PT. PFIZER INDONESIA

Local Product Document

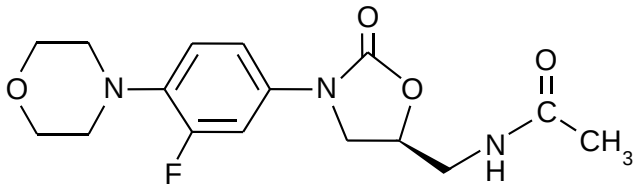
Generic Name: Linezolid
Trade Name: ZYVOX
CDS Effective Date: July 21, 2023
Supersedes: February 14, 2022

To reduce the development of drug-resistant bacteria and maintain the effectiveness of ZYVOX formulations and other antibacterial drugs, ZYVOX should be used only to treat or prevent infections that are proven or strongly suspected to be caused by bacteria.

DESCRIPTION

ZYVOX I.V. Injection contains linezolid, which is a synthetic antibacterial agent of the oxazolidinone class. The chemical name for linezolid is (S)-N-[[3-[3-Fluoro-4-(4-morpholinyl)phenyl]-2-oxo-5-oxazolidinyl] methyl]-acetamide.

The empirical formula is $C_{16}H_{20}FN_3O_4$. Its molecular weight is 337.35, and its chemical structure is represented below:



PHARMACEUTICAL FORM

ZYVOX I.V. Injection is supplied as a ready-to-use sterile isotonic solution for intravenous infusion. Each mL contains 2 mg of linezolid.

LIST OF EXCIPIENTS

Inactive ingredients are sodium citrate, citric acid, and dextrose in an aqueous vehicle for intravenous administration. The sodium (Na^+) content is 0.38 mg/mL (5 mEq per 300-mL bag; 3.3 mEq per 200-mL bag; and 1.7 mEq per 100-mL bag).

CLINICAL PHARMACOLOGY

Pharmacokinetics

The mean pharmacokinetic parameters of linezolid in adults after single and multiple oral and intravenous (IV) doses are summarized in Table 1. Plasma concentrations of linezolid at steady-state after oral doses of 600 mg given every 12 hours (q12h) are shown in Figure 1.

Table 1. Mean (Standard Deviation) Pharmacokinetic Parameters of Linezolid in Adults

Dose of Linezolid	C_{max} µg/mL	C_{min} µg/mL	T_{max} hrs	AUC* µg • h/mL	$t_{1/2}$ hrs	CL mL/min
600 mg tablet						
single dose	12.70 (3.96)	---	1.28 (0.66)	91.40 (39.30)	4.26 (1.65)	127 (48)
every 12 hours	21.20 (5.78)	6.15 (2.94)	1.03 (0.62)	138.00 (42.10)	5.40 (2.06)	80 (29)
600 mg IV injection‡						
single dose	12.90 (1.60)	---	0.50 (0.10)	80.20 (33.30)	4.40 (2.40)	138 (39)
every 12 hours	15.10 (2.52)	3.68 (2.36)	0.51 (0.03)	89.70 (31.00)	4.80 (1.70)	123 (40)
600 mg oral suspension						
single dose	11.00 (2.76)	---	0.97 (0.88)	80.80 (35.10)	4.60 (1.71)	141 (45)

* AUC for single dose = $AUC_{0-\infty}$; for multiple-dose = $AUC_{0-\tau}$
‡ Data dose-normalized from 625 mg, IV dose was given as 0.5-hour infusion.
C_{max} = Maximum plasma concentration; C_{min} = Minimum plasma concentration; T_{max} = Time to C_{max}; AUC = Area under concentration-time curve; $t_{1/2}$ = Elimination half-life; CL = Systemic clearance

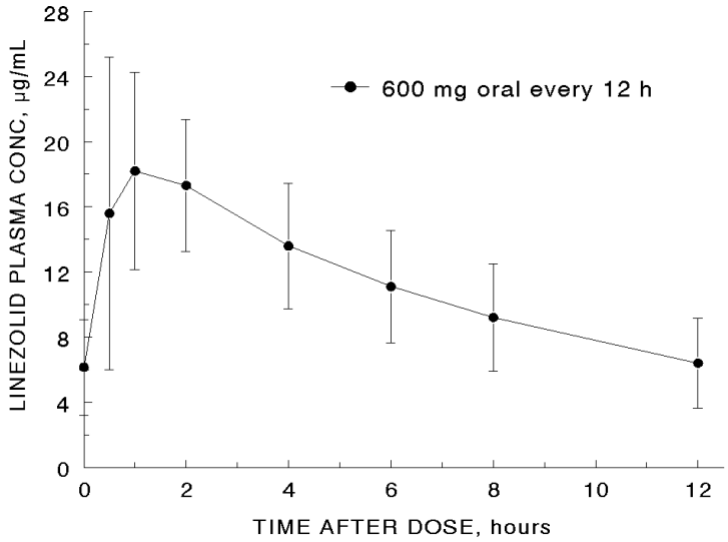


Figure 1. Plasma Concentrations of Linezolid in Adults at Steady-State Following Oral Dosing Every 12 Hours (Mean ± Standard Deviation, n=16)

Absorption: Linezolid is rapidly and extensively absorbed after oral dosing. Maximum plasma concentrations are reached approximately 1 to 2 hours after dosing, and the absolute bioavailability is approximately 100%. Therefore, linezolid may be given orally or intravenously without dose adjustment.

Linezolid may be administered without regard to the timing of meals. The time to reach the maximum concentration is delayed from 1.5 hours to 2.2 hours and C_{max} is decreased by about 17% when high fat food is given with linezolid. However, the total exposure measured as $AUC_{0-\infty}$ values is similar under both conditions.

Distribution: Animal and human pharmacokinetic studies have demonstrated that linezolid readily distributes to well-perfused tissues. The plasma protein binding of linezolid is approximately 31% and is concentration-independent. The volume of distribution of linezolid at steady-state averaged 40 to 50 liters in healthy adult volunteers.

Linezolid concentrations have been determined in various fluids from a limited number of subjects in Phase 1 volunteer studies following multiple dosing of linezolid. The ratio of linezolid in saliva relative to plasma was 1.2 to 1 and for sweat relative to plasma was 0.55 to 1.

Metabolism: Linezolid is primarily metabolized by oxidation of the morpholine ring, which results in two inactive open-ring carboxylic acid metabolites: the aminoethoxyacetic acid metabolite (A), and the hydroxyethyl glycine metabolite (B). Formation of metabolite B is mediated by a non-enzymatic chemical oxidation mechanism *in vitro*. Linezolid is not an inducer of cytochrome P450 (CYP) in rats, and it has been demonstrated from *in vitro* studies that linezolid is not detectably metabolized by human cytochrome P450 and it does not inhibit the activities of clinically significant human CYP isoforms (1A2, 2C9, 2C19, 2D6, 2E1, 3A4).

Excretion: Nonrenal clearance accounts for approximately 65% of the total clearance of linezolid. Under steady-state conditions, approximately 30% of the dose appears in the urine as linezolid, 40% as metabolite B, and 10% as metabolite A. The renal clearance of linezolid is low (average 40 mL/min) and suggests net tubular reabsorption. Virtually no linezolid appears in the feces, while approximately 6% of the dose appears in the feces as metabolite B, and 3% as metabolite A.

A small degree of nonlinearity in clearance was observed with increasing doses of linezolid, which appears to be due to lower renal and nonrenal clearance of linezolid at higher concentrations. However, the difference in clearance was small and was not reflected in the apparent elimination half-life.

Special Populations

Geriatric: The pharmacokinetics of linezolid are not significantly altered in elderly patients (65 years or older). Therefore, dose adjustment for geriatric patients is not necessary.

Pediatric: The pharmacokinetics of linezolid following a single IV dose were investigated in pediatric patients ranging in age from birth through 17 years (including premature and full-term neonates), in healthy adolescent subjects ranging in age from 12 through 17 years, and in pediatric patients ranging in age from 1 week through 12 years. The pharmacokinetic parameters of linezolid are summarized in Table 2 for the pediatric populations studied and healthy adult subjects after administration of single IV doses.

The C_{max} and the volume of distribution (V_{ss}) of linezolid are similar regardless of age in pediatric patients. However, clearance of linezolid varies as a function of age. With the exclusion of pre-term neonates less than one week of age, clearance is most rapid in the youngest age groups ranging from >1 week old to 11 years, resulting in lower single-dose systemic exposure (AUC) and shorter half-life as compared with adults. As age of pediatric patients increases, the clearance of linezolid gradually decreases, and by adolescence mean clearance values approach those observed for the adult population. There is wider inter-subject variability in linezolid clearance and systemic drug exposure (AUC) across all pediatric age groups as compared with adults.

Similar mean daily AUC values were observed in pediatric patients from birth to 11 years of age dosed every 8 hours (q8h) relative to adolescents or adults dosed every 12 hours (q12h). Therefore, the dosage for pediatric patients up to 11 years of age should be 10 mg/kg q8h. Pediatric patients 12 years and older should receive 600 mg q12h (see section **DOSAGE AND ADMINISTRATION**).

Table 2. Pharmacokinetic Parameters of Linezolid in Pediatrics and Adults Following a Single Intravenous Infusion of 10 mg/kg or 600 mg Linezolid (Mean: (%CV); [Min, Max Values])

Age Group	C_{max} µg/mL	V_{ss} L/kg	AUC* µg•h/mL	$t_{1/2}$ hrs	CL mL/min/kg
Neonatal Patients					
Pre-term** <1 week (N=9)†	12.7 (30%) [9.6, 22.2]	0.81 (24%) [0.43, 1.05]	108 (47%) [41, 191]	5.6 (46%) [2.4, 9.8]	2.0 (52%) [0.9, 4.0]
Full-term*** <1 week (N=10)†	11.5 (24%) [8.0, 18.3]	0.78 (20%) [0.45, 0.96]	55 (47%) [19, 103]	3.0 (55%) [1.3, 6.1]	3.8 (55%) [1.5, 8.8]
Full-term*** ≥1 week to ≤28 days (N=10)†	12.9 (28%) [7.7, 21.6]	0.66 (29%) [0.35, 1.06]	34 (21%) [23, 50]	1.5 (17%) [1.2, 1.9]	5.1 (22%) [3.3, 7.2]
Infant Patients >28 days to <3 Months (N=12)†	11.0 (27%) [7.2, 18.0]	0.79 (26%) [0.42, 1.08]	33 (26%) [17, 48]	1.8 (28%) [1.2, 2.8]	5.4 (32%) [3.5, 9.9]

Pediatric Patients 3 months through 11 years† (N=59)	15.1 (30%) [6.8, 36.7]	0.69 (28%) [0.31, 1.50]	58 (54%) [19, 153]	2.9 (53%) [0.9, 8.0]	3.8 (53%) [1.0, 8.5]
Adolescent Subjects and Patients 12 through 17 years‡ (N=36)	16.7 (24%) [9.9, 28.9]	0.61 (15%) [0.44, 0.79]	95 (44%) [32, 178]	4.1 (46%) [1.3, 8.1]	2.1 (53%) [0.9, 5.2]
Adult Subjects§ (N=29)	12.5 (21%) [8.2, 19.3]	0.65 (16%) [0.45, 0.84]	91 (33%) [53, 155]	4.9 (35%) [1.8, 8.3]	1.7 (34%) [0.9, 3.3]

* AUC = Single dose $AUC_{0-\infty}$
** In this data set, "pre-term" is defined as <34 weeks gestational age (Note: Only 1 patient enrolled was pre-term with a postnatal age between 1 week and 28 days)
*** In this data set, "full-term" is defined as ≥34 weeks gestational age
† Dose of 10 mg/kg
‡ Dose of 600 mg or 10 mg/kg up to a maximum of 600 mg
§ Dose normalized to 600 mg
C_{max} = Maximum plasma concentration; V_{ss} = Volume of distribution; AUC = Area under concentration-time curve;
$t_{1/2}$ = Apparent elimination half-life; CL = Systemic clearance normalized for body weight

Gender: Females have a slightly lower volume of distribution of linezolid than males. Plasma concentrations are higher in females than in males, which is partly due to body weight differences. After a 600-mg dose, mean oral clearance is approximately 38% lower in females than in males. However, there are no significant gender differences in mean apparent elimination-rate constant or half-life. Thus, drug exposure in females is not expected to substantially increase beyond levels known to be well tolerated. Therefore, dose adjustment by gender does not appear to be necessary.

Renal Insufficiency: The pharmacokinetics of the parent drug, linezolid, are not altered in patients with any degree of renal insufficiency; however, the two primary metabolites of linezolid may accumulate in patients with renal insufficiency, with the amount of accumulation increasing with the severity of renal dysfunction (see Table 3). However, there was no increase in AUC of parent drug. The clinical significance of accumulation of these two metabolites has not been determined in patients with severe renal insufficiency. Because similar plasma concentrations of linezolid are achieved regardless of renal function, no dose adjustment is recommended for patients with renal insufficiency. However, given the absence of information on the clinical significance of accumulation of the primary metabolites, use of linezolid in patients with renal insufficiency should be weighed against the potential risks of accumulation of these metabolites. Both linezolid and the two metabolites are eliminated by dialysis. Although there is some removal of the major metabolites of linezolid by hemodialysis, metabolite plasma levels after single 600 mg doses were still considerably higher following dialysis than those observed in patients with normal renal function or mild to moderate renal insufficiency. Approximately 30% of a dose was eliminated in a 3-hour dialysis session beginning 3 hours after the dose of linezolid was administered; therefore, linezolid should be given after hemodialysis.

In 24 patients with severe renal insufficiency, 21 of whom were on regular hemodialysis, peak plasma concentrations of the two major metabolites after several days dosing were about 10-fold those seen in patients with normal renal function. Peak plasma levels of linezolid were not affected.

The clinical significance of these observations has not been established as limited safety data are currently available (see section **DOSAGE AND ADMINISTRATION**).

Table 3. Mean (Standard Deviation) AUCs and Elimination Half-lives of Linezolid and Metabolites A and B in Patients with Varying Degrees of Renal Insufficiency After a Single 600-mg Oral Dose of Linezolid

Parameter	Healthy Subjects CL_{CR} >80 mL/min	Moderate Renal Impairment 30 < CL_{CR} < 80 mL/min	Severe Renal Impairment 10 < CL_{CR} < 30 mL/min	Hemodialysis-Dependent	
				Off Dialysis*	On Dialysis
Linezolid					
$AUC_{0-\infty}$, µg h/mL	110 (22)	128 (53)	127 (66)	141 (45)	83 (23)
$t_{1/2}$, hours	6.4 (2.2)	6.1 (1.7)	7.1 (3.7)	8.4 (2.7)	7.0 (1.8)
Metabolite A					
AUC_{0-48}, µg h/mL	7.6 (1.9)	11.7 (4.3)	56.5 (30.6)	185 (124)	68.8 (23.9)
$t_{1/2}$, hours	6.3 (2.1)	6.6 (2.3)	9.0 (4.6)	NA	NA
Metabolite B					
AUC_{0-48}, µg h/mL	30.5 (6.2)	51.1 (38.5)	203 (92)	467 (102)	239 (44)
$t_{1/2}$, hours	6.6 (2.7)	9.9 (7.4)	11.0 (3.9)	NA	NA

* between hemodialysis sessions
NA = Not applicable

Hepatic Insufficiency: The pharmacokinetics of linezolid are not altered in patients (n=7) with mild-to-moderate hepatic insufficiency (Child-Pugh class A or B). On the basis of the available information, no dose adjustment is recommended for patients with mild-to-moderate hepatic insufficiency. The pharmacokinetics of linezolid in patients with severe hepatic insufficiency have not been evaluated. However, as linezolid is metabolized by a non-enzymatic process, impairment of hepatic function would not be expected to significantly alter its metabolism (see section **DOSAGE AND ADMINISTRATION**).

Drug-Drug Interactions

Drugs Metabolized by Cytochrome P450: Linezolid is not an inducer of cytochrome P450 (CYP) in rats. It is not detectably metabolized by human cytochrome P450 and it does not inhibit the activities of clinically significant human CYP isoforms (1A2, 2C9, 2C19, 2D6, 2E1, 3A4). Therefore, no CYP450-induced drug interactions are expected with linezolid.

Concurrent administration of linezolid does not substantially alter the pharmacokinetic characteristics of (S)-warfarin, which is extensively metabolized by CYP2C9. Drugs such as warfarin and phenytoin, which are CYP2C9 substrates, may be given with linezolid without changes in dosage regimen.

Antibiotics*:*
Aztreonam*:* The pharmacokinetics of linezolid or aztreonam are not altered when administered together.

Gentamicin*:* The pharmacokinetics of linezolid or gentamicin are not altered when administered together.

Rifampicin*:* The effect of rifampin on the pharmacokinetics of linezolid was studied in sixteen healthy adult male volunteers administered linezolid 600 mg twice daily for 2.5 days with and without rifampin 600 mg once daily for 8 days. Rifampin decreased the linezolid C_{max} and AUC by a mean 21% [90% CI, 15, 27] and a mean 32% [90% CI, 27, 37], respectively. The mechanism of this interaction and its clinical significance are unknown (see section **PRECAUTIONS**).

Monoamine Oxidase Inhibition*:* Linezolid is a reversible, nonselective inhibitor of monoamine oxidase. Therefore, linezolid has the potential for interaction with adrenergic and serotonergic agents.

Adrenergic Agents*:* A significant pressor response has been observed in normal adult subjects receiving linezolid and tyramine doses of more than 100 mg. Therefore, patients receiving linezolid need to avoid consuming large amounts of foods or beverages with high tyramine content (see section **PRECAUTIONS**, **Information for Patients**).

A reversible enhancement of the pressor response of either pseudoephedrine HCl (PSE) or phenylpropanolamine HCl (PPA) is observed when linezolid is administered to healthy normotensive subjects (see section **PRECAUTIONS**, **Drug Interactions**). A similar study has not been conducted in hypertensive patients. The interaction studies conducted in normotensive subjects evaluated the blood pressure and heart rate effects of placebo, PPA or PSE alone, linezolid alone, and the combination of steady-state linezolid (600 mg q12h for 3 days) with two doses of PPA (25 mg) or PSE (60 mg) given 4 hours apart. Heart rate was not affected by any of the treatments. Blood pressure was increased with both combination treatments. Maximum blood pressure levels were seen 2 to 3 hours after the second dose of PPA or PSE, and returned to baseline 2 to 3 hours after peak. The results of the PPA study follow, showing the mean (and range) maximum systolic blood pressure in mm Hg: placebo = 121 (103 to 158); linezolid alone = 120 (107 to 135); PPA alone = 125 (106 to 139); PPA with linezolid = 147 (129 to 176). The results from the PSE study were similar to those in the PPA study. The mean maximum increase in systolic blood pressure over baseline was 32 mm Hg (range: 20-52 mm Hg) and 38 mm Hg (range: 18-79 mm Hg) during co-administration of linezolid with pseudoephedrine or phenylpropanolamine, respectively.

Serotonergic Agents: The potential drug-drug interaction with dextromethorphan was studied in healthy volunteers. Subjects were administered dextromethorphan (two 20-mg doses given 4 hours apart) with or without linezolid. No serotonin syndrome effects (confusion, delirium, restlessness, tremors, blushing, diaphoresis, hyperpyrexia) have been observed in normal subjects receiving linezolid and dextromethorphan. The effects of other serotonin re-uptake inhibitors have not been studied.

MICROBIOLOGY

Linezolid is a synthetic antibacterial agent of a new class of antibiotics, the oxazolidinones, which has clinical utility in the treatment of infections caused by aerobic Gram-positive bacteria. The *in vitro* spectrum of activity of linezolid also includes certain Gram-negative bacteria and anaerobic bacteria. Linezolid inhibits bacterial protein synthesis through a mechanism of action different from that of other antibacterial agents; therefore, cross-resistance between linezolid and other classes of antibiotics is unlikely. Linezolid binds to a site on the bacterial 23S ribosomal RNA of the 50S subunit and prevents the formation of a functional 70S initiation complex, which is an essential component of the bacterial translation process. The results of time-kill studies have shown linezolid to be bacteriostatic against enterococci and staphylococci. For streptococci, linezolid was found to be bactericidal for the majority of strains.

In clinical trials, resistance to linezolid developed in 6 patients infected with *Enterococcus faecium* (4 patients received 200 mg q12h, lower than the recommended dose, and 2 patients received 600 mg q12h). In a compassionate use program, resistance to linezolid developed in 8 patients with *E. faecium* and in 1 patient with *Enterococcus faecalis*. All patients had either unremoved prosthetic devices or undrained abscesses. Resistance to linezolid occurs *in vitro* at a frequency of 1×10^{-9} to 1×10^{-11}. *In vitro* studies have shown that point mutations in the 23S rRNA are associated with linezolid resistance. Reports of vancomycin-resistant *E. faecium* becoming resistant to linezolid during its clinical use have been published. In one report nosocomial spread of vancomycin- and linezolid-resistant *E. faecium* occurred. There has been a report of *Staphylococcus aureus* (methicillin-resistant) developing resistance to linezolid during its clinical use. The linezolid resistance in these organisms was associated with a point mutation in the 23S rRNA (substitution of thymine for guanine at position 2576) of the organism. When antibiotic-resistant organisms are encountered in the hospital, it is important to emphasize infection control policies. Resistance to linezolid has not been reported in *Streptococcus* spp., including *Streptococcus pneumoniae*.

In vitro studies have demonstrated additivity or indifference between linezolid and vancomycin, gentamicin, rifampin, imipenem-cilastatin, aztreonam, ampicillin, or streptomycin.

Linezolid has been shown to be active against most isolates of the following microorganisms, both *in vitro* and in clinical infections, as described in the **INDICATIONS AND USAGE** section.

Aerobic and facultative Gram-positive microorganisms

Enterococcus faecium (vancomycin-resistant strains only)
Staphylococcus aureus (including methicillin-resistant strains)
Streptococcus agalactiae
Streptococcus pneumoniae (including multi-drug resistant isolates [MDRSP][**])
Streptococcus pyogenes

The following *in vitro* data are available, but their clinical significance is unknown. At least 90% of the following microorganisms exhibit an *in vitro* minimum inhibitory concentration (MIC) less than or equal to the susceptible breakpoint for linezolid. However, the safety and effectiveness of linezolid in treating clinical infections due to these microorganisms have not been established in adequate and well-controlled clinical trials.

Aerobic and facultative Gram-positive microorganisms
Enterococcus faecalis (including vancomycin-resistant strains)
Enterococcus faecium (vancomycin-susceptible strains)
Staphylococcus epidermidis (including methicillin-resistant strains)
Staphylococcus haemolyticus
Viridans group streptococci

Aerobic and facultative Gram-negative microorganisms
Pasteurella multocida

Susceptibility Testing Methods
NOTE: Susceptibility testing by dilution methods requires the use of linezolid susceptibility powder.

When available, the results of *in vitro* susceptibility tests should be provided to the physician as periodic reports which describe the susceptibility profile of nosocomial and community-acquired pathogens. These reports should aid the physician in selecting the most effective antimicrobial.

Dilution Techniques: Quantitative methods are used to determine antimicrobial minimum inhibitory concentrations (MICs). These MICs provide estimates of the susceptibility of bacteria to antimicrobial compounds. The MICs should be determined using a standardized procedure. Standardized procedures are based on a dilution method (broth or agar) or equivalent with standardized inoculum concentrations and standardized concentrations of linezolid powder. The MIC values should be interpreted according to criteria provided in Table 3.

Diffusion Techniques: Quantitative methods that require measurement of zone diameters also provide reproducible estimates of the susceptibility of bacteria to antimicrobial compounds. One such standardized procedure requires the use of standardized inoculum

[**] MDRSP refers to isolates resistant to two or more of the following antibiotics: penicillin, second-generation cephalosporins, macrolides, tetracycline, and trimethoprim/sulfamethoxazole.

concentrations. This procedure uses paper disks impregnated with 30 µg of linezolid to test the susceptibility of microorganisms to linezolid. The disk diffusion interpretive criteria are provided in Table 4.

Table 4. Susceptibility Interpretive Criteria for Linezolid

Pathogen	Susceptibility Interpretive Criteria					
	Minimal Inhibitory Concentrations (MIC in µg/mL)			Disk Diffusion (Zone Diameters in mm)		
	S	I	R	S	I	R
Enterococcus spp.	≤2	4	≥8	≥23	21-22	≤20
Staphylococcus spp.[a]	≤4	---	---	≥21	---	---
Streptococcus pneumoniae[a]	≤2[b]	---	---	≥21[c]	---	---
Streptococcus spp. other than *S. pneumoniae*[a]	≤2[b]	---	---	≥21[c]	---	---

[a] The current absence of data on resistant strains precludes defining any categories other than "Susceptible." Strains yielding test results suggestive of a "nonsusceptible" category should be retested, and if the result is confirmed, the isolate should be submitted to a reference laboratory for further testing.

[b] These interpretive standards for *S. pneumoniae* and *Streptococcus* spp. other than *S. pneumoniae* are applicable only to tests performed by broth microdilution using cation-adjusted Mueller-Hinton broth with 2 to 5% lysed horse blood inoculated with a direct colony suspension and incubated in ambient air at 35°C for 20 to 24 hours.

[c] These zone diameter interpretive standards are applicable only to tests performed using Mueller-Hinton agar supplemented with 5% defibrinated sheep blood inoculated with a direct colony suspension and incubated in 5% CO_2 at 35°C for 20 to 24 hours.

A report of "Susceptible" indicates that the pathogen is likely to be inhibited if the antimicrobial compound in the blood reaches the concentrations usually achievable. A report of "Intermediate" indicates that the result should be considered equivocal, and, if the microorganism is not fully susceptible to alternative, clinically feasible drugs, the test should be repeated. This category implies possible clinical applicability in body sites where the drug is physiologically concentrated or in situations where high dosage of drug can be used. This category also provides a buffer zone which prevents small uncontrolled technical factors from causing major discrepancies in interpretation. A report of "Resistant" indicates that the pathogen is not likely to be inhibited if the antimicrobial compound in the blood reaches the concentrations usually achievable; other therapy should be selected.

Quality Control

Standardized susceptibility test procedures require the use of quality control microorganisms to control the technical aspects of the test procedures. Standard linezolid powder should provide the following range of values noted in Table 5.

NOTE: Quality control microorganisms are specific strains of organisms with intrinsic biological properties relating to resistance mechanisms and their genetic expression within bacteria; the specific strains used for microbiological quality control are not clinically significant.

Table 5. Acceptable Quality Control Ranges for Linezolid to be Used in Validation of Susceptibility Test Results

QC Strain	Acceptable Quality Control Ranges	
	Minimum Inhibitory Concentration (MIC in µg/mL)	**Disk Diffusion (Zone Diameters in mm)**
Enterococcus faecalis ATCC 29212	1 - 4	Not applicable
Staphylococcus aureus ATCC 29213	1 - 4	Not applicable
Staphylococcus aureus ATCC 25923	Not applicable	25 - 32
Streptococcus pneumoniae ATCC 49619[a]	0.50 – 2[b]	25 - 34[c]

[a] This organism may be used for validation of susceptibility test results when testing S*treptococcus* spp. other than *S. pneumoniae*.
[b] This quality control range for *S. pneumoniae* is applicable only to tests performed by broth microdilution using cation-adjusted Mueller-Hinton broth with 2 to 5% lysed horse blood inoculated with a direct colony suspension and incubated in ambient air at 35°C for 20 to 24 hours.
[c] This quality control zone diameter range is applicable only to tests performed using Mueller-Hinton agar supplemented with 5% defibrinated sheep blood inoculated with a direct colony suspension and incubated in 5% CO_2 at 35°C for 20 to 24 hours.

INDICATIONS AND USAGE

ZYVOX formulations are indicated in the treatment of the following infections caused by susceptible strains of the designated microorganisms (see sections **PRECAUTIONS** and **DOSAGE AND ADMINISTRATION**).

ZYVOX is indicated for the treatment of MRSA, and VRE of the following infections caused by Gram positive bacteria:

- Nosocomial pneumonia
- Complicated skin and soft tissue infections, including diabetic foot infections, without concomitant osteomyelitis, caused by *Staphylococcus aureus* (methicillin-susceptible and -resistant strains), *Streptococcus pyogenes*, or *Streptococcus agalactiae*. ZYVOX has not been studied in the treatment of decubitus ulcers. Combination therapy may be clinically indicated if the documented or presumptive pathogens include Gram-negative organisms (see section **CLINICAL STUDIES**).

Linezolid should only be initiated in a hospital environment and after consultation with a relevant specialist.

Linezolid is active against Gram-positive bacteria only. Linezolid has no clinical activity against Gram-negative pathogens. Specific Gram-negative therapy is required if a concomitant Gram-negative pathogen is documented or suspected (see section **PRECAUTIONS**).

Consideration should be given to official guidance on the appropriate use of antibacterial agents.

To reduce the development of drug-resistant bacteria and maintain the effectiveness of ZYVOX and other antibacterial drugs, ZYVOX should be used only to treat or prevent infections that are proven or strongly suspected to be caused by susceptible bacteria. When culture and susceptibility information are available, they should be considered in selecting or modifying antibacterial therapy.

CONTRAINDICATIONS

ZYVOX formulations are contraindicated for use in patients who have known hypersensitivity to linezolid or any of the other product components.

Monoamine Oxidase Inhibitors

Linezolid should not be used in patients taking any medicinal product which inhibits monoamine oxidases A or B (e.g., phenelzine, isocarboxazid) or within two weeks of taking any such medicinal product.

Potential Interactions Producing Elevation of Blood Pressure

Unless patients are monitored for potential increases in blood pressure, linezolid should not be administered to patients with uncontrolled hypertension, pheochromocytoma, thyrotoxicosis and/or patients taking any of the following types of medications: directly and indirectly acting sympathomimetic agents (e.g., pseudoephedrine, phenylpropanolamine), vasopressive agents (e.g., epinephrine, norepinephrine), dopaminergic agents (e.g., dopamine, dobutamine) (see section **Drug Interactions**).

Potential Serotonergic Interactions

Unless patients are carefully observed for signs and/or symptoms of serotonin syndrome, linezolid should not be administered to patients with carcinoid syndrome and/or patients taking any of the following medications: serotonin re-uptake inhibitors, tricyclic antidepressants, serotonin 5-HT1 receptor agonists (triptans), meperidine or buspirone (see section **Drug Interactions**).

WARNINGS

Reversible myelosuppression (including anemia, leukopenia, pancytopenia, and thrombocytopenia) that may be dependent on duration of therapy has been reported in some patients receiving linezolid. Thrombocytopenia may occur more often in patients with severe

renal insufficiency, whether or not on dialysis, and in patients with moderate to severe hepatic impairment. In cases where the outcome is known, when linezolid was discontinued, the affected hematologic parameters have risen toward pretreatment levels. Complete blood counts should be monitored weekly in patients who receive linezolid, particularly in those who receive linezolid for longer than two weeks, those with pre-existing myelosuppression, who have severe renal insufficiency or moderate to severe hepatic impairment, those receiving concomitant drugs that produce bone marrow suppression, or those with a chronic infection who have received previous or concomitant antibiotic therapy. Discontinuation of therapy with linezolid should be considered in patients who develop or have worsening myelosuppression.

In adult and juvenile dogs and rats, myelosuppression, reduced extramedullary hematopoiesis in spleen and liver, and lymphoid depletion of thymus, lymph nodes, and spleen were observed (see section **ANIMAL PHARMACOLOGY**).

Pseudomembranous colitis has been reported with nearly all antibacterial agents, including ZYVOX, and may range in severity from mild to life-threatening. Therefore, it is important to consider this diagnosis in patients who present with diarrhea subsequent to the administration of any antibacterial agent.

Treatment with antibacterial agents alters the normal flora of the colon and may permit overgrowth of clostridia. Studies indicated that a toxin produced by *Clostridium difficile* is a primary cause of "antibiotic-associated colitis."

After the diagnosis of pseudomembranous colitis has been established, appropriate therapeutic measures should be initiated. Mild cases of pseudomembranous colitis usually respond to drug discontinuation alone. In moderate to severe cases, consideration should be given to management with fluids and electrolytes, protein supplementation, and treatment with an antibacterial agent clinically effective against *Clostridium difficile*.

Convulsions have been reported to occur rarely in patients when treated with linezolid. In most of these cases, a history of seizures or risk factors for seizures were reported.

PRECAUTIONS

General

Lactic acidosis has been reported with the use of ZYVOX. In reported cases, patients experienced repeated episodes of nausea and vomiting. Patients who develop recurrent nausea or vomiting, unexplained acidosis, or a low bicarbonate level while receiving ZYVOX should receive immediate medical evaluation.

Spontaneous reports of serotonin syndrome associated with the co-administration of ZYVOX and serotonergic agents, including antidepressants such as selective serotonin reuptake inhibitors (SSRIs) and opioids have been reported (see sections **CONTRAINDICATIONS** and **PRECAUTIONS**, **Drug Interactions**).

Where administration of ZYVOX and concomitant serotonergic agents is clinically appropriate, patients should be closely observed for signs and symptoms of serotonin syndrome such as cognitive dysfunction, hyperpyrexia, hyperreflexia and incoordination.

If signs or symptoms occur physicians should consider discontinuation of either one or both agents. If the concomitant serotonergic agent is withdrawn, discontinuation symptoms can be observed.

Rhabdomyolysis has been reported with the use of linezolid. If signs or symptoms of rhabdomyolysis are observed, linezolid should be discontinued and appropriate therapy initiated.

Hyponatremia and/or Syndrome of Inappropriate Antidiuretic Hormone Secretion (SIADH) have been observed in some patients treated with linezolid. It is recommended that serum sodium levels be monitored regularly in the elderly, in patients taking diuretics, and in other patients at risk of hyponatremia.

In healthy volunteers, coadministration of rifampin with linezolid resulted in a 21% decrease in linezolid C_{max} and a 32% decrease in linezolid AUC (see section **Drug-Drug Interactions**). The clinical significance of this interaction is unknown.

Linezolid has no clinical activity against Gram-negative pathogens and is not indicated for the treatment of Gram-negative infections. Specific Gram-negative therapy is required if a concomitant Gram-negative pathogen is documented or suspected. Linezolid should be used with special caution in patients at high risk for life threatening systemic infections, such as those with infections related to central venous catheters in intensive care units. Linezolid is not approved for the treatment of patients with catheter-related bloodstream infections.

Clostridium difficile associated diarrhea (CDAD) has been reported with use of nearly all antibacterial agents, including ZYVOX, and may range in severity from mild diarrhea to fatal colitis. Treatment with antibacterial agents alters the normal flora of the colon leading to overgrowth of *C. difficile*.

C. difficile produces toxins A and B which contribute to the development of CDAD. Hypertoxin producing strains of *C. difficile* cause increased morbidity and mortality, as these infections can be refractory to antimicrobial therapy and may require colectomy. CDAD must be considered in all patients who present with diarrhea following antibiotic use.

Careful medical history is necessary since CDAD has been reported to occur over two months after the administration of antibacterial agents.

If CDAD is suspected or confirmed, ongoing antibiotic use not directed against *C. difficile* may need to be discontinued. Appropriate fluid and electrolyte management, protein supplementation, antibiotic treatment of *C. difficile*, and surgical evaluation should be instituted as clinically indicated.

Clinical Trial in Catheter-Related Gram-Positive Bloodstream Infections
An open-label, randomized clinical trial was conducted in adult patients with catheter-related Gram-positive bloodstream infections comparing linezolid (600 mg q12h IV/PO) to vancomycin 1 g IV q12h or oxacillin 2 g IV q6h/dicloxacillin 500 mg PO q6h with a treatment duration of 7 to 28 days. The mortality rates in this study were 78/363 (21.5%) and 58/363 (16.0%) on linezolid and the comparator, respectively. Based on results from a logistic regression, the estimated odds ratio is 1.426 [95% CI 0.970, 2.098]. While causality has not been established, this observed imbalance occurred primarily in linezolid-treated patients in whom either Gram-negative pathogens, mixed Gram-negative and Gram-positive pathogens, or no pathogen were identified at baseline.

Patients randomized to linezolid who had only a Gram-positive infection at baseline, including the subgroup of patients with Gram-positive bacteremia experienced a survival rate similar to the comparator.

Peripheral and optic neuropathy have been reported in patients treated with ZYVOX, primarily those patients treated for longer than the maximum recommended duration of 28 days. In cases of optic neuropathy that progressed to loss of vision, patients were treated for extended periods beyond the maximum recommended duration. Visual blurring has been reported in some patients treated with ZYVOX for less than 28 days.

If symptoms of visual impairment appear, such as changes in visual acuity, changes in color vision, blurred vision, or visual field defect, prompt ophthalmic evaluation is recommended. **Visual function should be monitored in all patients taking ZYVOX for extended periods (≥3 months) and in all patients reporting new visual symptoms regardless of length of therapy with ZYVOX.** If peripheral or optic neuropathy occurs, the continued use of ZYVOX in these patients should be weighed against the potential risks.

Effects on ability to drive and use machines
The effect of linezolid on the ability to drive or operate machinery has not been systematically evaluated.

The use of antibiotics may promote the overgrowth of nonsusceptible organisms. Should superinfection occur during therapy, appropriate measures should be taken.

ZYVOX has not been studied in patients with uncontrolled hypertension, pheochromocytoma, carcinoid syndrome, or untreated hyperthyroidism.

The safety and efficacy of ZYVOX formulations given for longer than 28 days have not been evaluated in controlled clinical trials.

Prescribing ZYVOX in the absence of a proven or strongly suspected bacterial infection or a prophylactic indication is unlikely to provide benefit to the patient and increases the risk of the development of drug-resistant bacteria.

Information for Patients

Patients should be advised that:

- They should inform their physician if they have a history of hypertension.
- Large quantities of foods or beverages with high tyramine content should be avoided while taking ZYVOX. Quantities of tyramine consumed should be less than 100 mg per meal. Foods high in tyramine content include those that may have undergone protein changes by aging, fermentation, pickling, or smoking to improve flavor, such as aged cheeses (0 to 15 mg tyramine per ounce); fermented or air-dried meats (0.1 to 8 mg tyramine per ounce); sauerkraut (8 mg tyramine per 8 ounces); soy sauce (5 mg tyramine per 1 teaspoon); tap beers (4 mg tyramine per 12 ounces); red wines (0 to 6 mg tyramine per 8 ounces). The tyramine content of any protein-rich food may be increased if stored for long periods or improperly refrigerated.
- They should inform their physician if taking medications containing pseudoephedrine HCl or phenylpropanolamine HCl, such as cold remedies and decongestants.
- They should inform their physician if taking serotonin re-uptake inhibitors or other antidepressants.
- They should inform their physician if they experience changes in vision.
- They should inform their physician if they have a history of seizures.
- Diarrhea is a common problem caused by antibiotics, which usually ends when the antibiotic is discontinued. Sometimes after starting treatment with antibiotics, patients can develop watery and bloody stools (with or without stomach cramps and fever) even as late as two or more months after having taken the last dose of the antibiotic. If this occurs, patients should contact their physician as soon as possible.

Patients should be counseled that antibacterial drugs including ZYVOX should only be used to treat bacterial infections. They do not treat viral infections (e.g., the common cold). When ZYVOX is prescribed to treat a bacterial infection, patients should be told that although it is common to feel better early in the course of therapy, the medication should be taken exactly as directed. Skipping doses or not completing the full course of therapy may (1) decrease the effectiveness of the immediate treatment and (2) increase the likelihood that bacteria will develop resistance and will not be treatable by ZYVOX or other antibacterial drugs in the future.

Drug Interactions (see also section **CLINICAL PHARMACOLOGY, Drug-Drug Interactions**)

Monoamine Oxidase Inhibition: Linezolid is a weak, reversible, nonselective inhibitor of monoamine oxidase. Therefore, linezolid has the potential for interaction with adrenergic and serotonergic agents.

Adrenergic Agents: Some individuals receiving ZYVOX may experience a mild, reversible enhancement of the pressor response to indirect-acting sympathomimetic agents, vasopressor or dopaminergic agents. Commonly used drugs such as phenylpropanolamine and pseudoephedrine have been specifically studied. Initial doses of adrenergic agents, such as dopamine or epinephrine, should be reduced and titrated to achieve the desired response.

Serotonergic Agents*:* Co-administration of linezolid and serotonergic agents was not associated with serotonin syndrome in phase 1, 2 or 3 studies. Spontaneous reports of serotonin syndrome occurring with co-administration of ZYVOX and serotonergic agents have occurred (see sections **CONTRAINDICATIONS** and **PRECAUTIONS, General**). Physicians should be alert to the possibility of signs and symptoms of serotonin syndrome (cognitive dysfunction, hyperpyrexia, hyperreflexia, incoordination) in patients receiving concomitant serotonergic agents.

Drug-Laboratory Test Interactions
There are no reported drug-laboratory test interactions.

Fertility, Pregnancy and Lactation

Carcinogenesis, Mutagenesis, Impairment of Fertility
Lifetime studies in animals have not been conducted to evaluate the carcinogenic potential of linezolid. Neither mutagenic nor clastogenic potential was found in a battery of tests including: assays for mutagenicity (Ames bacterial reversion and CHO cell mutation), an *in vitro* unscheduled DNA synthesis (UDS) assay, an *in vitro* chromosome aberration assay in human lymphocytes, and an *in vivo* mouse micronucleus assay.

Linezolid did not affect the fertility or reproductive performance of adult female rats. It reversibly decreased fertility and reproductive performance in adult male rats when given at doses ≥50 mg/kg/day, with exposures approximately equal to or greater than the expected human exposure level (exposure comparisons are based on AUCs). The reversible fertility effects were mediated through altered spermatogenesis. Affected spermatids contained abnormally formed and oriented mitochondria and were non-viable. Epithelial cell hypertrophy and hyperplasia in the epididymis was observed in conjunction with decreased fertility. Similar epididymal changes were not seen in dogs.

In sexually mature male rats exposed to drug as juveniles, mildly decreased fertility was observed following treatment with linezolid through most of their period of sexual

development (50 mg/kg/day from days 7 to 36 of age, and 100 mg/kg/day from days 37 to 55 of age), with exposures up to 1.7-fold greater than mean AUCs observed in pediatric patients aged 3 months to 11 years. Decreased fertility was not observed with shorter treatment periods, corresponding to exposure in utero through the early neonatal period (gestation day 6 through postnatal day 5), neonatal exposure (postnatal days 5 to 21), or to juvenile exposure (postnatal days 22 to 35). Reversible reductions in sperm motility and altered sperm morphology were observed in rats treated from postnatal day 22 to 35.

Pregnancy

Teratogenic Effects. Pregnancy Category C: Linezolid was not teratogenic in mice or rats at exposure levels 6.5-fold (in mice) or equivalent to (in rats) the expected human exposure level, based on AUCs. However, embryo and fetal toxicities were seen (see section **PRECAUTIONS**, **Non-teratogenic Effects**). There are no adequate and well-controlled studies in pregnant women. ZYVOX should be used during pregnancy only if the potential benefit justifies the potential risk to the fetus.

Non-teratogenic Effects

In mice, embryo and fetal toxicities were seen only at doses that caused maternal toxicity (clinical signs and reduced body weight gain). A dose of 450 mg/kg/day (6.5-fold the estimated human exposure level based on AUCs) correlated with increased post-implantational embryo death, including total litter loss, decreased fetal body weights, and an increased incidence of costal cartilage fusion.

Linezolid was also not teratogenic in rabbits when administered twice daily at total oral doses up to 15 mg/kg/day (0.5 times the clinical exposure, based on AUC). Maternal toxicity (clinical signs, reduced body weight gain and food consumption) occurred at 5 and 15 mg/kg/day, and reduced fetal body weight occurred at 15 mg/kg/day. Linezolid exposures were low due to the characteristic sensitivity of rabbits to antibiotics.

Linezolid produced reversible myelosuppression in adult and juvenile rats and dogs.

In rats administered linezolid orally for 6 months, non-reversible, minimal to mild axonal degeneration of sciatic nerves was observed in males dosed at 80 mg/kg/day; minimal degeneration of the sciatic nerve was also observed in 1 male at this dose level at a 3-month interim necropsy. Similar changes were not observed in female rats. Sensitive morphologic evaluation of perfusion-fixed tissues was conducted to investigate evidence of optic nerve degeneration. Minimal to moderate optic nerve degeneration was evident in 2 male rats administered Linezolid at 80 mg/kg/day for 6 months, but the direct relationship to drug was equivocal because of the acute nature of the finding and its asymmetrical distribution. The nerve degeneration observed was microscopically compatible to a spontaneous unilateral optic nerve degeneration reported in aging rats and may be an exacerbation of a common background change.

In rats, mild fetal toxicity was observed at 15 and 50 mg/kg/day (exposure levels 0.22-fold to approximately equivalent to the estimated human exposure, respectively based on AUCs).

The effects consisted of decreased fetal body weights and reduced ossification of sternebrae, a finding often seen in association with decreased fetal body weights. Slight maternal toxicity, in the form of reduced body weight gain, was seen at 50 mg/kg/day.

When female rats were treated with 50 mg/kg/day (approximately equivalent to the estimated human exposure based on AUCs) of linezolid during pregnancy and lactation, survival of pups was decreased on postnatal days 1 to 4. Male and female pups permitted to mature to reproductive age, when mated, showed an increase in preimplantation loss.

Nursing Mothers
Linezolid and its metabolites are excreted in the milk of lactating rats. Concentrations in milk were similar to those in maternal plasma. It is not known whether linezolid is excreted in human milk. Because many drugs are excreted in human milk, caution should be exercised when ZYVOX is administered to a nursing woman.

Pediatric Use
Pharmacokinetic information generated in pediatric patients with ventriculoperitoneal shunts showed variable cerebrospinal fluid (CSF) linezolid concentrations following single and multiple dosing of linezolid; therapeutic concentrations were not consistently achieved or maintained in the CSF. Therefore, the use of linezolid for the empiric treatment of pediatric patients with central nervous system infections is not recommended.

Geriatric Use
Of the 2046 patients treated with ZYVOX in phase 3 comparator-controlled clinical trials, 589 (29%) were 65 years or older and 253 (12%) were 75 years or older. No overall differences in safety or effectiveness were observed between these patients and younger patients.

ANIMAL PHARMACOLOGY
Target organs of linezolid toxicity were similar in juvenile and adult rats and dogs. Dose- and time-dependent myelosuppression, as evidenced by bone marrow hypocellularity/decreased hematopoiesis, decreased extramedullary hematopoiesis in spleen and liver, and decreased levels of circulating erythrocytes, leukocytes, and platelets have been seen in animal studies. Lymphoid depletion occurred in thymus, lymph nodes, and spleen. Generally, the lymphoid findings were associated with anorexia, weight loss, and suppression of body weight gain, which may have contributed to the observed effects. These effects were observed at exposure levels that are comparable to those observed in some human subjects. The hematopoietic and lymphoid effects were reversible, although in some studies, reversal was incomplete within the duration of the recovery period.

ADVERSE REACTIONS
Adult Patients
The safety of ZYVOX formulations was evaluated in 2046 adult patients enrolled in seven phase 3 comparator-controlled clinical trials, who were treated for up to 28 days. In these studies, 85% of the adverse events reported with ZYVOX were described as mild to moderate

in intensity. Table 6 shows the incidence of adverse events reported in at least 2% of patients in these trials. The most common adverse events in patients treated with ZYVOX were diarrhea (incidence across studies: 2.8% to 11.0%), headache (incidence across studies: 0.5% to 11.3%), and nausea (incidence across studies: 3.4% to 9.6%).

Table 6. Incidence (%) of Adverse Events Reported in ≥2% of Adult Patients in Comparator-Controlled Clinical Trials with ZYVOX

Event	ZYVOX (n=2046)	All Comparators* (n=2001)
Diarrhea	8.3	6.3
Headache	6.5	5.5
Nausea	6.2	4.6
Vomiting	3.7	2.0
Insomnia	2.5	1.7
Constipation	2.2	2.1
Rash	2.0	2.2
Dizziness	2.0	1.9
Fever	1.6	2.1

* Comparators included cefpodoxime proxetil 200 mg PO q12h; ceftriaxone 1 g IV q12h; clarithromycin 250 mg PO q12h; dicloxacillin 500 mg PO q6h; oxacillin 2 g IV q6h; vancomycin 1 g IV q12h.

Other adverse events reported in phase 2 and phase 3 studies included oral moniliasis, vaginal moniliasis, hypertension, dyspepsia, localized abdominal pain, pruritus, and tongue discoloration.

The data described in Table 7 reflect exposure to linezolid in a total of 2046 patients in the therapeutic studies. The table shows the incidence of drug-related adverse events reported in at least 1% of adult patients in these trials by dose of ZYVOX.

Table 7. Incidence (%) of Drug-Related Adverse Events Occurring in >1% of Adult Patients Treated with ZYVOX in Comparator-Controlled Clinical Trials

Adverse Event	Clinical Trials 39/39A		All Other Clinical Trials	
	ZYVOX 400 mg PO q12h (n=548)	Clarithromycin 250 mg PO q12h (n=537)	ZYVOX 600 mg q12h (n=1498)	All Other Comparators * (n=1464)
% of patients with 1 drug-related adverse event	25.4	19.6	20.4	14.3
% of patients discontinuing due to	3.5	2.4	2.1	1.7

drug-related adverse events†				
Diarrhea	5.3	4.8	4.0	2.7
Nausea	3.5	3.5	3.3	1.8
Headache	2.7	2.2	1.9	1.0
Taste alteration	1.8	2.0	0.9	0.2
Vaginal moniliasis	1.6	1.3	1.0	0.4
Fungal infection	1.5	0.2	0.1	<0.1
Abnormal liver function tests	0.4	0	1.3	0.5
Vomiting	0.9	0.4	1.2	0.4
Tongue discoloration	1.1	0	0.2	0
Dizziness	1.1	1.5	0.4	0.3
Oral moniliasis	0.4	0	1.1	0.4

* Comparators included cefpodoxime proxetil 200 mg PO q12h; ceftriaxone 1 g IV q12h; dicloxacillin 500 mg PO q6h; oxacillin 2 g IV q6h; vancomycin 1 g IV q12h.

† The most commonly reported drug-related adverse events leading to discontinuation in patients treated with ZYVOX were nausea, headache, diarrhea, and vomiting.

Pediatric Patients

The safety of ZYVOX formulations was evaluated in 215 pediatric patients ranging in age from birth through 11 years, and in 248 pediatric patients aged 5 through 17 years (146 of these 248 were age 5 through 11 and 102 were age 12 to 17). These patients were enrolled in two Phase 3 comparator-controlled clinical trials and were treated for up to 28 days. In these studies, 83% and 99%, respectively, of the adverse events reported with ZYVOX were described as mild to moderate in intensity. In the study of hospitalized pediatric patients (birth through 11 years) with Gram-positive infections, who were randomized 2 to 1 (linezolid:vancomycin), mortality was 6.0% (13/215) in the linezolid arm and 3.0% (3/101) in the vancomycin arm. However, given the severe underlying illness in the patient population, no causality could be established. Table 8 shows the incidence of adverse events reported in at least 2% of pediatric patients treated with ZYVOX in these trials.

Table 8. Incidence (%) of Adverse Events Reported in ≥2% of Pediatric Patients Treated with ZYVOX in Comparator-Controlled Clinical Trials

	Uncomplicated Skin and Skin Structure Infections*		**All Other Indications†**	
Event	**ZYVOX (n = 248)**	**Cefadroxil (n = 251)**	**ZYVOX (n = 215)**	**Vancomycin (n = 101)**
Fever	2.9	3.6	14.1	14.1
Diarrhea	7.8	8.0	10.8	12.1
Vomiting	2.9	6.4	9.4	9.1
Sepsis	0	0	8.0	7.1
Rash	1.6	1.2	7.0	15.2
Headache	6.5	4.0	0.9	0

Anemia	0	0	5.6	7.1
Thrombocytopenia	0	0	4.7	2.0
Upper respiratory infection	3.7	5.2	4.2	1.0
Nausea	3.7	3.2	1.9	0
Dyspnea	0	0	3.3	1.0
Reaction at site of injection or of vascular catheter	0	0	3.3	5.1
Trauma	3.3	4.8	2.8	2.0
Pharyngitis	2.9	1.6	0.5	1.0
Convulsion	0	0	2.8	2.0
Hypokalemia	0	0	2.8	3.0
Pneumonia	0	0	2.8	2.0
Thrombocythemia	0	0	2.8	2.0
Cough	2.4	4.0	0.9	0
Generalized abdominal pain	2.4	2.8	0.9	2.0
Localized abdominal pain	2.4	2.8	0.5	1.0
Apnea	0	0	2.3	2.0
Gastrointestinal bleeding	0	0	2.3	1.0
Generalized edema	0	0	2.3	1.0
Loose stools	1.6	0.8	2.3	3.0
Localized pain	2.0	1.6	0.9	0
Skin disorder	2.0	0	0.9	1.0

* Patients 5 through 11 years of age received ZYVOX 10 mg/kg PO q12h or cefadroxil 15 mg/kg PO q12h. Patients 12 years or older received ZYVOX 600 mg PO q12h or cefadroxil 500 mg PO q12h.

† Patients from birth through 11 years of age received ZYVOX 10 mg/kg IV/PO q8h or vancomycin 10 to 15 mg/kg IV q6-24h, depending on age and renal clearance.

Table 9 shows the incidence of drug-related adverse events reported in more than 1% of pediatric patients (and more than 1 patient) in either treatment group in the comparator-controlled Phase 3 trials.

Table 9. Incidence (%) of Drug-related Adverse Events Occurring in >1% of Pediatric Patients (and >1 Patient) in Either Treatment Group in Comparator-Controlled Clinical Trials

Event	Uncomplicated Skin and Skin Structure Infections*		All Other Indications†	
	ZYVOX (n=248)	Cefadroxil (n=251)	ZYVOX (n=215)	Vancomycin (n=101)
% of patients with ≥1 drug-related adverse event	19.2	14.1	18.8	34.3
% of patients discontinuing due to a drug-related adverse event	1.6	2.4	0.9	6.1
Diarrhea	5.7	5.2	3.8	6.1
Nausea	3.3	2.0	1.4	0
Headache	2.4	0.8	0	0
Loose stools	1.2	0.8	1.9	0
Thrombocytopenia	0	0	1.9	0
Vomiting	1.2	2.4	1.9	1.0
Generalized abdominal pain	1.6	1.2	0	0
Localized abdominal pain	1.6	1.2	0	0
Anemia	0	0	1.4	1.0
Eosinophilia	0.4	0.4	1.4	0
Rash	0.4	1.2	1.4	7.1
Vertigo	1.2	0.4	0	0
Oral moniliasis	0	0	0.9	4.0
Fever	0	0	0.5	3.0
Pruritus at non-application site	0.4	0	0	2.0
Anaphylaxis	0	0	0	10.1‡

* Patients 5 through 11 years of age received ZYVOX 10 mg/kg PO q12h or cefadroxil 15 mg/kg PO q12h. Patients 12 years or older received ZYVOX 600 mg PO q12h or cefadroxil 500 mg PO q12h.

† Patients from birth through 11 years of age received ZYVOX 10 mg/kg IV/PO q8h or vancomycin 10 to 15 mg/kg IV q6-24h, depending on age and renal clearance.

‡ These reports were of 'red-man syndrome', which were coded as anaphylaxis.

Laboratory Changes

ZYVOX has been associated with thrombocytopenia when used in doses up to and including 600 mg every 12 hours for up to 28 days. In phase 3 comparator-controlled trials, the percentage of adult patients who developed a substantially low platelet count (defined as less than 75% of lower limit of normal and/or baseline) was 2.4% (range among studies: 0.3 to 10.0%) with ZYVOX and 1.5% (range among studies: 0.4 to 7.0%) with a comparator.

Thrombocytopenia associated with the use of ZYVOX appears to be dependent on duration of therapy, (generally greater than 2 weeks of treatment). The platelet counts for most patients returned to the normal range/baseline during the follow-up period. No related clinical adverse events were identified in phase 3 clinical trials in patients developing thrombocytopenia. Bleeding events were identified in thrombocytopenic patients in a compassionate use program for ZYVOX; the role of linezolid in these events cannot be determined (see section **WARNINGS**).

Changes seen in other laboratory parameters, without regard to drug relationship, revealed no substantial differences between ZYVOX and the comparators. These changes were generally not clinically significant, did not lead to discontinuation of therapy, and were reversible. The incidence of adult patients with at least one substantially abnormal hematologic or serum chemistry value is presented in Tables 10 and 11.

Table 10. Percent of Adult Patients who Experienced At Least One Substantially Abnormal* Hematology Laboratory Value in Comparator-Controlled Clinical Trials with ZYVOX

Laboratory Assay	Clinical Trials 39/39A		All Other Clinical Trials	
	ZYVOX 400 mg q12h	Clarithromycin 250 mg q12h	ZYVOX 600 mg q12h	All Other Comparators†
Hemoglobin (g/dL)	0.9	0.0	7.1	6.6
Platelet count (x $10^3/mm^3$)	0.7	0.8	3.0	1.8
WBC (x $10^3/mm^3$)	0.2	0.6	2.2	1.3
Neutrophils (x $10^3/mm^3$)	0.0	0.2	1.1	1.2

***** <75% (<50% for neutrophils) of Lower Limit of Normal (LLN) for values normal at baseline; <75% (<50% for neutrophils) of LLN and of baseline for values abnormal at baseline.

† Comparators included cefpodoxime proxetil 200 mg PO q12h; ceftriaxone 1 g IV q12h; dicloxacillin 500 mg PO q6h; oxacillin 2 g IV q6h; vancomycin 1 g IV q12h.

Table 11. Percent of Adult Patients who Experienced At Least One Substantially Abnormal* Serum Chemistry Laboratory Value in Comparator-Controlled Clinical Trials with ZYVOX

Laboratory Assay	Clinical Trials 39/39A		All Other Clinical Trials	
	ZYVOX 400 mg q12h	Clarithromycin 250 mg q12h	ZYVOX 600 mg q12h	All Other Comparators†
AST (U/L)	1.7	1.3	5.0	6.8
ALT (U/L)	1.7	1.7	9.6	9.3
LDH (U/L)	0.2	0.2	1.8	1.5
Alkaline phosphatase (U/L)	0.2	0.2	3.5	3.1
Lipase (U/L)	2.8	2.6	4.3	4.2
Amylase (U/L)	0.2	0.2	2.4	2.0
Total bilirubin (mg/dL)	0.2	0.0	0.9	1.1
BUN (mg/dL)	0.2	0.0	2.1	1.5

Creatinine (mg/dL)	0.2	0.0	0.2	0.6

* >2 x Upper Limit of Normal (ULN) for values normal at baseline;
>2 x ULN and >2 x baseline for values abnormal at baseline.

† Comparators included cefpodoxime proxetil 200 mg PO q12h; ceftriaxone 1 g IV q12h; dicloxacillin 500 mg PO q6h; oxacillin 2 g IV q6h; vancomycin 1 g IV q12h.

Table 12. Percent of Pediatric Patients who Experienced At Least One Substantially Abnormal* Hematology Laboratory Value in Comparator-Controlled Clinical Trials with ZYVOX

Laboratory Assay	Uncomplicated Skin and Skin Structure Infections†		All Other Indications‡	
	ZYVOX	Cefadroxil	ZYVOX	Vancomycin
Hemoglobin (g/dL)	0.0	0.0	15.7	12.4
Platelet count (x $10^3/mm^3$)	0.0	0.4	12.9	13.4
WBC (x $10^3/mm^3$)	0.8	0.8	12.4	10.3
Neutrophils (x $10^3/mm^3$)	1.2	0.8	5.9	4.3

***** <75% (<50% for neutrophils) of Lower Limit of Normal (LLN) for values normal at baseline;
<75% (<50% for neutrophils) of LLN and <75% (<50% for neutrophils, <90% for hemoglobin if baseline <LLN) of baseline for values abnormal at baseline.

† Patients 5 through 11 years of age received ZYVOX 10 mg/kg PO q12h or cefadroxil 15 mg/kg PO q12h. Patients 12 years or older received ZYVOX 600 mg PO q12h or cefadroxil 500 mg PO q12h.

‡ Patients from birth through 11 years of age received ZYVOX 10 mg/kg IV/PO q8h or vancomycin 10 to 15 mg/kg IV q6-24h, depending on age and renal clearance.

Table 13. Percent of Pediatric Patients who Experienced At Least One Substantially Abnormal* Serum Chemistry Laboratory Value in Comparator-Controlled Clinical Trials with ZYVOX

Laboratory Assay	Uncomplicated Skin and Skin Structure Infections†		All Other Indications‡	
	ZYVOX	Cefadroxil	ZYVOX	Vancomycin
ALT (U/L)	0.0	0.0	10.1	12.5
Lipase (U/L)	0.4	1.2	---	---
Amylase (U/L)	---	---	0.6	1.3
Total bilirubin (mg/dL)	---	---	6.3	5.2
Creatinine (mg/dL)	0.4	0.0	2.4	1.0

* >2 x Upper Limit of Normal (ULN) for values normal at baseline; >2 x ULN and >2 (>1.5 for total bilirubin) x baseline for values abnormal at baseline.

† Patients 5 through 11 years of age received ZYVOX 10 mg/kg PO q12h or cefadroxil 15 mg/kg PO q12h. Patients 12 years or older received ZYVOX 600 mg PO q12h or cefadroxil 500 mg PO q12h.

‡ Patients from birth through 11 years of age received ZYVOX 10 mg/kg IV/PO q8h or vancomycin 10 to 15 mg/kg IV q6-24h, depending on age and renal clearance.

Postmarketing Experience

Myelosuppression (including anemia, leukopenia, pancytopenia, and thrombocytopenia) has been reported during postmarketing use of ZYVOX (see section **WARNINGS)**. Peripheral

neuropathy and optic neuropathy sometimes progressing to loss of vision have been reported in patients treated with ZYVOX.

Lactic acidosis has been reported with the use of ZYVOX (see section **PRECAUTIONS**). Although these reports have primarily been in patients treated for longer than the maximum recommended duration of 28 days, these events have also been reported in patients receiving shorter courses of therapy. Serotonin syndrome has been reported in patients receiving concomitant serotonergic agents and ZYVOX (see section **PRECAUTIONS**). These events have been chosen for inclusion due to either their seriousness, frequency of reporting, possible causal connection to ZYVOX, or a combination of these factors. Because they are reported voluntarily from a population of unknown size, estimates of frequency cannot be made and causal relationship cannot be precisely established.

Gastrointestinal disorders such as tongue discoloration and superficial tooth discoloration has been reported very rarely with the use of linezolid. The discoloration was removable with professional dental cleaning (manual descaling) in cases with known outcome.

Table 14. Adverse Drug Reaction Table

System Organ Class	Adverse Drug Reactions
Infections and infestations	moniliasis
Blood and lymphatic system disorders	pancytopenia*^, leucopenia*^, thrombocytopenia*^, anemia*^, sideroblastic anemia*‡
Immune system disorders	anaphylaxis*
Metabolism and nutrition disorders	lactic acidosis*^
Nervous system disorders	convulsions*^, peripheral neuropathy*^, headache+, taste alteration+
Eye disorders	optic neuropathy*^[a]
Gastrointestinal disorders	vomiting+, diarrhea+, nausea+, abdominal pain+, abdominal cramps+, abdominal distension+, tongue discoloration*, superficial tooth discoloration*[b]
Skin and subcutaneous tissue disorders	bullous skin disorders including severe cutaneous adverse reactions (such as toxic epidermal necrolysis* and Stevens-Johnson syndrome*), angioedema*, hypersensitivity vasculitis*, rash*
Musculoskeletal and connective tissue disorders	rhabdomyolysis*^
Investigations	abnormal hematology tests+, abnormal liver function tests+

+ Events considered drug-related in controlled clinical trials with an incidence of at least 1%
* ADR identified post-marketing
‡ Primarily reported in patients receiving linezolid for more than the maximum recommended duration of 28 days
^ See sections **WARNINGS** and **PRECAUTIONS**

Table 14. Adverse Drug Reaction Table

System Organ Class	Adverse Drug Reactions

[a] Sometimes progressing to loss of vision, have been reported in patients treated with linezolid. These reports have primarily been in patients treated for longer than the maximum recommended durations of 28 days
[b] The discoloration was removable with professional dental cleaning (manual descaling) in cases with known outcome

Reporting of suspected adverse reactions

Reporting suspected adverse reactions after authorisation of the medicinal product is important. It allows continued monitoring of the benefit/risk balance of the medicinal product. Healthcare professionals are asked to report any suspected adverse reactions via:
Pusat Farmakovigilans/MESO Nasional
Direktorat Pengawasan Keamanan, Mutu, dan Ekspor Impor Obat, Narkotika, Psikotropika, Prekursor dan Zat Adiktif
Badan Pengawas Obat dan Makanan
Jl. Percetakan Negara No. 23, Jakarta Pusat, 10560
Email: pv-center@pom.go.id
Phone: +62-21-4244691 Ext.1079
Website: https://e-meso.pom.go.id/ADR

PT Pfizer Indonesia
Email: IDN.AEReporting@pfizer.com
Website: www.pfizersafetyreporting.com

OVERDOSAGE

In the event of overdosage, supportive care is advised, with maintenance of glomerular filtration. Hemodialysis may facilitate more rapid elimination of linezolid. In a phase 1 clinical trial, approximately 30% of a dose of linezolid was removed during a 3-hour hemodialysis session beginning 3 hours after the dose of linezolid was administered. Data are not available for removal of linezolid with peritoneal dialysis or hemoperfusion. Clinical signs of acute toxicity in animals were decreased activity and ataxia in rats and vomiting and tremors in dogs treated with 3000 mg/kg/day and 2000 mg/kg/day, respectively.

DOSAGE AND ADMINISTRATION

The recommended dosage for ZYVOX formulations for the treatment of infections is described in Table 15.

Table 15 Dosage Guidelines for ZYVOX

Infection*	Dosage and Route of Administration		Recommended Duration of Treatment (consecutive days)
	Pediatric Patients (6- 11 Years of Age)	Adults and Adolescents (12 Years and Older)	
Complicated skin and soft tissue infections	10 mg/kg IV q8h	600 mg IV q12h	10 to 14
Nosocomial pneumonia			

* Due to the designated pathogens (see section **INDICATIONS AND USAGE**)

Adult patients with infection due to MRSA should be treated with ZYVOX 600 mg q12h.

In controlled clinical trials, the protocol-defined duration of treatment for all infections ranged from 7 to 28 days. Total treatment duration was determined by the treating physician based on site and severity of the infection, and on the patient's clinical response.

No dose adjustment is necessary when switching from intravenous to oral administration. Patients whose therapy is started with ZYVOX I.V. Injection may be switched to either ZYVOX Tablets at the discretion of the physician, when clinically indicated.

Elderly patients: No dose adjustment is required.

Patients with renal insufficiency: No dose adjustment is required (see section **CLINICAL PHARMACOLOGY**).

Patients with severe renal insufficiency (i.e., CL_{CR} <30 mL/min): No dose adjustment is required. Due to the unknown clinical significance of higher exposure (up to 10-fold) to the two primary metabolites of linezolid in patients with severe renal insufficiency, linezolid should be used with special caution in these patients and only when the anticipated benefit is considered to outweigh the theoretical risk.

As approximately 30% of a linezolid dose is removed during 3 hours of hemodialysis, linezolid should be given after dialysis in patients receiving such treatment. The primary metabolites of linezolid are removed to some extent by hemodialysis, but the concentrations of these metabolites are still very considerably higher following dialysis than those observed in patients with normal renal function or mild to moderate renal insufficiency.

Therefore, linezolid should be used with special caution in patients with severe renal insufficiency who are undergoing dialysis and only when the anticipated benefit is considered to outweigh the theoretical risk.

To date, there is no experience of linezolid administration to patients undergoing continuous ambulatory peritoneal dialysis (CAPD) or alternative treatments for renal failure (other than hemodialysis).

Patients with hepatic insufficiency: No dose adjustment is required. However, there are limited clinical data and it is recommended that linezolid should be used in such patients only when the anticipated benefit is considered to outweigh the theoretical risk (see section **CLINICAL PHARMACOLOGY**).

Intravenous Administration
ZYVOX I.V. Injection is supplied in single-use, ready-to-use infusion bags (see section **HOW SUPPLIED** for container sizes). Parenteral drug products should be inspected visually for particulate matter prior to administration. Check for minute leaks by firmly squeezing the bag. If leaks are detected, discard the solution, as sterility may be impaired.

ZYVOX I.V. Injection should be administered by intravenous infusion over a period of 30 to 120 minutes. **Do not use this intravenous infusion bag in series connections**. Additives should not be introduced into this solution. If ZYVOX I.V. Injection is to be given concomitantly with another drug, each drug should be given separately in accordance with the recommended dosage and route of administration for each product. In particular, physical incompatibilities resulted when ZYVOX I.V. Injection was combined with the following drugs during simulated Y-site administration: amphotericin B, chlorpromazine HCl, diazepam, pentamidine isethionate, erythromycin lactobionate, phenytoin sodium, and trimethoprim-sulfamethoxazole. Additionally, chemical incompatibility resulted when ZYVOX I.V. Injection was combined with ceftriaxone sodium.

If the same intravenous line is used for sequential infusion of several drugs, the line should be flushed before and after infusion of ZYVOX I.V. Injection with an infusion solution compatible with ZYVOX I.V. Injection and with any other drug(s) administered via this common line (see section **Compatible Intravenous Solutions**).

Compatible Intravenous Solutions
5% Dextrose Injection, USP
0.9% Sodium Chloride Injection, USP
Lactated Ringer's Injection, USP

Keep the infusion bags in the overwrap until ready to use. Store at room temperature. Protect from freezing. ZYVOX I.V. Injection may exhibit a yellow color that can intensify over time without adversely affecting potency.

CLINICAL STUDIES

Adults

Vancomycin-resistant Enterococcal Infections

Adult patients with documented or suspected vancomycin-resistant enterococcal infection were enrolled in a randomized, multi-center, double-blind trial comparing a high dose of ZYVOX (600 mg) with a low dose of ZYVOX (200 mg) given every 12 hours (q12h) either intravenously (IV) or orally for 7 to 28 days. Patients could receive concomitant aztreonam or aminoglycosides. There were 79 patients randomized to high-dose linezolid and 66 to low-dose linezolid. The intent-to-treat (ITT) population with documented vancomycin-resistant enterococcal infection at baseline consisted of 65 patients in the high-dose arm and 52 in the low-dose arm.

The cure rates for the ITT population with documented vancomycin-resistant enterococcal infection at baseline are presented in Table 16 by source of infection. These cure rates do not include patients with missing or indeterminate outcomes. The cure rate was higher in the high-dose arm than in the low-dose arm, although the difference was not statistically significant at the 0.05 level.

Table 16. Cure Rates at the Test-of-Cure Visit for ITT Adult Patients with Documented Vancomycin-Resistant Enterococcal Infections at Baseline

Source of Infection	Cured	
	ZYVOX 600 mg q12h n/N (%)	ZYVOX 200 mg q12h n/N (%)
Any site	39/58 (67)	24/46 (52)
Any site with associated bacteremia	10/17 (59)	4/14 (29)
Bacteremia of unknown origin	5/10 (50)	2/7 (29)
Skin and skin structure	9/13 (69)	5/5 (100)
Urinary tract	12/19 (63)	12/20 (60)
Pneumonia	2/3 (67)	0/1 (0)
Other*	11/13 (85)	5/13 (39)

* Includes sources of infection such as hepatic abscess, biliary sepsis, necrotic gall bladder, pericolonic abscess, pancreatitis, and catheter-related infection.

Nosocomial Pneumonia

Adult patients with clinically and radiologically documented nosocomial pneumonia were enrolled in a randomized, multi-center, double-blind trial. Patients were treated for 7 to 21 days. One group received ZYVOX I.V. Injection 600 mg q12h, and the other group received vancomycin 1 g q12h IV. Both groups received concomitant aztreonam (1 to 2 g every 8 hours IV), which could be continued if clinically indicated. There were 203 linezolid-treated and 193 vancomycin-treated patients enrolled in the study. One hundred twenty-two (60%) linezolid-treated patients and 103 (53%) vancomycin-treated patients were clinically evaluable. The cure rates in clinically evaluable patients were 57% for linezolid-treated patients and 60% for vancomycin-treated patients. The cure rates in clinically evaluable patients with ventilator-associated pneumonia were 47% for linezolid-treated patients and 40% for vancomycin-treated patients. A modified intent-to-treat (MITT) analysis of 94

linezolid-treated patients and 83 vancomycin-treated patients included subjects who had a pathogen isolated before treatment. The cure rates in the MITT analysis were 57% in linezolid-treated patients and 46% in vancomycin-treated patients. The cure rates by pathogen for microbiologically evaluable patients are presented in Table 17.

Table 17. Cure Rates at the Test-of-Cure Visit for Microbiologically Evaluable Adult Patients with Nosocomial Pneumonia

Pathogen	Cured	
	ZYVOX n/N (%)	Vancomycin n/N (%)
Staphylococcus aureus	23/38 (61)	14/23 (61)
Methicillin-resistant *S. aureus*	13/22 (59)	7/10 (70)
Streptococcus pneumoniae	9/9 (100)	9/10 (90)

Pneumonia caused by multi-drug resistant *S. pneumoniae* (MDRSP*)

ZYVOX was studied for the treatment of community-acquired (CAP) and hospital-acquired (HAP) pneumonia due to MDRSP by pooling clinical data from seven comparative and non-comparative Phase 2 and Phase 3 studies involving adult and pediatric patients. The pooled MITT population consisted of all patients with *S. pneumoniae* isolated at baseline; the pooled ME population consisted of patients satisfying criteria for microbiologic evaluability. The pooled MITT population with CAP included 15 patients (41%) with severe illness (risk classes IV and V) as assessed by a prediction rule. The pooled clinical cure rates for patients with CAP due to MDRSP were 35/48 (73%) in the MITT and 33/36 (92%) in the ME populations respectively. The pooled clinical cure rates for patients with HAP due to MDRSP were 12/18 (67%) in the MITT and 10/12 (83%) in the ME populations respectively.

Table 18. Clinical cure rates for 36 microbiologically-evaluable patients with CAP due to MDRSP who were treated with ZYVOX (stratified by antibiotic susceptibility)**

Susceptibility Screening	Clinical Cure	
	n/N[a]	(%)
Penicillin-resistant	14/16	88
2nd generation cephalosporin-resistant[b]	19/22	86
Macrolide-resistant[c]	29/30	97
Tetracycline-resistant	22/24	92
Trimethoprim/sulfamethoxazole-resistant	18/21	86

a) n= pooled number of patients treated successfully; N= pooled number of patients having MDRSP isolates that exhibited resistance to the listed antibiotic
b) 2nd-generation cephalosporin tested was cefuroxime
c) macrolide tested was erythromycin

* MDRSP refers to isolates resistant to two or more of the following antibiotics: penicillin, second-generation cephalosporins, macrolides, tetracycline, and trimethoprim/sulfamethoxazole.

Complicated Skin and Soft Tissue Infections

Adult patients with clinically documented complicated skin and skin structure infections were enrolled in a randomized, multi-center, double-blind, double-dummy trial comparing study medications administered IV followed by medications given orally for a total of 10 to 21 days of treatment. One group of patients received ZYVOX I.V. Injection 600 mg q12h followed by ZYVOX Tablets 600 mg q12h; the other group received oxacillin 2 g every 6 hours (q6h) IV followed by dicloxacillin 500 mg q6h orally. Patients could receive concomitant aztreonam if clinically indicated. There were 400 linezolid-treated and 419 oxacillin-treated patients enrolled in the study. Two hundred forty-five (61%) linezolid-treated patients and 242 (58%) oxacillin-treated patients were clinically evaluable. The cure rates in clinically evaluable patients were 90% in linezolid-treated patients and 85% in oxacillin-treated patients. A modified intent-to-treat (MITT) analysis of 316 linezolid-treated patients and 313 oxacillin-treated patients included subjects who met all criteria for study entry. The cure rates in the MITT analysis were 86% in linezolid-treated patients and 82% in oxacillin-treated patients. The cure rates by pathogen for microbiologically evaluable patients are presented in Table 19.

Table 19. Cure Rates at the Test-of-Cure Visit for Microbiologically Evaluable Adult Patients with Complicated Skin and Soft Tissue Infections

Pathogen	Cured	
	ZYVOX n/N (%)	**Oxacillin/Dicloxacillin n/N (%)**
Staphylococcus aureus	73/83 (88)	72/84 (86)
Methicillin-resistant *S. aureus*	2/3 (67)	0/0 (-)
Streptococcus agalactiae	6/6 (100)	3/6 (50)
Streptococcus pyogenes	18/26 (69)	21/28 (75)

A separate study provided additional experience with the use of ZYVOX in the treatment of methicillin-resistant *Staphylococcus aureus* (MRSA) infections. This was a randomized, open-label trial in hospitalized adult patients with documented or suspected MRSA infection.

One group of patients received ZYVOX I.V. Injection 600 mg q12h followed by ZYVOX Tablets 600 mg q12h. The other group of patients received vancomycin 1 g q12h IV. Both groups were treated for 7 to 28 days, and could receive concomitant aztreonam or gentamicin if clinically indicated. The cure rates in microbiologically evaluable patients with MRSA skin and skin structure infection were 26/33 (79%) for linezolid-treated patients and 24/33 (73%) for vancomycin-treated patients.

Diabetic Foot Infections

Adult diabetic patients with clinically documented complicated skin and skin structure infections (“diabetic foot infections”) were enrolled in a randomized (2:1 ratio), multi-center, open-label trial comparing study medications administered IV or orally for a total of 14 to 28 days of treatment. One group of patients received ZYVOX 600 mg q12h IV or orally; the other group received ampicillin/sulbactam 1.5 to 3 g IV or amoxicillin/clavulanate 500 to 875

mg every 8 to 12 hours (q8-12h) orally. In countries where ampicillin/sulbactam is not marketed, amoxicillin/clavulanate 500 mg to 2 g every 6 hours (q6h) was used for the intravenous regimen. Patients in the comparator group could also be treated with vancomycin 1 g q12h IV if MRSA was isolated from the foot infection. Patients in either treatment group who had Gram-negative bacilli isolated from the infection site could also receive aztreonam 1 to 2 g q8-12h IV. All patients were eligible to receive appropriate adjunctive treatment methods, such as debridement and off-loading, as typically required in the treatment of diabetic foot infections, and most patients received these treatments. There were 241 linezolid-treated and 120 comparator-treated patients in the intent-to-treat (ITT) study population. Two hundred twelve (86%) linezolid-treated patients and 105 (85%) comparator-treated patients were clinically evaluable. In the ITT population, the cure rates were 68.5% (165/241) in linezolid-treated patients and 64% (77/120) in comparator-treated patients, where those with indeterminate and missing outcomes were considered failures. The cure rates in the clinically evaluable patients (excluding those with indeterminate and missing outcomes) were 83% (159/192) and 73% (74/101) in the linezolid- and comparator-treated patients, respectively. A critical post-hoc analysis focused on 121 linezolid-treated and 60 comparator-treated patients who had a Gram-positive pathogen isolated from the site of infection or from blood, who had less evidence of underlying osteomyelitis than the overall study population, and who did not receive prohibited antimicrobials. Based upon that analysis, the cure rates were 71% (86/121) in the linezolid-treated patients and 63% (38/60) in the comparator-treated patients. None of the above analyses were adjusted for the use of adjunctive therapies. The cure rates by pathogen for microbiologically evaluable patients are presented in Table 20.

Table 20. Cure Rates at the Test-of-Cure Visit for Microbiologically Evaluable Adult Patients with Diabetic Foot Infections

Pathogen	Cured	
	ZYVOX n/N (%)	**Comparator n/N (%)**
Staphylococcus aureus	49/63 (78)	20/29 (69)
Methicillin-resistant *S. aureus*	12/17 (71)	2/3 (67)
Streptococcus agalactiae	25/29 (86)	9/16 (56)

HOW SUPPLIED

ZYVOX 2 mg/ml Injection; Foil bag @ 300 mL; Reg. No. DKI1746000149A1

STORAGE CONDITIONS

Solution for Infusion: Store below 25°C.
Do not freeze. Sensitive to light.
Keep bags in foil overwrap and carton until ready to use.

HARUS DENGAN RESEP DOKTER

Zyvox Injections
Manufactured and released by:

HP Halden Pharma AS, Halden, Norway

Imported and secondary packed by:
PT. Pfizer Indonesia
Jakarta, Indonesia

Leaflet kemasan: Informasi bagi pengguna

Zyvox
2 mg/ml larutan untuk infus
Linezolid

Baca semua bagian leaflet ini dengan cermat sebelum mulai menggunakan obat ini karena berisi informasi penting bagi Anda.
- Simpan leaflet ini. Anda mungkin perlu membacanya kembali.
- Jika Anda memiliki pertanyaan lebih lanjut, tanyakan kepada dokter, apoteker, atau perawat Anda.
- Obat ini telah diresepkan hanya untuk Anda. Jangan berikan kepada orang lain. Obat ini dapat membahayakan mereka, sekalipun tanda-tanda penyakit mereka sama dengan Anda.
- Jika Anda mengalami efek samping apa pun, konsultasikan dengan dokter atau perawat Anda. Termasuk setiap kemungkinan efek samping yang tidak tercantum dalam leaflet ini. Lihat bagian 13.

Isi leaflet ini:

1. Nama obat
Zyvox

2. Bentuk sediaan
Larutan untuk infus.

3. Deskripsi obat

Zyvox Injeksi I.V. mengandung linezolid, yaitu sebuah obat antibakteri sintetis dari golongan oksazolidinon.

Zyvox Injeksi I.V. disediakan sebagai larutan isotonik steril siap pakai untuk infus intravena.

4. Apa kandungan obat ini?

Setiap ml mengandung 2 mg linezolid. Kantong infus 300 ml berisi 600 mg linezolid.

Daftar Zat Tambahan

Bahan tidak aktifnya adalah natrium sitrat, asam sitrat, dan dekstrosa dalam media air untuk pemberian secara intravena. Kandungan natriumnya (Na+) adalah 0,38 mg/ml (5 mEq per kantong 300 ml).

5. Kekuatan obat

2 mg/ml.

6. Apa kegunaan obat ini?

Formulasi Zyvox diindikasikan untuk mengobati infeksi berikut ini yang disebabkan oleh galur yang rentan dari mikroorganisme yang ditentukan.

Zyvox diindikasikan untuk pengobatan *Staphylococcus aureus* yang resisten terhadap metisilin (MRSA), dan *Enterococcus* yang resisten terhadap vankomisin (VRE) pada infeksi berikut ini yang disebabkan oleh bakteri Gram positif:

- Pneumonia nosokomial
- Komplikasi infeksi kulit dan jaringan lunak, termasuk infeksi kaki diabetik, tanpa disertai osteomielitis, yang disebabkan oleh *Staphylococcus aureus* (galur yang sensitif dan resisten terhadap metisilin), *Streptococcus pyogenes*, atau *Streptococcus agalactiae*. Zyvox belum diteliti dalam mengobati ulkus dekubitus. Terapi kombinasi dapat diindikasikan secara klinis jika patogen yang didokumentasikan atau diduga termasuk organisme Gram-negatif.

Linezolid hanya boleh diberikan di lingkungan rumah sakit dan setelah berkonsultasi dengan dokter spesialis yang relevan.

Linezolid **hanya** aktif terhadap bakteri Gram positif. Linezolid tidak memiliki aktivitas klinis terhadap patogen Gram negatif. Terapi Gram negatif spesifik diperlukan jika patogen Gram negatif penyerta didokumentasikan atau diduga.

Panduan resmi tentang penggunaan agen antibakteri yang tepat harus menjadi pertimbangan.

Untuk mengurangi perkembangan bakteri yang resisten terhadap obat serta mempertahankan keefektifan Zyvox dan obat-obatan antibakteri lainnya, maka Zyvox hanya boleh digunakan untuk mengobati atau mencegah infeksi yang sudah terbukti atau diduga kuat disebabkan oleh bakteri yang rentan. Jika informasi kultur dan kerentanan tersedia, maka perlu dijadikan pertimbangan dalam memilih atau memodifikasi terapi antibakteri.

7. Berapa banyak dan seberapa sering Anda seharusnya menggunakan obat ini? Apa yang harus dilakukan jika ada dosis terlewat?

Selalu gunakan obat ini dengan tepat sesuai anjuran dokter atau apoteker Anda. Tanyakan kepada dokter atau apoteker jika Anda merasa tidak yakin.

Obat ini akan diberikan kepada Anda melalui drip (lewat infus ke dalam vena) oleh dokter atau petugas kesehatan.

Larutan untuk infus harus diberikan dalam jangka waktu 30 hingga 120 menit. Durasi pengobatan yang dianjurkan adalah 10 hingga 14 hari berturut-turut.

Dewasa dan Remaja (12 Tahun atau Lebih)
Dosis Zyvox Injeksi I.V. yang dianjurkan adalah 600 mg secara intravena setiap 12 jam.

Anak-anak (6–11 Tahun)
Dosis yang dianjurkan untuk anak-anak adalah 10 mg/kg secara intravena setiap 8 jam.

Lansia
Tidak ada anjuran penyesuaian dosis untuk pasien lansia.

Saat Anda menggunakan Zyvox, dokter akan melakukan tes darah rutin untuk memantau hitung jenis darah Anda.

Dokter akan memantau penglihatan Anda jika Anda menggunakan Zyvox selama lebih dari 28 hari.

Jika Anda lupa menggunakan Zyvox
Karena Anda akan menerima obat ini di bawah pengawasan yang ketat, kecil kemungkinannya dosis Anda akan terlewat. Jika Anda merasa ada dosis pengobatan yang terlewat, segera beri tahu dokter atau perawat Anda. Jangan menggunakan dosis ganda untuk mengejar dosis yang terlupa.

Jika Anda memiliki pertanyaan lebih lanjut seputar penggunaan obat ini, tanyakan kepada dokter atau apoteker Anda.

8. Kapan seharusnya Anda tidak menggunakan obat ini?

Jangan menggunakan Zyvox

- Jika Anda alergi terhadap linezolid atau bahan-bahan lainnya dalam obat ini
- Jika Anda sedang menggunakan atau telah menggunakan dalam 2 minggu terakhir obat-obatan yang diketahui termasuk golongan penghambat monoamin oksidase (MAOI: misalnya fenelzin, isokarboksazid). Obat-obatan ini dapat digunakan untuk mengobati depresi atau penyakit Parkinson.
- Jika Anda memiliki tekanan darah tinggi yang tidak terkendali, atau menderita feokromositoma (sejenis tumor pada kelenjar adrenal), atau menderita tirotoksikosis (aktivitas kelenjar tiroid yang berlebihan).
- Jika Anda sedang menggunakan jenis obat-obatan berikut ini: agen simpatomimetik dengan kerja langsung atau tidak langsung (misalnya pseudoefedrin, fenilpropanolamin), agen vasopresif (misalnya epinefrin, norepinefrin), agen dopaminergik (misalnya dopamin, dobutamin).

- Jika Anda mengalami kulit memerah atau gejala lain yang disebabkan oleh tumor karsinoid.
- Jika Anda sedang menggunakan obat-obatan berikut ini: penghambat penyerapan kembali serotonin, antidepresan trisiklik, agonis reseptor 5-HT1 serotonin (triptan), meperidin, atau buspiron.

9. Apa pertimbangan saat menggunakan obat ini?

Konsultasikan dengan dokter sebelum menggunakan Zyvox.

Zyvox mungkin tidak cocok untuk Anda jika Anda menjawab **ya** ke pertanyaan mana pun berikut ini. Dalam hal ini, beri tahu dokter Anda karena mereka perlu melakukan pemeriksaan kesehatan Anda secara umum dan tekanan darah Anda sebelum dan selama pengobatan Anda atau mungkin memutuskan pengobatan lain yang lebih baik untuk Anda.

Tanyakan kepada dokter jika Anda tidak yakin apakah kategori ini berlaku bagi ini.

- Apakah Anda memiliki tekanan darah tinggi, apakah Anda menggunakan obat untuk mengatasi kondisi ini atau tidak?
- Apakah Anda pernah didiagnosis memiliki tiroid overaktif?
- Apakah Anda memiliki tumor pada kelenjar adrenal (feokromositoma) atau sindrom karsinoid (disebabkan oleh tumor pada sistem hormon dengan gejala berupa diare, kulit memerah, mengi)?
- Apakah Anda menderita depresi manik, kelainan skizoafektif, kebingungan mental, atau gangguan mental lainnya?
- Apakah Anda menderita rasa nyeri yang sedang hingga berat, apakah Anda menggunakan obat untuk mengatasi kondisi ini atau tidak?
- Apakah Anda memiliki riwayat hiponatremia (kadar natrium darah rendah)?

Penggunaan obat-obatan tertentu, termasuk antidepresan dan opioid, bersama dengan Zyvox dapat menimbulkan sindrom serotonin, suatu kondisi yang berpotensi mengancam jiwa (lihat bagian 10 dan bagian 13).

Berhati-hatilah saat menggunakan Zyvox

Konsultasikan dengan dokter sebelum menggunakan obat ini, jika Anda:

- mudah lebam dan berdarah
- menderita anemia (jumlah sel darah merah rendah)
- rentan terkena infeksi
- memiliki riwayat kejang
- memiliki gangguan hati atau masalah ginjal, khususnya jika Anda menjalani dialisis
- mengalami diare

Beri tahu dokter segera jika selama pengobatan Anda mengalami

- gangguan penglihatan seperti penglihatan kabur, perubahan dalam penglihatan warna, kesulitan melihat secara detail, atau jika bidang pandang Anda menjadi terbatas.
- hilangnya sensitivitas pada lengan atau tungkai Anda atau sensasi kesemutan atau ditusuk-tusuk pada lengan atau tungkai Anda.
- Anda mungkin mengalami diare selama menggunakan atau setelah menggunakan antibiotik, termasuk Zyvox. Jika kondisi ini bertambah parah atau terus berlanjut atau

jika Anda mengamati adanya darah atau lendir dalam feses Anda, Anda harus berhenti menggunakan Zyvox segera dan konsultasikan hal ini dengan dokter Anda. Dalam situasi ini, Anda dilarang mengonsumsi obat yang menghentikan atau memperlambat buang air besar.
- mual atau muntah berulang, nyeri abdomen, atau napas cepat.
- nyeri otot, nyeri tekan, atau merasa lemah tanpa sebab yang jelas dan/atau air seni berwarna gelap. Gejala ini bisa saja menunjukkan adanya kondisi serius yang disebut rhabdomiolisis (terurainya otot), yang dapat menimbulkan kerusakan ginjal.
- merasa sakit dan tidak enak badan disertai kelemahan otot, sakit kepala, kebingungan, dan gangguan memori yang dapat menunjukkan adanya kondisi hiponatremia (kadar natrium darah rendah).

10. Apa saja obat lain atau makanan yang harus dihindari selama menggunakan obat ini?

Ada risiko bahwa Zyvox kadang-kadang berinteraksi dengan obat-obatan tertentu lainnya sehingga menimbulkan efek samping seperti perubahan tekanan darah, suhu, atau denyut jantung.

Beri tahu dokter atau apoteker jika Anda sedang menggunakan atau baru-baru ini menggunakan obat-obatan lainnya.

Beri tahu dokter jika Anda sedang menggunakan atau dalam 2 minggu terakhir telah menggunakan obat-obatan berikut ini karena Zyvox **tidak boleh** digunakan jika Anda sedang menggunakan obat-obatan ini atau telah menggunakannya baru-baru ini (lihat juga bagian '**Jangan menggunakan Zyvox**' di atas).

- penghambat monoamin oksidase (MAOI misalnya fenelzin, isokarboksazid). Obat-obatan ini dapat digunakan untuk mengobati depresi atau penyakit Parkinson

Beri tahu juga dokter jika Anda sedang menggunakan obat-obatan berikut ini. Dokter Anda mungkin akan tetap memutuskan untuk memberikan Zyvox kepada Anda, tetapi dengan memeriksa kesehatan Anda secara umum dan tekanan darah Anda sebelum dan selama pengobatan berlangsung. Dalam kasus lain, dokter mungkin memutuskan bahwa pengobatan lain mungkin lebih baik untuk Anda.

- Obat selesma atau flu dekongestan yang mengandung pseudoefedrin atau fenilpropanolamin.
- Antidepresan tertentu yang dikenal sebagai trisiklik atau SSRI (penghambat ambilan kembali serotonin selektif).
- Obat-obatan yang digunakan untuk mengobati reaksi alergi berat yang muncul tiba-tiba seperti adrenalin (epinefrin).
- Obat-obatan yang meningkatkan tekanan darah Anda, seperti noradrenalin (norepinefrin), dopamin, dan dobutamin.
- Obat-obatan yang digunakan untuk mengobati rasa nyeri sedang hingga berat, misalnya opioid.
- Obat-obatan yang digunakan untuk mengobati gangguan kecemasan, seperti buspiron.
- Obat-obatan yang menghentikan pembekuan darah, seperti warfarin.
- Antibiotik yang disebut rifampisin.

Zyvox dengan makanan, minuman, dan alkohol

- Hindari mengonsumsi keju matang, ekstrak ragi, atau ekstrak kedelai misalnya kecap dalam jumlah besar dan mengonsumsi alkohol, khususnya meneguk bir dan anggur. Hal ini karena Zyvox dapat bereaksi dengan zat yang disebut tiramin yang secara alami terkandung dalam beberapa jenis makanan. Interaksi ini dapat menyebabkan kenaikan tekanan darah Anda.

Zyvox mengandung natrium
Setiap 1 ml larutan Zyvox mengandung 0,38 mg natrium.
Harap beri tahu dokter atau perawat jika Anda sedang menjalani diet rendah natrium.

11. Apakah obat ini aman bagi ibu hamil dan menyusui?
Efek Zyvox pada ibu hamil belum diketahui. Oleh karena itu, obat ini tidak boleh digunakan selama kehamilan kecuali jika disarankan oleh dokter Anda.

Jika Anda hamil atau menyusui, menduga bahwa diri Anda hamil, atau sedang merencanakan kehamilan, mintalah saran dari dokter atau apoteker Anda sebelum menggunakan obat ini.

Anda dilarang menyusui selama menggunakan Zyvox kecuali jika disarankan oleh dokter Anda karena Zyvox dapat dikeluarkan bersama ASI dan berdampak terhadap bayi.

12. Apakah pasien diizinkan mengemudi dan mengoperasikan mesin saat menggunakan obat ini?
Pengaruh linezolid terhadap kemampuan untuk mengemudi atau mengoperasikan mesin belum dievaluasi secara sistematis.

13. Apa saja potensi efek yang tidak diinginkan dari penggunaan obat ini?
Seperti semua obat-obatan yang ada, obat ini bisa menimbulkan efek samping, meskipun tidak semua orang mengalaminya.

Beri tahu dokter, perawat, atau apoteker segera jika Anda mengalami efek samping apa pun berikut ini selama menjalani pengobatan dengan Zyvox:

- Kelainan kulit berat, pembengkakan khususnya di sekitar wajah dan leher, mengi, dan/atau kesulitan bernapas. Ini bisa jadi merupakan tanda-tanda reaksi alergi dan mungkin Anda perlu berhenti menggunakan Zyvox. Reaksi kulit seperti ruam ungu menonjol disebabkan oleh peradangan pembuluh darah, kulit memerah perih dan mengelupas (dermatitis), ruam, gatal-gatal.
- Gangguan penglihatan seperti penglihatan kabur, perubahan dalam penglihatan warna, kesulitan melihat secara detail, atau jika bidang pandang Anda menjadi terbatas.
- Diare berat dengan darah dan/atau lendir pada feses Anda (kolitis yang dikaitkan dengan antibiotik, termasuk kolitis pseudomembranosa), yang dalam kondisi jarang dapat berkembang menjadi komplikasi yang mengancam jiwa.
- Mual atau muntah berulang, nyeri abdomen, atau napas cepat.
- Sawan atau kejang juga telah dilaporkan dalam penggunaan Zyvox. Anda harus memberi tahu dokter jika Anda merasakan agitasi, kebingungan, delirium, kekakuan,

tremor, kehilangan koordinasi, dan kejang di samping penggunaan antidepresan yang disebut SSRI atau opioid.
- Perdarahan atau lebam yang tidak diketahui sebabnya, yang bisa jadi disebabkan perubahan jumlah sel tertentu dalam darah yang dapat memengaruhi pembekuan darah atau menyebabkan anemia.
- Perubahan jumlah sel tertentu dalam darah yang dapat memengaruhi kemampuan Anda dalam memerangi infeksi, beberapa tanda infeksi di antaranya adalah: demam, nyeri tenggorok, tukak mulut, dan merasa lelah.
- Nyeri otot, nyeri tekan, atau merasa lemah tanpa sebab yang jelas dan/atau air seni berwarna gelap. Gejala ini bisa saja menunjukkan adanya kondisi serius yang disebut rhabdomiolisis (terurainya otot), yang dapat menimbulkan kerusakan ginjal.

Mati rasa, kesemutan, atau penglihatan kabur telah dilaporkan oleh pasien yang telah menggunakan Zyvox selama lebih dari 28 hari. Jika Anda merasa adanya gangguan pada penglihatan Anda, segera konsultasikan dengan dokter.

Efek samping lainnya antara lain:
- Infeksi jamur khususnya seriawan vagina atau mulut
- Sakit kepala
- Perubahan rasa di dalam mulut
- Perubahan beberapa hasil tes darah
- Kesulitan untuk tidur
- Kenaikan tekanan darah
- Pusing
- Batuk
- Nyeri abdomen lokal atau umum
- Konstipasi
- Gangguan pencernaan
- Nyeri lokal
- Sensasi seperti kesemutan atau mati rasa
- Lidah membengkak, nyeri, atau berubah warna
- Inflamasi pembuluh vena (termasuk di tempat pemberian infus (drip))
- Konvulsi
- Infeksi saluran pernapasan atas
- Kesulitan bernapas
- Kadar kalium darah rendah
- Perdarahan gastrointestinal
- Penurunan jumlah trombosit
- Peningkatan kadar kreatinin
- Penurunan jumlah sel darah
- Badan terasa lemah dan/atau perubahan sensoris
- Perubahan warna gigi superfisial
- Mencret

Melaporkan efek samping
Jika Anda mengalami efek samping apa pun, konsultasikan dengan dokter, apoteker, atau perawat Anda. Termasuk setiap kemungkinan efek samping yang tidak tercantum dalam

leaflet ini. Dengan melaporkan efek samping, Anda bisa membantu memberikan informasi lebih lanjut mengenai keamanan obat ini.

Untuk melaporkan efek samping, hubungi www.pfizersafetyreporting.com atau email di IDN.AEReporting@pfizer.com.

14. Tanda-tanda dan gejala-gejala overdosis
Kemungkinan efek overdosis adalah muntah, tremor (gemetar), merasa tidak stabil atau kurangnya koordinasi.

15. Apa yang harus dilakukan jika Anda menggunakan lebih dari dosis yang dianjurkan?
Jika Anda khawatir terlalu banyak menerima dosis Zyvox, segera beri tahu dokter atau perawat.

16. Bagaimana cara menyimpan obat ini?
Simpan pada suhu di bawah 25 °C.

Jangan dibekukan. Sensitif terhadap cahaya.

Simpan kantong di dalam bungkus foil dan dusnya hingga siap untuk digunakan.

Jauhkan obat ini dari pandangan dan jangkauan anak-anak.

Jangan gunakan obat ini jika sudah melewati tanggal kedaluwarsanya.

17. Nomor izin pemasaran
Zyvox Injeksi 2 mg/ml; Kantong foil @ 300 ml; No. Reg. DKI1746000149A1

18. Nama dan alamat pemohon dan/atau pemilik obat sesuai dengan ketentuan yang berlaku

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19. Tanggal revisi PIL
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20. Peringatan khusus
HARUS DENGAN RESEP DOKTER