

## Pediatric Tuberculosis Treatment

To address *Mycobacterium tuberculosis* during childhood

### Condition

In areas of high to moderate transmission, *Mycobacterium tuberculosis* is often difficult to diagnose in children, and those infected often do not receive timely or adequate treatment. In addition, children are particularly susceptible to developing tuberculosis disease (TB) due to the prevalence of risk factors that can compound immunodeficiency such as malnutrition, HIV, or other infections. The most common type of pediatric TB is pulmonary, while extrapulmonary TB occurs in about 20-30% of all cases of pediatric TB.

### Treatment Rationale

A combination of medications taken over a significant period of time is the foundation of effective TB treatment. The exact dosing and length of treatment depends on the form of TB as well as one's age and health status. TB treatment in children differs from conventional adult treatment in two ways. First, diagnosis of pediatric TB is often more difficult, resulting in a greater risk of delayed treatment of children until the disease is in a more advanced stage. Second, because ideal formulations for children are not currently on the market, children are at higher risk of being treated incorrectly, which can lead to drug-induced hepatotoxicity or the development of multidrug resistant tuberculosis.

The World Health Organization (WHO) has subscribed the following 4-drug pediatric dosing regimen for drug-susceptible TB:

Isoniazid (H) – 10 mg/kg (range 7–15 mg/kg); maximum dose 300 mg/day

Rifampicin (R) – 15 mg/kg (range 10–20 mg/kg); maximum dose 600 mg/day

Pyrazinamide (Z) – 35 mg/kg (30–40 mg/kg)

Ethambutol (E) – 20 mg/kg (15–25 mg/kg)

### Current Use in Low TB Burden Settings

Pediatric TB is rare in settings where TB infection is relatively low among the general population. For those infected, the standard treatment regimen, along with close medical observation, is utilized to encourage full recovery and prevent further spread of the disease.

### Application in High TB Burden Settings

WHO Pediatric TB Guidelines (2014) recommend that children who have suspected or confirmed pulmonary TB and reside in settings where there is a high prevalence of HIV should be given the four-drug regimen (HRZE) for 2 months and the 2 drug regimen (HR) for 4 months.

The recommended treatment depends on the child's age, weight, and HIV status. Children who have suspected or confirmed pulmonary TB residing in an area of low HIV prevalence and low isoniazid resistance should receive a three-drug regimen (HRZ) for 2 months, then a two-drug regimen (HR) for 4 months.

PREVENTION/TREATMENT



PREVENTION



DIAGNOSTIC



TREATMENT



### GLOBAL ANNUAL DEATHS ASSOCIATED WITH PEDIATRIC TB:

	NUMBER
Children who acquire TB	at least 1,000,000
Children who die of TB	210,000

## REPRESENTATIVE PRODUCTS

MAKE	MODEL	PROCUREMENT PRICE	TECH	STATUS	NOTES
<b>Generic</b>	Isoniazid	\$0.85-\$1.13 per 100 boxes	100-mg tablets	Marketed	Must be used in correct combination with WHO regimen
<b>Generic</b>	Rifampicin	\$3.70-\$4.70 per 100 boxes	150-mg tablet or capsule	Marketed	Must be used in correct combination with WHO regimen
		\$7.30-\$8.50 per 100 boxes	300-mg tablet or capsule		
<b>Generic</b>	Pyrazinamide	\$13.00-15.80 per 672 boxes	400-mg tablet	Marketed	Must be used in correct combination with WHO regimen
		\$21.00 per 672 boxes	500-mg tablet		
		\$1.60 per 90 boxes	500-mg tablet		
<b>Generic</b>	Ethambutol	\$3.04-\$8.86 per 100 boxes	100-mg tablet	Marketed	Must be used in correct combination with WHO regimen

Prices approximate both the highest and lowest product prices offered by the procurement agency, Global Drug Facility (GDF) and its principal suppliers. GDF recommends using the highest product prices when making budget estimations.

## CHARACTERISTICS OF REPRESENTATIVE PRODUCT

	TECHNOLOGY CHARACTERISTICS	OPERATIONAL PARAMETERS	POTENTIAL OPPORTUNITIES FOR IMPROVEMENT
<b>SKILLS REQUIRED</b>	Intended end user	Pediatric clinician, child	The intricacies of determining pharmaceutical need for TB should not be underestimated. Parents should also be well-informed of the treatment regimen to ensure compliance.
	Training required	Minutes	
	Time required per use	Minutes	
<b>ENVIRONMENT/ INFRASTRUCTURE</b>	Power required	None	
	Waste collection	None	
	Complementary technologies required	None	
	Temperature and storage	Store away from heat and light, 20-25°C	
	Maintenance	None	
<b>COST</b>	Device cost (approximate)		US \$100-500 in countries with a high burden of TB for drug susceptible TB (if inclusive of all treatment costs including medication, hospitalization, DOTS, outpatient care, etc...). US \$22-50 in high burden countries if only inclusive of medication costs.
	Cost/course (approximate)		
<b>OTHER</b>	Portability	<10g	
	Regulatory		
	Efficacy		

### Sources:

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 World Health Organization. Global Tuberculosis Report 2015, 20th ed, 2015. Geneva. Available from: [http://apps.who.int/iris/bitstream/10665/191102/1/9789241565059\\_eng.pdf?ua=1](http://apps.who.int/iris/bitstream/10665/191102/1/9789241565059_eng.pdf?ua=1)  
 World Health Organization, Stop TB Partnership, Treatment Action Group, International Union Against Tuberculosis and Lung Disease, U.S. Agency for International Development, U.S. Centers for Disease Control and Prevention, and UNICEF. Roadmap for Childhood Tuberculosis. 2013. Geneva. Available from: <http://www.who.int/tb/challenges/children/en/>.