
Pretomanid [prescribing information]. Hyderabad, India: Mylan Laboratories Limited; August 2019.
Prevacid (lansoprazole) [prescribing information]. Lexington, MA: Takeda Pharmaceuticals America Inc; November 2020.
Prevymis (letermovir) [prescribing information]. Whitehouse Station, NJ: Merck & Co., INC.; August 2019.
Prezcobix (darunavir and cobicistat) [prescribing information]. Titusville, NJ: Janssen Therapeutics; December 2020.
Prezista (darunavir) [prescribing information]. Titusville, NJ: Janssen Products, LP; December 2020.

Prilosec [prescribing information]. Wilmington, DE: AstraZeneca Pharmaceuticals LP; June 2011.
Prior FH, Isbister GK, Dawson AH, Whyte IM. Serotonin toxicity with therapeutic doses of dexamphetamine and venlafaxine. Med J Aust. 2002;176(5):240-241.11999244
Procardia XL (nifedipine) [prescribing information]. New York, NY: Pfizer Inc; January 2015.
Pukrittayakamee S, Prakongpan S, Wanwimolruk S, Clemens R, Looareesuwan S, White NJ. Adverse effect of rifampin on quinine efficacy in uncomplicated falciparum malaria. Antimicrob Agents Chemother. 2003;47(5):1509-1513.12709315
Purgato M, Papola D, Gastaldon C, et al. Paroxetine versus other anti-depressive agents for depression. Cochrane Database Syst Rev. 2014;(4):CD006531.24696195
Pyrukynd (mitapivat) [prescribing information]. Cambridge, MA: Agios Pharmaceuticals Inc; Feb 2022.
Qaseem A, Barry MJ, Kansagara D, Clinical Guidelines Committee of the American College of Physicians. Nonpharmacologic versus pharmacologic treatment of adult patients with major depressive disorder: a clinical practice guideline from the American College of Physicians. Ann Intern Med. 2016;164(5):350-359.26857948
Qinlock (ripretinib) [prescribing information]. Waltham, MA: Deciphera Pharmaceuticals, LLC; June 2021.
Qualaquin (quinine) [prescribing information]. Cranbury, NJ: Sun Pharmaceutical Industries Inc; June 2019.
Qulipta (atogepant) [prescribing information]. Dublin, Ireland: Forest Laboratories Ireland Ltd; September 2021.
Quinidine gluconate [prescribing information]. Philadelphia, PA: Mutual Pharmaceutical Company Inc; September 2009.
Quviviq (daridorexant) [prescribing information]. Radnor, PA: Idorsia Pharmaceuticals US Inc; January 2022.
Rafajlovska V, Slaveska R, Cvetkov LJ. Influence of some factors on tannin contents in extracts of St. John's wort (Hypericum perforatum L.). Herba Pol. 1998;44:307-314.
Ragueneau-Majlessi I, Levy RH, Bergen D, et al. Carbamazepine pharmacokinetics are not affected by zonisamide: in vitro mechanistic study and in vivo clinical study in epileptic patients. Epilepsy Res. 2004;62(1):1-11.15519127
Rahimi R, Nikfar S, Abdollahi M. Efficacy and tolerability of Hypericum perforatum in major depressive disorder in comparison with selective serotonin reuptake inhibitors: a meta-analysis. Prog Neuropsychopharmacol Biol Psychiatry. 2009;33(1):118-127.19028540
Rajasingham R, Meya DB, Boulware DR. Are fluconazole or sertraline dose adjustments necessary with concomitant rifampin? HIV Med. 2018;19(6):e64-e65.28766827
Rajoli RKR, Curley P, Chiong J, et al. Predicting drug-drug interactions between rifampicin and long-acting cabotegravir and rilpivirine using physiologically based pharmacokinetic modeling. J Infect Dis. 2019;219(11):1735-1742.30566691
Rakhit A, Holford NH, Effeney DJ, Riegelman S. Induction of quinidine metabolism and plasma protein binding by phenobarbital in dogs. J Pharmacokinet Biopharm. 1984;12(5):495-515.6520745
Ramanathan S, Kakuda TN, Mack R, West S, Kearney BP. Pharmacokinetics of elvitegravir and etravirine following coadministration of ritonavir-boosted elvitegravir and etravirine. Antivir Ther. 2008;13(8):1011-1017.19195326
Ramirez J, Innocenti F, Schuetz EG, Flockhart DA, Relling MV, Santucci R, Ratain MJ. CYP2B6, CYP3A4, and CYP2C19 are responsible for the in vitro N-demethylation of meperidine in human liver microsomes. Drug Metab Dispos. 2004;32(9):930-936.15319333
Ranexa (ranolazine) [prescribing information]. Foster City, CA: Gilead Sciences Inc; December 2013.
Rang ST, Field J, Irving C. Serotonin toxicity caused by an interaction between fentanyl and paroxetine. Can J Anaesth. 2008;55(8):521-525.18676387
Rapamune (sirolimus) [prescribing information]. Philadelphia, PA: Wyeth Pharmaceuticals, Inc, November 2015.
Ravindran AV, Balneaves LG, Faulkner G, et al. Canadian network for mood and anxiety treatments (CANMAT) 2016 Clinical guidelines for the management of adults with major depressive disorder: section 5. Complementary and alternative medicine treatments. Can J Psychiatry. 2016;61(9):576-587.27486153
Recorlev (levoketoconazole) [prescribing information]. Chicago, IL:Xeris Pharmaceuticals, Inc.; January 2022.
Reddy VP, Walker M, Sharma P, Ballard P, Vishwanathan K. Development, verification, and prediction of osimertinib drug-drug interactions using PBPK modeling approach to inform drug label. CPT Pharmacometrics Syst Pharmacol.

2018;7(5):321-330.29468841
Reglan (metoclopramide) [prescribing information]. Baudette, MN: ANI Pharmaceuticals Inc; August 2017.
Reid R, Abramson BL, Blake J, et al. Managing menopause. J Obstet Gynaecol Can. 2014;36(9):830-833.25222364
Relling MV, Pui CH, Sandlund JT, et al. Adverse effect of anticonvulsants on efficacy of chemotherapy for acute lymphoblastic leukaemia. Lancet. 2000;356(9226):285-290.11071183
Relpax (eletriptan) [prescribing information]. New York, NY: Pfizer Inc; September 2013.
Remeron (mirtazapine) [prescribing information]. Whitehouse Station, NJ: Merck & Co Inc; July 2016.
Rengelshausen J, Banfield M, Riedel KD, et al. Opposite effects of short-term and long-term St John's wort intake on voriconazole pharmacokinetics. Clin Pharmacol Ther. 2005;78(1):25-33.16003289
Rescriptor (delavirdine) [prescribing information]. Research Triangle Park, NC: ViiV Healthcare; August 2019.
Retevmo (selpercatinib) [prescribing information]. Indianapolis, IN: Lilly USA, LLC; May 2020.
Revatio (sildenafil) [prescribing information]. New York, NY: Pfizer Inc; February 2018.
Rexulti (brexpiprazole) [prescribing information]. Rockville, MD: Otsuka America Pharmaceuticals, Inc.; July 2015.
Reyataz (atazanavir) [prescribing information]. Princeton, NJ: Bristol-Myers Squibb Company; September 2020.
Reyvow (lasmiditan) [prescribing information]. Indianapolis, IN: Lilly USA LLC; October 2019.
Rezurock (belumosudil) [prescribing information]. Warrendale, PA: Kadmon Pharmaceuticals LLC; July 2021.
Rhein J, Morawski BM, Hullsiek KH, et al. Efficacy of adjunctive sertraline for the treatment of HIV-associated cryptococcal meningitis: an open-label dose-ranging study. Lancet Infect Dis. 2016;16(7):809-818.26971081
Richard IH, Kulan R, Tanner C, et al. Serotonin syndrome and the combined use of deprenyl and an antidepressant in Parkinson's disease. Parkinson Study Group. Neurology. 1997;48(4):1070-1077.9109902
Ridtitid W, Wongnawa M, Mahatthanatrakul W, Chaipol P, Sunbhanich M. Effect of rifampin on plasma concentrations of mefloquine in healthy volunteers. J Pharm Pharmacol. 2000;52(10):1265-1269.11092571
Rinvoq (upadacitinib) [prescribing information]. North Chicago, IL: AbbVie Inc; August 2019.
Risperdal (risperidone) [prescribing information]. Titusville, NJ: Janssen Pharmaceuticals Inc; February 2021.
Risperdal Consta (risperidone) intramuscular injection [prescribing information]. Titusville, NJ: Janssen Pharmaceuticals Inc; February 2021.
Robertson P Jr, Hellriegel ET, Arora S, Nelson M. Effect of modafinil on the pharmacokinetics of ethinyl estradiol and triazolam in healthy volunteers. Clin Pharmacol Ther. 2002;71(1):46-56.11823757
Robles LA. Serotonin syndrome induced by fentanyl in a child: case report. Clin Neuropharmacol. 2015;38(5):206-208.26366964
Rodgers GC, Blackman MS. Quinidine interaction with anticonvulsants. Drug Intell Clin Pharm. 1983;17(11):819-820.6641505
Rodman JH, Murry DJ, Madden T, Santana VM. Altered etoposide pharmacokinetics and time to engraftment in pediatric patients undergoing autologous bone marrow transplantation. J Clin Oncol. 1994;12(11):2390-2397.7964955
Rodon J, Jacobs CD, Chu Q, et al. A phase I pharmacokinetic study of bexarotene with paclitaxel and carboplatin in patients with advanced non-small cell lung cancer (NSCLC). Cancer Chemother Pharmacol. 2012;69(3):825-834.22057853
Rosebraugh CJ, Flockhart DA, Yasuda SU, Woosley RL. Visual hallucination and tremor induced by sertraline and oxycodone in a bone marrow transplant patient. J Clin Pharmacol. 2001;41(2):224-227.11210406
Rotblatt M, Ziment I. Evidence-Based Herbal Medicine. Philadelphia, PA: Hanley and Belfus; 2002.
Rowland A, van Dyk M, Warncken D, Mangoni AA, Sorich MJ, Rowland A. Evaluation of modafinil as a perpetrator of metabolic drug-drug interactions using a model informed cocktail reaction phenotyping trial protocol. Br J Clin Pharmacol. 2018;84(3):501-509.29178272
Roy S, Fortier LP. Fentanyl-induced rigidity during emergence from general anesthesia potentiated by venlafaxine. Can J Anaesth. 2003;50(1):32-35.12514147
Rozerem (ramelteon) [prescribing information]. Deerfield, IL: Takeda Pharmaceuticals America Inc; December 2018.
Rozlytrek (entrectinib) [prescribing information]. South San Francisco, CA: Genentech USA, Inc.; August 2019.
Rukobia (fostemsavir) [prescribing information]. Research Triangle Park, NC: ViiV Healthcare; July 2020.

Ruschitzka F, Meier PJ, Turina M, Lüscher TF, Noll G. Acute heart transplant rejection due to Saint John's wort. Lancet. 2000;355(9203):548-549.10683008
Russo E, Scicchitano F, Whalley BJ, et al. Hypericum perforatum: pharmacokinetic, mechanism of action, tolerability, and clinical drug-drug interactions. Phytother Res. 2014;28(5):643-655. doi: 10.1002/ptr.505023897801
Rydapt (midostaurin) [prescribing information]. East Hanover, NJ: Novartis Pharmaceuticals Corp; April 2017.
Saaikoski T, Saari T, Hagelberg NM, et al. Rifampicin markedly decreases the exposure to oral and intravenous tramadol. Eur J Clin Pharmacol. 2013;69(6):1293-1301.23242004
Saavedra IN, Aguilera LI, Faure E, Galdames DG. Phenytoin/Clonazepam interaction. Ther Drug Monit. 1985;7(4):481-484.4082246
Saggers VH, Hariratnajothi N, McLean AE. The effect of diet and phenobarbitone on quinine metabolism in the rat and in man. Biochem Pharmacol. 1970;19(2):499-503.4396249
Saima S, Furuie K, Yoshimoto H, Fukuda J, Hayashi T, Echizen H. The effects of rifampicin on the pharmacokinetics and pharmacodynamics of orally administered nilvadipine to healthy subjects. Br J Clin Pharmacol. 2002;53(2):203-206.11851646
Saito YA, Rey E, Almazar-Elder AE, et al. A randomized, double-blind, placebo-controlled trial of St John's wort for treating irritable bowel syndrome. Am J Gastroenterol. 2010;105(1):170-177.19809408
Saleh S, Becker C, Frey R, Muck W. Population pharmacokinetics and the pharmacokinetic/pharmacodynamic relationship of riociguat in patients with pulmonary arterial hypertension or chronic thromboembolic pulmonary hypertension. Pulm Circ. 2016;6(suppl 1):S86-S96.27162632
Samadi S, Khadivzadeh T, Emami A, Moosavi NS, Tafaghodi M, Behnam HR. The effect of Hypericum perforatum on the wound healing and scar of cesarean. J Altern Complement Med. 2010;16(1):113-117.20064022
Samant TS, Huth F, Umehara K, et al. Ribociclib drug-drug interactions: clinical evaluations and physiologically-based pharmacokinetic modeling to guide drug labeling. Clin Pharmacol Ther. 2020;108(3):575-585.32557601
Samsca (tolvaptan) [prescribing information]. Rockville, MD: Otsuka America Pharmaceutical, Inc.; April 2021.
Sancuso (granisetron) transdermal system [prescribing information]. Bedminster, NJ: Kyowa Kirin Inc; January 2017.
Sandimmune (cyclosporine) [prescribing information]. East Hanover, NJ: Novartis Pharmaceuticals Corporation; March 2015.
Sandyk R. L-dopa induced "serotonin syndrome" in a parkinsonian patient on bromocriptine. J Clin Psychopharmacol. 1986;6(3):194-195.3711372
Sanger GJ. Translating 5-HT receptor pharmacology. Neurogastroenterol Motil. 2009;21(12):1235-1238.19906028
Sardella A, Lodi G, Demarosi F, Tarozzi M, Canegallo L, Carrassi A. Hypericum perforatum extract in burning mouth syndrome: a randomized placebo-controlled study. J Oral Pathol Med. 2008;37(7):395-401.18331283
Sarris J. Herbal medicines in the treatment of psychiatric disorders: a systematic review. Phytother Res. 2007;21(8):703-716.17562566
Sarris J, Kavanagh DJ, Deed G, Bone KM. St. John's wort and Kava in treating major depressive disorder with comorbid anxiety: a randomised double-blind placebo-controlled pilot trial. Hum Psychopharmacol. 2009;24(1):41-48.19090505
Sarris J, Kean J, Schweitzer I, Lake J. Complementary medicines (herbal and nutritional products) in the treatment of attention deficit hyperactivity disorder (ADHD): a systematic review of the evidence. Complement Ther Med. 2011;19(4):216-227.21827936
Sarris J, Nierenberg AA, Scweitzer I, et al. Conditional probability of response or nonresponse of placebo compared with antidepressants or St John's wort in major depressive disorder. J Clin Psychopharmacol. 2013;33(6):827-830.24091858
Sasahara K, Shimokawa Y, Hirao Y, et al. Pharmacokinetics and metabolism of delamanid, a novel anti-tuberculosis drug, in animals and humans: importance of albumin metabolism in vivo. Drug Metab Dispos. 2015;43(8):1267-1276.26055620
Sativex (tetrahydrocannabinol and cannabidiol) [Canadian product monograph]. Histon, Cambridge, United Kingdom: GW Pharma Ltd.; December 2019.

Sativex (tetrahydrocannabinol and cannabidiol oromucosal spray) [U.K. summary of product characteristics]. Wiltshire, U.K.: GW Pharma Ltd; February 2014.
Sato S, Someya T, Shioiri O, et al. Involvement of CYP3A4 in the metabolism of bromperidol in vitro. Pharmacol Toxicol. 2000;86(3):145-148.10752674
Savaysa (edoxaban) [prescribing information]. Parsippany, NJ: Daiichi Sankyo Inc; September 2017.
Schempp CM, Winghofer B, Langheinrich M, Schöpf E, Simon JC. Hypericin levels in human serum interstitial skin blister fluid after oral single-dose and steady-state administration of Hypericum perforatum extract (St. John's wort). Skin Pharmacol Appl Skin Physiol. 1999;12(5):299-304.10461100
Schempp H, Denke A, Mann E, Schneider W, Elstner EF. Biochemical activities of extracts from Hypericum perforatum L. 3rd communication: modulation of peroxidase activity as a simple method for standardization. Arzneimittelforschung. 1999;49(2):115-119.10083979
Schmitt LA, Liu Y, Murphy PA, Birt DF. Evaluation of the light-sensitive cytotoxicity of Hypericum perforatum extracts, fractions, and pure compounds. J Agric Food Chem. 2006;54(8):2881-2890.16608204
Schöller-Gyüre M, Kakuda TN, Woodfall B, et al. Effect of steady-state etravirine on the pharmacokinetics and pharmacodynamics of ethinylestradiol and norethindrone. Contraception. 2009;80(1):44-52. doi:10.1016/j.contraception.2009.01.00919501215
Scholler-Gyure M, van den Brink W, Kakuda TN, et al. Pharmacokinetic and pharmacodynamic study of the concomitant administration of methadone and TMC125 in HIV-negative volunteers. J Clin Pharmacol. 2008;48(3):322-329.18195053
Scholz I, Liakoni E, Hammann F, et al. Effects of Hypericum perforatum (St. John's wort) on the pharmacokinetics and pharmacodynamics of rivaroxaban in humans [published online September 22, 2020]. Br J Clin Pharmacol. Doi: 10.1111/bcp.14553.32959922
Schoretsanitis G, Spina E, Hiemke C, de Leon J. A systematic review and combined analysis of therapeutic drug monitoring studies for long-acting paliperidone. Expert Rev Clin Pharmacol. 2018;11(12):1237-1253.30449206
Schuck E, Ferry J, Gidal B, Hussein Z. Changes in perampanel levels during de-induction: simulations following carbamazepine discontinuation. Acta Neurol Scan. 2020;142(2);131-138.32430908
Schulz V. Safety of St. John's wort extract compared to synthetic antidepressants. Phytomedicine. 2006;13(3):199-204.16428030
Schwartz A, Brown JR. Quinidine-rifampin interaction. Am Heart J. 1984;107(4):789-790.6702573
Schwarz UI, Büschel B, Kirch W. Unwanted pregnancy on self-medication with St John's wort despite hormonal contraception. Br J Clin Pharmacol. 2003;55(1):112-113.12534648
Schwartz AR, Pizon AF, Brooks DE. Dextromethorphan-induced serotonin syndrome. Clin Toxicol (Phila). 2008;46(8):771-773.19238739
Schwartzberg LS, Yardley DA, Elias AD, et al. A phase I/Ib study of enzalutamide alone and in combination with endocrine therapies in women with advanced breast cancer. Clin Cancer Res. 2017;23(15):4046-4054.28280092
Scottish Intercollegiate Guidelines Network (SIGN). Management of perinatal mood disorders. Edinburgh: SIGN; 2012. (SIGN publication no. 127). [March 2012]. http://www.sign.ac.uk.
Sehgal VN, Srivastava G. Corticosteroid-unresponsive pemphigus vulgaris following antiepileptic therapy. Int J Dermatol. 1988;27(4):258.3391717
Seifritz E, Hatzinger M, Holsboer-Trachsler E. Efficacy of Hypericum extract WS 5570 compared with paroxetine in patients with a moderate major depressive episode - a subgroup analysis. Int J Psychiatry Clin Pract. 2016;20(3):126-132.27161105
Selectol (celiprolol) [KR product information]. Accessed July 13, 2017. http://drug.mfds.go.kr/html/bxsSearchDrugProduct.jsp?item_Seq=200001290.
Selzentry (maraviroc) [prescribing information]. Research Triangle Park, NC: Viiv Healthcare; October 2020.
Sennesael AL, Larock AS, Hainaut P, et al. The impact of strong inducers on direct oral anticoagulant levels. Am J Med. 2021;134(10):1295-1299.34181907
Seree EJ, Pisano PJ, Placidi M, Rahmani R, Barra YA. Identification of the human and animal hepatic cytochromes

P450 involved in clonazepam metabolism. Fundam Clin Pharmacol. 1993;7(2):69-75.8486332
Seroquel (quetiapine) [prescribing information]. Wilmington, DE: AstraZeneca Pharmaceuticals LP; September 2020.
Seroquel XR (quetiapine) [prescribing information]. Wilmington, DE: AstraZeneca Pharmaceuticals LP; September 2020.
Shahani L. Tramadol precipitating serotonin syndrome in a patient on antidepressants. J Neuropsychiatry Clin Neurosci. 2012;24(4):E52.23224488
Shaik MN, Hee B, Wei H, LaBadie RR. Evaluation of the effect of rifampin on the pharmacokinetics of the Smoothened inhibitor glasdegib in healthy volunteers. Br J Clin Pharmacol. 2018;84(6):1346-1353.29488303
Shakoor M, Ayub S, Ahad A, Ayub Z. Transient serotonin syndrome cause by concurrent use of tramadol and selective serotonin reuptake inhibitor. Am J Case Rep. 2014;15:562-564.25540831
Shan JJ, Wu, XC, Pang PK, Ling L. their use as T-type calcium channel targeted therapeutics. PCT Int Appl. 2000.
Shi JG, Chen X, Emm T, et al. The effect of CYP3A4 inhibition or induction on the pharmacokinetics and pharmacodynamics of orally administered ruxolitinib (INCB018424 phosphate) in healthy volunteers. J Clin Pharmacol. 2012;52(6):809-818.21602517
Shin KH, Kim BH, Kim TE, et al. The effects of ketoconazole and rifampicin on the pharmacokinetics of mirodenafil in healthy Korean male volunteers: an open-label, one-sequence, three-period, three-treatment crossover study. Clin Ther. 2009;31(12):3009-3020.20110038
Shinoda M, Akita M, Hasegawa M, Hasegawa T, Nabeshima T. The necessity of adjusting the dosage of zonisamide when coadministered with other anti-epileptic drugs. Biol Pharm Bull. 1996;19(8):1090-1092.8874824
Shipochliev T. Uterotonic action of extracts from a group of medicinal plants [in Bulgarian]. Vet Med Nauki. 1981;18(4):94-98.7314446
Shoaf SE, Bricmont P, Mallikaarjun S. Effects of CYP3A4 inhibition and induction on the pharmacokinetics and pharmacodynamics of tolvaptan, a non-peptide AVP antagonist in healthy subjects. Br J Clin Pharmacol. 2012;73(4):579-587.21988334
Shon J-H, Yeo C-W, Liu K-H, Lee S-S, Cha I-J, Shin J-G. Itraconazole and rifampin alter significantly the disposition and antihistamine effect of ebastine and its metabolites in healthy participants. J Clin Pharmacol. 2010;50(2):195-204.19841159
Shprecher D, Sloan CT, Sederholm B. Neuropsychiatric side effects of cyclobenzaprine. BMJ Case Rep. 2013; pii: bcr2013008997.23645641
Sigaroudi A, Kullak-Ublick GA, Weiler S. Concomitant administration of rifampicin and oxcarbazepine results in a significant decrease of the active MHD metabolite of oxcarbazepine. Eur J Clin Pharmacol. 2016;72(3):377-378.26631062
Sirturo (bedaquiline) [prescribing information]. Titusville, NJ: Janssen Products LP; May 2015.
Sirvent T, Gibson DM. Rapid isocratic HPLC analysis of hypericins. J Liq Chromatogr Relat Technol. 2000;23(2):251-259.
Skelaxin (metaxalone) [prescribing information]. Bristol, TN: King Pharmaceuticals Inc; March 2018.
Sklerov J, Levine B, Moore KA, King T, Fowler D. A fatal intoxication following the ingestion of 5-methoxy-N,N-dimethyltryptamine in an ayahuasca preparation. J Anal Toxicol. 2005;29(8):838-841.16356341
Small D, Ferguson-Sells L, Dahdah N, Bonnet D, Landry J, Li B. Pharmacokinetics and safety of tadalafil in a paediatric population with pulmonary arterial hypertension: A multiple ascending-dose study. Br J Clin Pharmacol. 2019;85(10):2302-2309.31222765
Smith P, Bullock JM, Booker BM, Haas CE, Berenson CS, Jusko WJ. The influence of St. John's wort on the pharmacokinetics and protein binding of imatinib mesylate. Pharmacotherapy. 2004;24(11):1508-1514.15537555
Smith DA, Koch KM, Arya N, Bowen CJ, Herendeen JM, Beelen A. Effects of ketoconazole and carbamazepine on lapatinib pharmacokinetics in healthy subjects. Br J Clin Pharmacol. 2009;67(4):421-426.19371315
So EL, Wolff D, Graves NM, et al. Pharmacokinetics of tiagabine as add-on therapy in patients taking enzyme-inducing antiepilepsy drugs. Epilepsy Res. 1995;22(3):221-226.8991789
Sohonos (palovarotene) [product monograph]. Mississauga, ON, Canada: Ipsen Biopharmaceuticals Canada Inc.;

January 2022.
Soldin OP, Tonning JM. Serotonin syndrome associated with triptan monotherapy. N Engl J Med. 2008;358(20):2185-2186.18480219
Soltamox (tamoxifen) [prescribing information]. Raleigh NC: Midatech Pharma US Inc; April 2019.
Solu-Cortef (hydrocortisone) injection [prescribing information]. New York, NY: Pfizer Inc; November 2019.
Solu-Medrol (methylprednisolone) [prescribing information]. New York, NY: Pfizer Inc; May 2012.
Soma (carisoprodol) [prescribing information]. Somerset, NJ: Meda Pharmaceuticals Inc; February 2013.
Sonata (zaleplon) [prescribing information]. New York, NY: Pfizer Inc; August 2019.
Song HK. Serotonin syndrome with perioperative oxycodone and pregabalin. Pain Physician. 2013;16(5):e632-e633.24077214
Sood A, Ebbert JO, Prasad K, Croghan IT, Bauer B, Schroeder DR. A randomized clinical trial of St. John's wort for smoking cessation. J Altern Complement Med. 2010;16(7):761-767.20590478
Sorscher SM. Probable serotonin syndrome variant in a patient receiving a selective serotonin reuptake inhibitor and a 5-HT3 receptor antagonist. J Psychopharmacol. 2002;16(2):191.12095081
Sovaldi (sofosbuvir) [prescribing information]. Foster City, CA: Gilead Sciences, Inc; March 2020.
Spigset O, Adielsson G. Combined serotonin syndrome and hyponatraemia caused by a citalopram-buspirone interaction. Int Clin Psychopharmacol. 1997;12(1):61-63.9179637
Spina E, Avenoso A, Facciola G, et al. Plasma concentrations of risperidone and 9-hydroxyrisperidone: effect of comedication with carbamazepine or valproate. Ther Drug Monit. 2000;22(4):481-485.10942191
Spina E, Scordo MG, Avenoso A, Perucca E. Adverse drug interaction between risperidone and carbamazepine in a patient with chronic schizophrenia and deficient CYP2D6 activity. J Clin Psychopharmacol. 2001;21(1):108-109.11199933
Sporanox (itraconazole) [prescribing information]. Titusville, NJ: Janssen Pharmaceuticals Inc; May 2018.
Spravato (esketamine) [prescribing information]. Titusville, NJ: Janssen Pharmaceuticals Inc; March 2019.
Sprycel (dasatanib) [prescribing information]. Princeton, NJ: Bristol-Myers Squibb Company; December 2018.
Sriwiriyajan S, Mahatthanatrakul W, Ridtitid W, Jaruratanasirikul S. Effect of efavirenz on the pharmacokinetics of ketoconazole in HIV-infected patients. Eur J Clin Pharmacol. 2007;63(5):479-483.17345073
Stage TB, Pedersen RS, Damkier P, et al. Intake of St John's wort improves the glucose tolerance in healthy subjects who ingest metformin compared with metformin alone. Br J Clin Pharmacol. 2015;79(2):298-306.25223504
Stage TB, Damkier P, Christensen MM, Nielsen LB, Højlund K, Brøsen K. Impaired glucose tolerance in healthy men treated with St. John's wort. Basic Clin Pharmacol Toxicol. 2016;118(3):219-224.26346185
Stanford BJ, Stanford SC. Postoperative delirium indicating an adverse drug interaction involving the selective serotonin reuptake inhibitor, paroxetine? J Psychopharmacol. 1999;13(3):313-317.10512094
Stanford SC, Stanford BJ, Gillman PK. Risk of severe serotonin toxicity following co-administration of methylene blue and serotonin reuptake inhibitors: an update on a case report of post-operative delirium. J Psychopharmacol. 2010;24(10):1433-1438.19423610
Stark JE, Cole JL. Deinduction of p-glycoprotein resulting in delayed viral response during hepatitis C treatment. J Clin Pharm Ther. 2021;46(5):1465-1468.33534133
Starlix (nateglinide) [prescribing information]. East Hanover, NJ: Novartis Pharmaceuticals Corporation; March 2017.
Staum JM. Enzyme induction: rifampin-disopyramide interaction. DICP. 1990;24(7-8):701-703.1695794
Stavropoulos NE, Kim A, Nseyo UU, et al. Hypericum perforatum L. extract - novel photosensitizer against human bladder cancer cells. J Photochem Photobiol B. 2006;84(1):64-69.16540336
Stendra (avanafil) [prescribing information]. Cranford, NJ: Mist Pharmaceuticals LLC; August 2018.
Sternbach H. The serotonin syndrome. Am J Psychiatry. 1991;148(6):705-713.2035713
Stevinson C, Ernst E. Safety of Hypericum in patients with depression: a comparison with conventional antidepressants. CNS Drugs. 1999;11(2):125-132.
Stevinson C, Ernst E. A pilot study of Hypericum perforatum for the treatment of premenstrual syndrome. BJOG. 2000;107(7):870-876.10901558

Stivarga (regorafenib) [prescribing information]. Whippany, NJ: Bayer HealthCare Pharmaceuticals Inc; June 2020.
Stjernholm MR, Katz FH. Effects of diphenylhydantoin, phenobarbital, and diazepam on the metabolism of methylprednisolone and its sodium succinate. J Clin Endocrinol Metab. 1975;41(5):887-893.1184723
Stochmal A, Gruszcyk M. Solid phase extraction and HPLC determination of hypericin in Hypericum perforatum. Herba Pol. 1998;4:315-323.
Stott C, White L, Wright S, Wilbraham D, Guy G. A phase I, open-label, randomized, crossover study in three parallel groups to evaluate the effect of rifampicin, ketoconazole, and omeprazole on the pharmacokinetics of THC/CBD oromucosal spray in healthy volunteers. Springerplus. 2013;2(1):236.23750331
Strack DK, Leckband SG, Meyer JM. Antipsychotic prescribing practices following withdrawal of concomitant carbamazepine. J Psychiatr Pract. 2009;15(6):442-448.19934718
Stribild (elvitegravir, cobicistat, emtricitabine, and tenofovir disoproxil fumarate) [prescribing information]. Foster City, CA: Gilead Sciences Inc; August 2020.
Sublocade (buprenorphine) extended release subcutaneous injection [prescribing information]. North Chesterfield, VA: Indivior Inc.; February 2020.
Suboxone (buprenorphine/naloxone) sublingual film [prescribing information]. North Chesterfield, VA: Indivior Inc.; October 2019.
Sugimoto K, Ohmori M, Tsuruoka S, et al. Different effects of St John's wort on the pharmacokinetics of simvastatin and pravastatin. Clin Pharmacol Ther. 2001;70(6):518-524.11753267
Sular (nisoldipine) [prescribing information]. Zug, Switzerland: Covis Pharma; December 2016.
Sun L, McDonnell D, Yu M, Kumar V, von Moltke L. Phase I open-label study to evaluate the effects of rifampin on the pharmacokinetics of olanzapine and samidorphan administered in combination in healthy human subjects. Clin Drug Investig. 2019;39(5):477-484.30888624
Sun L, Mills R, Sadler BM, Rege B. Population pharmacokinetics of olanzapine and samidorphan when administered in combination in healthy subjects and patients with schizophrenia [published online May 21, 2021]. J Clin Pharmacol. doi: 10.1002/jcph.1911.34018607
Sunvepra (asunaprevir) [product monograph]. Montreal, Canada: Bristol-Myers Squibb Canada; March 2016.
Sunwoo YE, Nguyen PTT, Chien CM, Ryu JY, Shon J, Shin J. Effect of rifampin on enantioselective disposition and anti-hypertensive effect of benidipine. Br J Clin Pharmacol. 2019;85(4):737-745.30589098
Supect (radotinib) capsules [KR prescribing information]. Accessed September 1, 2014. http://drug.mfds.go.kr/html/bxsSearchDrugProduct.jsp?item_Seq=201200121.
Suphanklang J, Santimaleeworagun W, Supasyndh O. Combination of escitalopram and rasagiline induced serotonin syndrome: a case report and review literature. J Med Assoc Thai. 2015;98(12):1254-1257.27004312
Surmaitis RM, Nappe TM, Cook MD. Serotonin syndrome associated with therapeutic metaxalone in a patient with cirrhosis [published ahead of print June 19, 2015]. Am J Emerg Med.26159819
Sustiva (efavirenz) [prescribing information]. Princeton, NJ: Bristol-Myers Squibb Co; October 2019.
Sutent [prescribing information]. New York, NY: Pfizer Labs; May 2011.
Svensson EM, Aweeka F, Park JG, Marzan F, Dooley KE, Karlsson MO. Model-based estimates of the effects of efavirenz on bedaquiline pharmacokinetics and suggested dose adjustments for patients coinfected with HIV and tuberculosis. Antimicrob Agents Chemother. 2013;57(6):2780-2787.23571542
Svensson EM, Murray S, Karlsson MO, Dooley KE. Rifampicin and rifapentine significantly reduce concentrations of bedaquiline, a new anti-TB drug. J Antimicrob Chemother. 2015;70(4):1106-1114.25535219
Symdeko (tezacaftor and ivacaftor) [prescribing information]. Boston, MA: Vertex Pharmaceuticals Inc; February 2018.
Symfi (efavirenz, lamivudine and tenofovir disoproxil fumarate) [prescribing information]. Morgantown, WV: Mylan Specialty LP; October 2019.
Symproic (naldemedine) [prescribing information]. Florham Park, NJ: Shionogi Inc; January 2018.
Symtuza (darunavir, cobicistat, emtricitabine, and tenofovir alafenamide) [prescribing information]. Titusville, NJ: Janssen Therapeutics; December 2020.

Tabrecta (capmatinib) [prescribing information]. East Hanover, NJ: Novartis Pharmaceuticals Corporation; May 2020.
Tafinlar (dabrafenib) [prescribing information]. East Hanover, NJ: Novartis Pharmaceuticals Corporation; April 2020.
Tagrisso (osimertinib) [prescribing information]. Wilmington, DE: AstraZeneca Pharmaceuticals LP; December 2020.
Takahashi H, Yoshida K, Higuchi H, Shimizu T. Development of parkinsonian symptoms after discontinuation of carbamazepine in patients concurrently treated with risperidone: two case reports. Clin Neuropharmacol. 2001;24(6):358-360.11801812
Takane H, Nosaka A, Wakushima H, Hosokawa K, Ieiri I. Rifampin reduces the analgesic effect of transdermal fentanyl. Ann Pharmacother. 2005;39(12):2139-2140.16288064
Takeda M, Nishinuma K, Yamashita S, Matsubayashi T, Tanino S, Nishimura T. Serum haloperidol levels of schizophrenics receiving treatment for tuberculosis. Clin Neuropharmacol. 1986;9(4):386-397.3731135
Takenaka O, Ferry J, Saeki K, Laurenza A. Pharmacokinetic/pharmacodynamic analysis of adjunctive perampanel in subjects with partial-onset seizures. Acta Neurol Scand. 2018;137(4):400-408.29171002
Tanaka A, Nagamatsu T, Yamaguchi M, et al. Myoclonus after dextromethorphan administration in peritoneal dialysis. Ann Pharmacother. 2011;45(1):e1.21228393
Tanaka C, Yin OQ, Smith T, et al. Effects of rifampin and ketoconazole on the pharmacokinetics of nilotinib in healthy participants. J Clin Pharmacol. 2011;51(1):75-83.20702754
Tannergren C, Engman H, Knutson L, Hedeland M, Bondesson U, Lennernas H. St John's wort decreases the bioavailability of R- and S-verapamil through induction of the first-pass metabolism. Clin Pharmacol Ther. 2004;75(4):298-309.15060508
Tapaninen T, Neuvonen PJ, Niemi M. Rifampicin reduces the plasma concentrations and the renin-inhibiting effect of aliskiren. Eur J Clin Pharmacol. 2010;66(5):497-502.20179914
Tarceva (erlotinib) [prescribing information]. Northbrook, IL: OSI Pharmaceuticals LLC; October 2016.
Tardivo JP, Wainwright M, Baptista MS. Local clinical phototreatment of herpes infection in São Paulo. Photodiagnosis Photodyn Ther. 2012;9(2):118-121.22594981
Targretin (bexarotene) capsule [prescribing information]. Bridgewater, NJ: Valeant Pharmaceuticals North America LLC; July 2015.
Tartara A, Galimberti CA, Manni R, et al. Differential effects of valproic acid and enzyme-inducing anticonvulsants on nimodipine pharmacokinetics in epileptic patients. Br J Clin Pharmacol. 1991;32(3):335-340.1777370
Tashakori A, Afshari R. Tramadol overdose as a cause of serotonin syndrome: a case series. Clin Toxicol (Phila). 2010;48(4):337-341.20367390
Tasigna (nilotinib) [prescribing information]. East Hanover, NJ: Novartis Pharmaceuticals Corporation; December 2020.
Tateo F, Martello S, Lubian E, Bononi M. Hypericin and hypericin-like substances: analytical problems. Dev Food Sci. 1998;40:143-157.
Tateishi T, Watanabe M, Kumai T, et al. CYP3A is responsible for N-dealkylation of haloperidol and bromperidol and oxidation of their reduced forms by human liver microsomes. Life Sci. 2000;67(24):2913-2920.11133003
Tavalisse (fostamatinib) [prescribing information]. South San Francisco, CA: Rigel Pharmaceuticals Inc; April 2018.
Tavneos (avacopan) [prescribing information]. Cincinnati, OH: ChemoCentryx, Inc.; October 2021.
Taysofy (ethinyl estradiol and norethindrone) [prescribing information]. Bridgewater, NJ: Amneal Pharmaceuticals LLC; May 2021.
Tazverik (tazemetostat) [prescribing information]. Cambridge, MA: Epizyme, Inc.; January 2020.
Technivie (ombitasvir/paritaprevir/ritonavir) [prescribing information]. North Chicago, IL: AbbVie Inc; December 2019.
Tegretol (carbamazepine) [prescribing information]. East Hanover, NJ: Novartis Pharmaceuticals Corporation; March 2018.
Tekturna (aliskiren) [prescribing information]. Orlando, FL: Noden Pharma USA Inc; June 2020.
Tenex (guanfacine) [prescribing information]. Bridgewater, NJ: Promius Pharma LLC; July 2013.
Teng R, Mitchell P, Butler K. Effect of rifampicin on the pharmacokinetics and pharmacodynamics of ticagrelor in healthy subjects. Eur J Clin Pharmacol. 2013;69(4):877-883.23093043

Tepadina (thiotepa) [prescribing information]. Lugano, Switzerland; ADIENNE SA; January 2017.
Thachil AF, Mohan R, Bhugra D. The evidence base of complementary and alternative therapies in depression. J Affect Disord. 2007;97(1-3):23-35.16926053
Thandar Y, Gray A, Botha J, Mosam A. Topical herbal medicines for atopic eczema: a systematic review of randomized controlled trials. Br J Dermatol. 2017;176(2):330-343.27373699
The Medicines and Healthcare products Regulatory Agency (MHRA). Levonorgestrel-containing emergency hormonal contraception: advice on interactions with hepatic enzyme inducers and contraceptive efficacy. Drug Safety Update. 2016;10(2):1-8. Accessed September 28, 2016.
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/553274/Sept_2016_DSU.pdf.
Thiopental [summary of product characteristics]. Reading, Berkshire, United Kingdom: Archimedes Pharma UK Limited; January 2014.
Thomas M, DiPaula BA, Grimm B. Important drug interaction involving phenytoin and quetiapine. Ment Health Clin. 2018;8(4):195-197.30155396
Tibella (tibolone) [product monograph]. Toronto, ON, Canada: BioSyent Pharma Inc.; May 2019.
Tibsovo (ivosidenib) [prescribing information]. Cambridge, MA: Agios Pharmaceuticals Inc; May 2019.
Tissot TA. Probable meperidine-induced serotonin syndrome in a patient with a history of fluoxetine use. Anesthesiology. 2003;98(6):1511-1512.12766667
Tivicay (dolutegravir) [prescribing information]. Research Triangle Park, NC: ViiV Healthcare; August 2013.
Tivicay (dolutegravir) [product monograph]. Laval, Quebec, Canada: ViiV Healthcare ULC; June 2015.
Tolsura (itraconazole) [prescribing information]. Greenville, NC: Mayne Pharma; June 2020.
Topletz-Erickson A, Lee A, Rustia EL, et al. Evaluation of safety and clinically relevant drug-drug interactions with tucatinib in healthy volunteers. Clin Pharmacokinet. 2022;61(10):1417-1426.35931943
Torisel (temsirolimus) [prescribing information]. Philadelphia, PA: Wyeth Pharmaceuticals Inc; March 2018.
Tortorici MA, Matschke K, Korth-Bradley JM, DiLea C, Lasseter KC. The effect of rifampin on the pharmacokinetics of sirolimus in healthy volunteers. Clin Pharmacol Drug Dev. 2014;3(1):51-56.27128230
Townsend R, Dietz A, Hale C, et al. Pharmacokinetic evaluation of CYP3A4-mediated drug-drug interactions of isavuconazole with rifampin, ketoconazole, midazolam, and ethinyl estradiol/norethindrone in healthy adults. Clin Pharmacol Drug Dev. 2017;6(1):44-53.27273461
Tradjenta (linagliptin) [prescribing information]. Ridgefield, CT: Boehringer Ingelheim Pharmaceuticals Inc; July 2019.
Trana C, Toth G, Wijns W, Barbato E. St. John's wort in patients non-responders to clopidogrel undergoing percutaneous coronary intervention: a single-center randomized open-label trial (St. John's Trial). J Cardiovasc Transl Res. 2013;6(3):411-414.23463297
Trazodone [prescribing information]. Pulaski, TN: AvKare; October 2020.
Trijardy XR (empagliflozin, linagliptin, and metformin) [prescribing information]. Ridgefield, CT: Boehringer Ingelheim Pharmaceuticals Inc; January 2020.
Trikafta (elexacaftor, tezacaftor, and ivacaftor) [prescribing information]. Boston, MA: Vertex Pharmaceuticals Incorporated; October 2019.
Trileptal (oxcarbazepine) [prescribing information]. East Hanover, NJ: Novartis Pharmaceuticals Corp; November 2017.
Triumeq (dolutegravir, abacavir, and lamivudine) [product monograph]. Laval, Quebec, Canada: Viiv Healthcare ULC; November 2021.
Truseltiq (infigratinib) [prescribing information]. Brisbane, CA: QED Therapeutics Inc; May 2021.
Tukysa (tucatinib) [prescribing information]. Bothell, WA: Seattle Genetics, Inc.; April 2020.
Turalio (pexidartinib) [prescribing information]. Basking Ridge, NJ: Daiichi Sankyo, Inc.; August 2019.
Turkel SB, Nadala JG, Wincor MZ. Possible serotonin syndrome in association with 5-HT(3) antagonist agents. Psychosomatics. 2001;42(3):258-260.11351116
Turkoglu S. Serotonin syndrome with sertraline and methylphenidate in an adolescent. Clin Neuropharmacol. 2015;38(2):65-66.25768857

Turton-Weeks SM, Barone GW, Gurley BJ, Ketel BL, Lightfoot ML, Abul-Ezz SR. St John's wort: a hidden risk for transplant patients. Prog Transplant. 2001;11(2):116-120.11871046
Twum-Barima Y, Carruthers SG. Quinidine-rifampicin interaction. N Engl J Med. 1981;304(24):1466-1469.7231477
Tybost (cobicistat) [prescribing information]. Foster City, CA: Gilead Sciences Inc; August 2020.
Tykerb [prescribing information]. Research Triangle Park, NC: GlaxoSmithKline; August 2011
Ubrelvy (ubrogepant) [prescribing information]. Madison, NJ: Allergan USA Inc; December 2019.
Udwadia ZF, Sridhar G, Beveridge CJ, Soutar C, McHardy GJ, Leitch AG. Catastrophic deterioration in asthma induced by rifampicin in steroid-dependent asthma. Respir Med. 1993;87(8):629.8290748
Ujiie Y, Fukasawa T, Yasui-Furukori N, Suzuki A, Tateishi T, Otani K. Rifampicin markedly decreases plasma concentration and hypnotic effect of brotizolam. Ther Drug Monit. 2006;28(3):299-302.16778710
Ultram (tramadol) [prescribing information]. Titusville, NJ: Janssen Pharmaceuticals Inc; August 2017.
Upreti VV, Boulton DW, Li L, et al. Effect of rifampicin on the pharmacokinetics and pharmacodynamics of saxagliptin, a dipeptidyl peptidase-4 inhibitor, in healthy subjects. Br J Clin Pharmacol. 2011;72(1):92-102.21651615
Upton R, ed. St. John's wort Hypericum perforatum. In: American Herbal Pharmacopoeia and Therapeutic Compendium. Scotts Valley, CA: American Herbal Pharmacopoeia and Therapeutic Compendium; 1997.
US Congress (103rd, 1993-1994). S.784—Dietary Supplement Health and Education Act of 1994. Congress.gov website. Published 1994. Accessed July 26, 2018. https://www.congress.gov/bill/103rd-congress/senate-bill/784.
U.S. Food and Drug Administration. FDA Drug Safety Communication: FDA warns about several safety issues with opioid pain medicines; requires label changes. FDA website. Published March 22, 2016. Accessed March 24, 2016. http://www.fda.gov/Drugs/DrugSafety/ucm489676.htm.
Uvadex (methoxsalen) [prescribing information]. Bedminster, NJ: Therakos, Inc.; March 2021.
Uzbay TI. Hypericum perforatum and substance dependence: a review. Phytother Res. 2008;22(5):578-582.18350514
Uzbay IT. Serotonergic anti-depressants and ethanol withdrawal syndrome: a review. Alcohol Alcohol. 2008;43(1):15-24.17934195
van der Zee HH, Boer J, Prens EP, Jemec GB. The effect of combined treatment with oral clindamycin and oral rifampicin in patients with hidradenitis suppurativa. Dermatology. 2009;219(2):143-147.19590174
van Giersbergen PL, Halabi A, Dingemanse J. Pharmacokinetic interaction between bosentan and the oral contraceptives norethisterone and ethinyl estradiol. Int J Clin Pharmacol Ther. 2006;44(3):113-118.16550733
van Marle W, Woods KL, Beeley L. Concurrent steroid and rifampicin therapy. Br Med J. 1979;1(6169):1020.435934
Varubi (rolapitant) [prescribing information]. Deerfield, IL: TerSera Therapeutics LLC; August 2020.
VA/DoD Clinical Practice Guideline. (2022). The management of major depressive disorder. Washington, DC: U.S. Government Printing Office. https://www.healthquality.va.gov/guidelines/MH/mdd/VADoDMDDCPGFinal508.pdf
Velcade [prescribing information]. Cambridge, MA: Millennium Pharmaceuticals, Inc; November 2011.
Velcade (bortezomib) [prescribing information]. Cambridge, MA: Millennium Pharmaceuticals Inc; April 2019.
Venclexta (venetoclax) [prescribing information]. North Chicago, IL: AbbVie Inc; April 2016.
Venlafaxine + tramadol: serotonin syndrome. Prescrire Int. 2004;13(70):57.15148976
Verelan (verapamil hydrochloride) [prescribing information]. Philadelphia, PA: Lannett Company, Inc.; October 2019.
Verelan PM (verapamil hydrochloride) [prescribing information]. Philadelphia, PA: Lannett Company, Inc.; October 2019.
Verma M, Singh T, Chhatwal J, Saini V, Pawar B. Rifampicin induced steroid unresponsiveness in nephrotic syndrome. Indian Pediatr. 1994;31(11):1437.7896353
Vermeulen A, Piotrovsky V, Ludwig EA. Population pharmacokinetics of risperidone and 9-hydroxyrisperidone in patients with acute episodes associated with bipolar I disorder. J Pharmacokinet Pharmacodyn. 2007;34(2):183-206.17136449
Verotta L, Appendino G, Belloro E, Jakupovic J, Bomardelli E. Furohyperforin, a prenylated phloroglucinol from St. John's wort (Hypericum perforatum). J Nat Prod. 1999:62(5):770-772.10346967
Verotta L, Appendino G, Jakupovic J, Bombardelli E. Hyperforin analogues from St. John's wort (Hypericum perforatum). J Nat Prod. 2000;63(3):412-415.10757735

Verzenio (abemaciclib) [prescribing information]. Indianapolis, IN: Lilly USA LLC; August 2018.
Vfend (voriconazole) [prescribing information]. New York, NY: Pfizer Inc; April 2021.
Viagra (sildenafil) [prescribing information]. New York, NY: Pfizer Inc; December 2017.
Viekira Pak (ombitasvir/paritaprevir/ritonavir/dasabuvir) [prescribing information]. North Chicago, IL: AbbVie Inc; December 2019.
Viibryd (vilazodone) [prescribing information]. Madison, WI: Allergan USA Inc; January 2020.
Villanueva V, Majid O, Nabangchang C, Yang H, Laurenza A, Ferry J, Hussein Z. Pharmacokinetics, exposure-cognition, and exposure-efficacy relationships of perampanel in adolescents with inadequately controlled partial-onset seizures. Epilepsy Res. 2016;127:126-134.27595590
Villikka K, Kivisto KT, Lamberg TS, Kantola T, Neuvonen PJ. Concentrations and effects of zopiclone are greatly reduced by rifampicin. Br J Clin Pharmacol. 1997;43(5):471-474.9159561
Villikka K, Kivistö KT, Mäenpää H, Joensuu H, Neuvonen PJ. Cytochrome P450-inducing antiepileptics increase the clearance of vincristine in patients with brain tumors. Clin Pharmacol Ther. 1999;66(6):589-593.10613614
Viracept (nelfinavir) [prescribing information]. Research Triangle Park, NC: ViiV Healthcare Company; September 2016.
Viramune (nevirapine) [prescribing information]. Ridgefield, CT: Boehringer Ingelheim Pharmaceuticals Inc; September 2018.
VIMRx Successfully Completes Phase I/II Clinical Study of VIMRxyn Synthetic Hypericin for the Treatment of Glioblastoma Brain Cancer. Business Wire. October 28, 1998.
Vishwanathan K, Dickinson PA, So K, et al. The effect of itraconazole and rifampicin on the pharmacokinetics of osimertinib. Br J Clin Pharmacol. 2018;84(6):1156-1169.29381826
Visudyne (verteporfin) [prescribing information]. Rochester, MI: JHP Pharmaceuticals LLC; June 2012.
Vitekta (elvitegravir) [prescribing information]. Foster City, CA: Gilead Sciences Inc; July 2015.
Vitrakvi (larotrectinib) [prescribing information]. Stamford, CT: Loxo Oncology, Inc.; November 2018.
Vizcaychipi MP, Walker S, Palazzo M. Serotonin syndrome triggered by tramadol. Br J Anaesth. 2007;99(6):919.18006535
Volz HP, Murck H, Kasper S, Möller HJ. St John's wort extract (LI 160) in somatoform disorders: results of a placebo-controlled trial. Psychopharmacology (Berl). 2002;164(3):294-300. doi:10.1007/s00213-002-1171-6. Epub 2002 Jul 17. Erratum in: Psychopharmacology (Berl). 2003;167(3):333.12424553
Vonjo (pacritinib) [prescribing information]. Seattle, WA: CTI BioPharma Corp.; February 2022.
Voquezna Dual Pak (vonoprazan, amoxicillin) [prescribing information]. Buffalo Grove, IL: Phathom Pharmaceuticals Inc; May 2022.
Voquezna Triple Pak (vonoprazan, amoxicillin, clarithromycin) [prescribing information]. Buffalo Grove, IL: Phathom Pharmaceuticals Inc; May 2022.
Vosevi (sofosbuvir, velpatasvir, and voxilaprevir) [prescribing information]. Foster City, CA: Gilead Sciences, Inc; November 2019.
Votrient (pazopanib) [prescribing information]. East Hanover, NJ: Novartis Pharmaceuticals Corporation; July 2020.
Vraylar (cariprazine) [prescribing information]. Madison, NJ: Allergan USA, Inc.; May 2019.
Vraylar (cariprazine) [product monograph]. St-Laurent, Quebec, Canada: AbbVie Corporation; September 2022.
Vu L, Cox GF, Ibrahim J, et al. Effects of paroxetine, ketoconazole, and rifampin on the metabolism of eliglustat, an oral substrate reduction therapy for Gaucher disease type 1. Mol Genet Metab Rep. 2020;22:100552.31993325
Vyvanse (lisdexamfetamine) [prescribing information]. Lexington, MA: Shire US Inc; July 2017.
Waade RB, Christensen H, Rudberg I, Refsum H, Hermann M. Influence of comedication on serum concentrations of aripiprazole and dehydroaripiprazole. Ther Drug Monit. 2009;31(2):233-238.19142178
Wakix (pitolisant) [UK summary of product characteristics]. Paris, France: Bioprojet Pharma; March 2017.
Wakix (pitolisant) [EMA summary of product characteristics]. Paris, France: Bioprojet Pharma; October 2020.
Wallace Jr RJ, Brown BA, Griffith DE, Girard W, Tanaka K. Reduced serum levels of clarithromycin in patients treated with multidrug regimens including rifampin or rifabutin for Mycobacterium avium-M. intracellulare infection. J

Infect Dis. 1995;171(3):747-750.7876634
Wallander KM, Ohman I, Dahlin M. Zonisamide: pharmacokinetics, efficacy, and adverse events in children with epilepsy. Neuropediatrics. 2014;45(6):362-370.25133701
Wallender E, Vucicevic K, Jagannathan P, et al. Predicting optimal dihydroartemisinin-piperaquine regimens to prevent malaria during pregnancy for human immunodeficiency virus-infected women receiving efavirenz. J Infect Dis. 2018;217(6):964-972.29272443
Walter G, Rey JM. Use of St. John's wort by adolescents with a psychiatric disorder. J Child Adolesc Psychopharmacol. 1999;9(4):307-311.10630461
Wan H, Chen Y. Effects of antidepressive treatment of Saint John's wort extract related to autonomic nervous function in women with irritable bowel syndrome. Int J Psychiatry Med. 2010;40(1):45-56.20565044
Wang LS, Zhou G, Zhu B, et al. St John's wort induces both cytochrome P450 3A4-catalyzed sulfoxidation and 2C19-dependent hydroxylation of omeprazole. Clin Pharmacol Ther. 2004;75(3):191-197.15001970
Wang X, Wang, J, Arora S, et al. Pharmacokinetic interactions of rolapitant with cytochrome P450 3A substrates in healthy subjects. J Clin Pharmacol. 2019;59(4):488-499.30422319
Wang XD, Li JL, Su QB, et al. Impact of the haplotypes of the human pregnane X receptor gene on the basal and St John's wort-induced activity of cytochrome P450 3A4 enzyme. Br J Clin Pharmacol. 2009;67(2):255-261.19173680
Wang Z, Gorski JC, Hamman MA, Huang SM, Lesko LJ, Hall SD. The effects of St John's wort (Hypericum perforatum) on human cytochrome P450 activity. Clin Pharmacol Ther. 2001;70(4):317-326. ***11673747***
Wang Z, Hamman MA, Huang SM, Lesko LJ, Hall SD. Effect of St John's wort on the pharmacokinetics of fexofenadine. Clin Pharmacol Ther. 2002;71(6):414-420.12087344
Wang K, Yao X, Zhang M, et al. Comprehensive PBPK model to predict drug interaction potential of zanubrutinib as a victim or perpetrator. CPT Pharmacometrics Syst Pharmacol. 2021;10(5):441-454.33687157
Wanwimolruk S, Kang W, Coville PF, Viriyayudhakorn S, Thitiarchakul S. Marked enhancement by rifampicin and lack of effect of isoniazid on the elimination of quinine in man. Br J Clin Pharmacol. 1995;40(1):87-91.8527275
Wassner SJ, Malekzadeh MH, Pennisi AJ, Ettenger RB, Uittenbogaart CH, Fine RN. Allograft survival in patients receiving anticonvulsant medications. Clin Nephrol. 1977;8(1):293-297.328199
Watanabe K, Yamaori S, Funahashi T, Kimura T, Yamamoto I. Cytochrome P450 enzymes involved in the metabolism of tetrahydrocannabinols and cannabinol by human hepatic microsomes. Life Sci. 2007;80(15):1415-1419.17303175
Weber W, Vander Stoep A, McCarty RL, Weiss NS, Biederman J, McClellan J. Hypericum perforatum (St. John's wort) for attention-deficit/hyperactivity disorder in children and adolescents: a randomized controlled trial. JAMA. 2008;299(22):2633-2641.18544723
Weeks P, Sieg A, Vahdat K, Raissi , Nathan S. Improved ticagrelor antiplatelet effect on discontinuation of phenytoin. Ann Pharmacother. 2014;48(5):644-647.24477376
Weiner M, Benator D, Peloquin CA, et al. Evaluation of the drug interaction between rifabutin and efavirenz in patients with HIV infection and tuberculosis. Clin Infect Dis. 2005;41(9):1343-1349.16206114
Wiggins BS, Northup A, Johnson D, Senfield J. Reduced anticoagulant effect of dabigatran in a patient receiving concomitant phenytoin. Pharmacotherapy. 2016;36(2):e5-e7.26846610
Will-Shahab L, Bauer S, Kunter U, Roots I, Brattström A. St. John's wort extract (Ze 117) does not alter the pharmacokinetics of a low-dose oral contraceptive. Eur J Clin Pharmacol. 2009;65(3):287-294.19015839
Wind S, Giessmann T, Jungnik A, et al. Pharmacokinetic drug interactions of afatinib with rifampicin and ritonavir. Clin Drug Investig. 2014;34(3):173-182.24399452
Winter H, Egizi E, Murray S, et al. Evaluation of the pharmacokinetic interaction between repeated doses of rifapentine or rifampin and a single dose of bedaquiline in healthy adult subjects. Antimicrob Agents Chemother. 2015;59(2):1219-1224.25512422
Winter HR, Trapnell CB, Slattery JT, et al. The effect of clarithromycin, fluconazole, and rifabutin on dapsone hydroxylamine formation in individuals with human immunodeficiency virus infection (AACTG 283). Clin Pharmacol Ther. 2004;76(6):579-587.15592329

Wooltorton E. Triptan migraine treatments and antidepressants: risk of serotonin syndrome. CMAJ. 2006;175(8):874.16988028
Wong YW, Yeh C and Thyrum PT. The effects of concomitant phenytoin administration on the steady-state pharmacokinetics of quetiapine. J Clin Psychopharmacol. 2001;21(1):89-93.11199955
Wrishko RE, Dingemanse J, Yu A, Darstein C, Phillips DL, Mitchell MI. Pharmacokinetic interaction between tadalafil and bosentan in healthy male subjects. J Clin Pharmacol. 2008;48(5):610-618.18305126
Wrishko RE, McCrea JB, Yee KL, et al. Effect of CYP3A inhibition and induction on the pharmacokinetics of suvorexant: two phase I, open-label, fixed-sequence trials in healthy subjects. Clin Drug Investig. 2019;39(5):441-451.30810914
Wu F, Krishna G, Surapaneni S. Physiologically based pharmacokinetic modeling to assess metabolic drug-drug interaction risks and inform the drug label for fedratinib. Cancer Chemother Pharmacol. 2020;86(4):461-473.32886148
Wurglics M, Schubert-Zsilavecz M. Hypericum perforatum: a 'modern' herbal antidepressant: pharmacokinetics of active ingredients. Clin Pharmacokinet. 2006;45(5):449-468.16640452
Xadago (safinamide) [prescribing information]. Louisville, KY: US WorldMeds LLC; June 2017.
Xalkori [prescribing information]. New York, NY: Pfizer Inc; June 2019.
Xanax (alprazolam) [prescribing information]. New York, NY: Pfizer Inc; March 2021.
Xarelto (rivaroxaban) [prescribing information]. Titusville, NJ: Janssen Pharmaceuticals Inc.; March 2017.
Xcopri (cenobamate) [prescribing information]. Paramus, NJ: SK Life Science Inc; August 2020.
Xelenta (lefamulin) [prescribing information]. Ireland: Nabriva Therapeutics US, Inc.; August 2019.
Xeljanz (tofacitinib) [prescribing information]. New York, NY: Pfizer Inc; December 2019.
Xerava (eravacycline) [prescribing information]. Watertown, MA: Tetraphase Pharmaceuticals Inc; August 2018.
Xie R, Tan LH, Polasek EC, et al. CYP3A and P-glycoprotein activity induction with St. John's Wort in healthy volunteers from 6 ethnic populations. J Clin Pharmacol. 2005;45(3):352-356.15703370
Xospata (gilteritinib) [prescribing information]. Northbrook, IL: Astellas Pharma US Inc; May 2019.
Xtampza ER (oxycodone) capsule, extended release [prescribing information]. Cincinnati, OH: Patheon Pharmaceuticals; March 2021.
Xu H, O'Gorman M, Tan W, Brega N, Bello A. The effects of ketoconazole and rifampin on the single-dose pharmacokinetics of crizotinib in healthy subjects. Eur J Clin Pharmacol. 2015;71(12):1441-1449.26381275
Xu H, Williams KM, Liauw WS, Murray M, Day RO, McLachlan AJ. Effects of St John's wort and CYP2C9 genotype on the pharmacokinetics and pharmacodynamics of gliclazide. Br J Pharmacol. 2008;153(7):1579-1586.18204476
Yamada S, Yasui-Furukori N, Akamine Y, Kaneko S, Uno T. Effects of the P-glycoprotein inducer carbamazepine on fexofenadine pharmacokinetics. Ther Drug Monit. 2009;31(6):764-768.19855315
Yasui-Furukori N, Kubo K, Ishioka M, Tsuchimine S, Inoue Y. Interaction between paliperidone and carbamazepine. Ther Drug Monit. 2013;35(5):649-652.24052066
Yasui-Furukori N, Tateishi T. Carbamazepine decreases antihypertensive effect of nilvadipine. J Clin Pharmacol. 2002;42(1):100-103.11808819
Yee KL, Khalilieh SG, Sanchez RI, et al. The effect of single and multiple doses of rifampin on the pharmacokinetics of doravirine in healthy subjects. Clin Drug Investig. 2017;37(7):659-667.28353169
Yokoyama K, Yamada T, Terachi S, et al. Milnacipran influences the indexes of I-metaiodobenzylguanidine scintigraphy in elderly depressed patients. Psychiatry Clin Neurosci. 2014;68(3):169-175.24895731
Yomamoto Y, Shiratani Y, Asai S, et al. Pharmacokinetics, tolerability, and clinical effectiveness of perampanel in Japanese patients with epilepsy. Seizure. 2020; 83:181-186.33171342
Yondelis (trabectedin) [product monograph]. Toronto, ON: Janssen Inc; July 2014.
Yoon YJ, Kim KB, Kim H, et al. Characterization of benidipine and its enantiomers' metabolism by human liver cytochrome P450 enzymes. Drug Metab Dispos. 2007;35(9):1518-1524.17537876
Yu Y, Loi CM, Hoffman J, Wang D. Physiologically based pharmacokinetic modeling of palbociclib. J Clin

Pharmacol. 2017;57(2):173-184.27402157
Yücel A, Kan Y, Yesilada E, Akın O. Effect of St.John's wort (Hypericum perforatum) oily extract for the care and treatment of pressure sores; a case report. J Ethnopharmacol. 2017;196:236-241.28011162
Yue QY, Bergquist C, Gerdén B. Safety of St John's wort (Hypericum perforatum).Lancet. 2000;355(9203):576-577.10683030
Yukawa E, Hokazono T, Funakoshi A, et al. Epidemiologic investigation of the relative clearance of haloperidol by mixed-effect modeling using routine clinical pharmacokinetic data in Japanese patients. J Clin Psychopharmacol. 2000;20(6):685-690.11106142
Yukawa E, Hokazono T, Yukawa M, et al. Population pharmacokinetics of haloperidol using routine clinical pharmacokinetic data in Japanese patients. Clin Pharmacokinet. 2002;41(2):153-159.11888334
Zaccara G, Gangemi PF, Bendoni L, Menge GP, Schwabe S, Monza GC. Influence of single and repeated doses of oxcarbazepine on the pharmacokinetic profile of felodipine. Ther Drug Monit. 1993;15(1):39-42.8451779
Zahir H, Greenberg J, Shuster D, Hsu C, Watanabe K, LaCreta F. Evaluation of absorption and metabolism-based DDI potential of pexidartinib in healthy subjects. Clin Pharmacokinet. 2022;61(11):1623-1639. doi:10.1007/s40262-022-01172-936264536
Zahir H, Kobayashi F, Zamora C, et al. Evaluation of potential drug-drug interaction risk of pexidartinib with substrates of cytochrome P450 and p-glycoprotein. J Clin Pharmacol. 2021;61(3):298-306.32918831
Zan-Extra (lercanidipine and enalapril) [product monograph]. Millers Point NSW, Australia: Mylan; November 2019.
Zarembski DG, Fischer SA, Santucci PA, Porter MT, Costanzo MR, Trohman RG. Impact of rifampin on serum amiodarone concentrations in a patient with congenital heart disease. Pharmacotherapy. 1999;19(2):249-251.10030779
Zelapar (selegiline) [prescribing information]. Bridgewater, NJ: Valeant Pharmaceuticals North America LLC; July 2014.
Zelboraf (vemurafenib) [prescribing information]. South San Francisco, CA: Genentech USA Inc; May 2020.
Zeller V, Dzeing-Ella A, Kitzis MD, Ziza JM, Mamoudy P, Desplaces N. Continuous clindamycin infusion, an innovative approach to treating bone and joint infections. Antimicrob Agents Chemother. 2010;54(1):88-92.19841148
Zemiglo (gemigliptin tartrate sesquihydrate) [KR prescribing information]. Authorization date June 27, 2012. Accessed June 5, 2017. https://nedrug.mfds.go.kr/pbp/CCBBB01/getItemDetail?itemSeq=201205933
Zepatier (elbasvir and grazoprevir) [prescribing information]. Whitehouse Station, NJ: Merck & Co Inc; December 2019.
Zepzelca (lurbinectedin) [prescribing information]. Palo Alto, CA: Jazz Pharmaceuticals Inc; June 2020.
Zhang X, Fettner S, Zwanziger E, Rowell L, Salgo M. Pharmacokinetic interaction study of ritonavir-boosted saquinavir in combination with rifabutin healthy subjects. Antimicrob Agents Chemother. 2011;55(2):680-687.21135186
Zhang S, Jin S, Griffin C, et al. Effects of itraconazole and rifampin on the pharmacokinetics of mobocertinib (TAK-788), an oral epidermal growth factor receptor inhibitor, in healthy volunteers. Clin Pharmacol Drug Dev. 2021;10(9):1044-1053.34145979
Zhang W, McIntyre C, Forbes H, et al. Effect of rifampicin on the pharmacokinetics of a single dose of vemurafenib in patients with BRAF V600 mutation-positive metastatic malignancy. Clin Pharmacol Drug Dev. 2019;6(6):837-843.30570831
Zhao XP, Zhong J, Liu XQ, Wang GJ. CYP3A4 mediated in vitro metabolism of vinflunine in human liver microsomes. Acta Pharmacol Sin. 2007;28(1):118-124.17184591
Zhou SF, Lai X. An update on clinical drug interactions with the herbal antidepressant St. John's wort. Curr Drug Metab. 2008;9(5):394-409.18537576
Zinner SH, Lagast H, Klastersky J. Antistaphylococcal activity of rifampin with other antibiotics. J Infect Dis. 1981;144(4):365-371.6270215

Zofran (ondansetron) [prescribing information]. East Hanover, NJ: Novartis Pharmaceuticals Corporation; October 2017.
Zohydro ER (hydrocodone bitartrate) [prescribing information]. San Diego, CA: Zogenix Inc; August 2014.
Zokinvy (lonafarnib) [prescribing information]. Palo Alto, CA: Eiger BioPharmaceuticals, Inc.; November 2020.
Zomig (zolmitriptan) [prescribing information]. Hayward, CA: Impax Specialty Pharma; December 2018.
Zonegran (zonisamide) [prescribing information]. Dublin, Ireland: Amdipharm Limited; April 2020.
Zontivity (vorapaxar) [prescribing information]. Parsippany, NJ: Aralez Pharmaceuticals US Inc; November 2019.
Zopiclone [product monograph]. Toronto, Ontario, Canada: Teva Canada Limited; April 2020.
Zornberg GL, Bodkin JA, Cohen BM. Severe adverse interaction between pethidine and selegiline. Lancet. 1991;337(8735):246.1670882
Zortress [prescribing information]. East Hanover, NJ: Novartis Pharmaceuticals Corporation; March 2010.
Ztalmy (ganaxolone) [prescribing information]. Radnor, PA: Marinus Pharmaceuticals Inc; March 2022.
Zubsolv (buprenorphine/naloxone) sublingual tablet [prescribing information]. Morristown, NJ: Orexo US, Inc.; October 2019.
Zydelig (idelalisib) [prescribing information]. Foster City, CA: Gilead Sciences Inc; October 2020.
Zykadia (ceritinib) [prescribing information]. East Hanover, NJ: Novartis Pharmaceuticals Corporation; March 2019.
Zytiga (abiraterone acetate) [prescribing information]. Horsham, PA: Janssen Biotech Inc; September 2018.

Further information

Always consult your healthcare provider to ensure the information displayed on this page applies to your personal circumstances.

Medical Disclaimer

Copyright © 2025 Wolters Kluwer Health

DRUG STATUS

	Availability
OTC	***Over the counter***
	CSA Schedule*
N/A	*Not a controlled drug*

User Reviews & Ratings

7.8 / 10

144 Reviews

Drugs.com Mobile App

Access drug & treatment information, identify pills, check interactions and set up personal medication records.

Download on the App Store GET IT ON Google Play

About

About Drugs.com
Advertising policy
Attribution & citations

Terms & privacy

Terms of use
Editorial policy
Privacy policy

Support

Help center
Sitemap
Contact us

Subscribe to our newsletter for the latest medication news, new drug approvals and FDA alerts.

Drugs.com provides accurate and independent information on more than 24,000 prescription drugs, over-the-counter medicines and natural products. This material is provided for educational purposes only and is not intended for medical advice, diagnosis or treatment. Data sources include Micromedex (updated 7 Apr 2025), Cerner Multum™ (updated 13 Apr 2025), ASHP (updated 10 Apr 2025) and others.

TRUSTe Certified Privacy Powered by TrustArc

@TRUST AACI CERTIFIED MEDICAL CONTENT

Ad Choices

ADVERTISEMENT

Copyright © 2000-2025 Drugs.com. All rights reserved.