

Table 9. Dosage for Pre-referral Treatment for Children (2-15 years) Weighing at Least 5kg

Weight (kg)	Age	Artesunate dose	Regimen (single dose)
5-8.9	0-12 months	50mg	One 50mg supp
9-19.9	13-42 months	100mg	One 100mg supp
20-29.9	43-60 months	200mg	Two 100mg supp
30-39.9	6-13 years	300mg	Three 100mg supp
>40	>14 years	400mg	One 400mg supp

6. Artemether 80mg, 40mg, and 20mg Ampoules

Severe malaria in adults and children can be treated with artemether intramuscular injections. The daily dosage is 3.2 mg/kg body weight on the first day followed by 1.6mg/kg body weight to a maximum of seven days. Once the patient can tolerate oral therapy, treatment should be switched to a complete dosage of oral ACTs.

Packaging for each artesunate injection is in boxes, and each contains one vial of artesunate plus one ampoule of 5 percent sodium bicarbonate.

Quinine

Quinine was first used to treat malaria in Rome in 1631. Whereas many antimalarials are prescribed in terms of base, for historical reasons, quinine doses are often recommended in terms of salt, usually sulfate for oral use and dihydrochloride for parenteral use. Various preparations include hydrochloride, dihydrochloride, sulfate, bisulfate, and gluconate. This makes quinine dosing very complicated because each salt has a different weight.

The following amounts of each form are equal:

- quinine base 100mg
- quinine bisulfate 169mg
- quinine dihydrochloride 122mg
- quinine hydrochloride 122mg
- quinine sulfate (actually [quinine]₂H₂SO₄·2H₂O) 121mg
- quinine gluconate 160mg

All quinine salts may be given orally or intravenously, and quinine gluconate may also be given intramuscularly or rectally.

Table 10. Dosage of Quinine Tablets

Age	Weight	Dose (every 8 hours for 7 days)
3 months to 1 year	5-10kg	75mg (1/4 tab)
1-5 years	10-18kg	150mg (1/2 tab)
5-7 years	18-24kg	225mg (3/4 tab)
7-10 years	24-30kg	300mg (1 tab)
10-13 years	30-40kg	375mg (1 ¼ tab)
13-15 years	40-50kg	450mg (1 ½ tab)
Older than 15 years	Over 50kg	600 (2 tab)

The intravenous dose of quinine is 8 mg/kg of quinine base every eight hours, the intramuscular dose is 12.8 mg/kg of quinine base twice daily, and the rectal dose is 20 mg/kg of quinine base twice daily. Treatment should last seven days.

Quinine formulations should be stored at room temperature and away from excess heat and moisture. Shelf life of quinine formulations is five years.

Sulphadoxine/Pyrimethamine (SP) 500mg/25mg

Sulfadoxine and pyrimethamine are folic acid antagonists. *P. falciparum* malaria clinically resistant to SP occurs frequently in parts of Southeast Asia and South America and is prevalent in East and Central Africa. Therefore, according to the most recent WHO recommendations, use of SP is restricted to IPTp. This requires administration of a complete curative dose of an antimalarial medicine at predefined intervals during pregnancy—typically in two doses and from the second trimester, at least one month apart—regardless of whether the pregnant women are infected with malaria.

- SP 500mg/25mg comes in tablet form, and a single dose comprises three tablets.
- Packaging is in packs of 1,000 tablets with 28 packs per carton.

Appendix B

Malaria Forecasting Guidance

Suggested Approaches to Forecasting for Malaria Programs in the Absence of Consumption Data

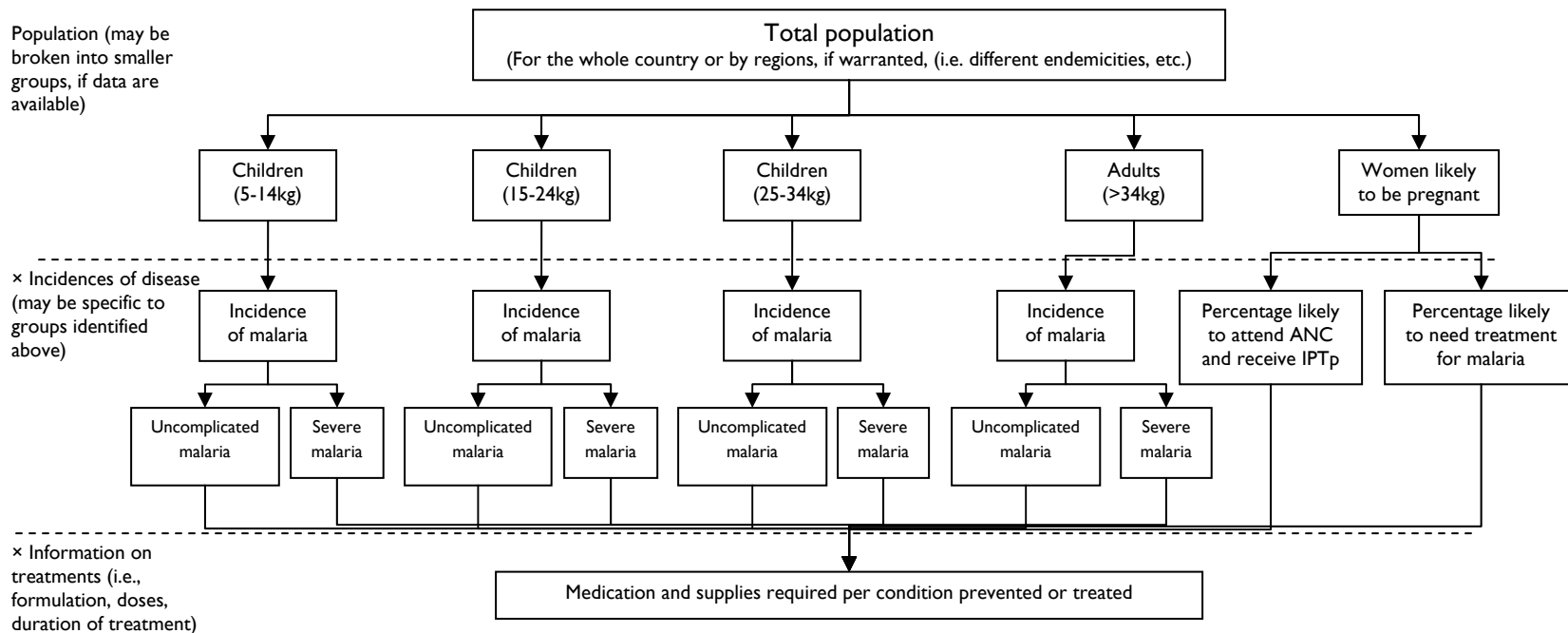
In many countries where we work, consumption data may not be available or may not reflect future use due to changes in malaria programs (i.e., RDT scale-up, LLIN and IRS campaigns, or changes in STGs). While every country will have a different context and require an appropriately tailored strategy, USAID | DELIVER PROJECT suggests two approaches to conducting a forecast of antimalarials based on non-consumption data that may be available. In the second part of this appendix, reference and proxy data are made available.

Morbidity Data

Follow the illustrative forecasting tree in figure 1 and populate with data available. You may have fewer or more branches in the forecasting tree than provided here. Each level of the tree is multiplied by the next to determine the final quantities of medicines and supplies needed. Data should include:

- Total population by weight band or age group used in recommended ACT, and population of women likely to be pregnant during the time reviewed
- Malaria incidence by groups organized above
- Treatments used by groups and diseases organized above. These should come from national STGs or by reviewing prescribing practices if these practices are substantially different from STGs and are not anticipating considerable changes, such as trainings.

Figure 5. Morbidity Forecasting Tree (Illustrative)



Services Data

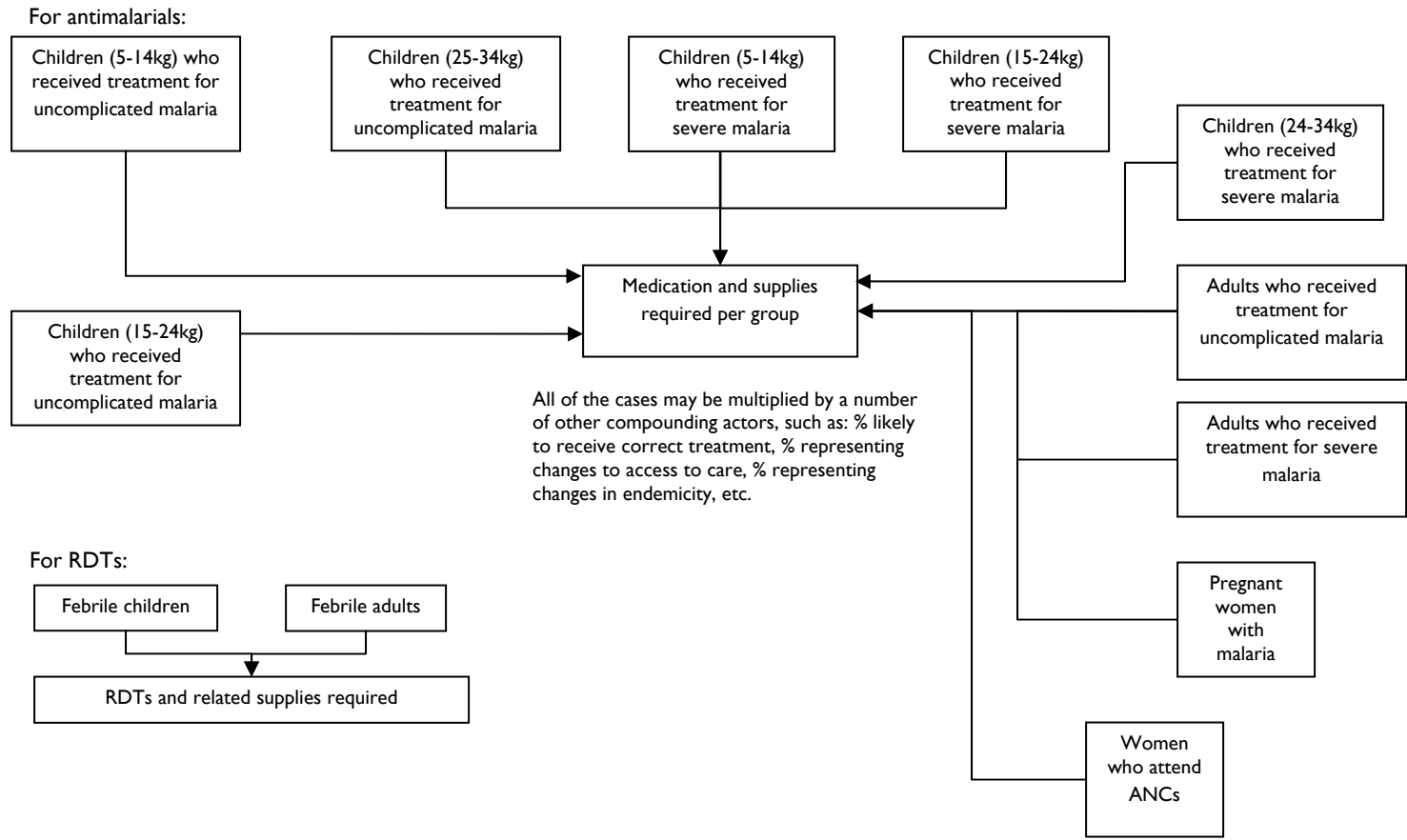
With this method, the number of cases for each condition is multiplied by medicines and supplies needed to determine the final quantity.

- For ANC and other antimalarial forecasting:
 - Malaria cases (by weight band or age group used in recommended ACT)
 - If data on malaria cases are not available, a percentage of fever episodes may be used to estimate malaria cases (see proxy data section below).
 - Number of suspected malaria cases with parasitological confirmation (treated and untreated) by groups organized above, if available.
 - Number of suspected malaria cases with negative parasitological confirmation (treated and untreated) by groups organized above, if available. This information may be useful if high numbers of negative results are receiving some type of treatment.
 - Number of severe malaria cases (as a percentage or figure of malaria cases by groups organized above, if available).
 - Number or percentage of women attending ANCs.
 - Number of pregnant women with malaria or treated for it in the past year.
 - Treatments used by groups and diseases organized above. These should come from national STGs or by reviewing prescribing practices if those are substantially different from STGs and not anticipating considerable changes, such as trainings.
- For RDT forecasting:
 - Number of cases tested by microscopy or RDT by groups organized above, if available, or
 - Number or percentage of fever cases tested by groups organized above, if available.

Notes:

- It's important that all patients suspected of having malaria be tested for parasitological confirmation. Forecasts for RDTs should therefore be much higher than those for patients who actually have malaria and receive treatment.
- If a scale-up of RDTs is planned for a new area, you may want to determine an upper limit for your forecast by determining the quantity of tests that a health worker can perform in a given period of time (e.g., working hours in a day).

Figure 6. Service Data Tree (Illustrative)



Reference Materials

General References

Possible sources of malaria data:

1. NMCP reports
2. RBM country facts website: <http://www.rbm.who.int/countryaction/index.html>
3. The WHO malaria country profiles website: <http://www.who.int/malaria/publications/country-profiles/en/index.html>
4. Health center sampling, which can be extrapolated to areas with similar transmission and/or service patterns.

Reference data for population:

Population of children from total population in sub-Saharan Africa¹⁸:

Children up to 4 years old: 16.5% of the total population

Children 5-9: 14.2% of the total population

Children 10-14: 12.3% of the total population

Children under 15: 43% of the total population

Relating age with weight or vice versa.

Girls under 5: http://www.who.int/childgrowth/standards/sft_wfa_girls_p_0_5.pdf

Boys under 5: http://www.who.int/childgrowth/standards/sft_wfa_boys_p_0_5.pdf

Girls 5-10: http://www.who.int/growthref/sft_wfa_girls_perc_5_10years.pdf

Boys 5-10: http://www.who.int/growthref/sft_wfa_boys_perc_5_10years.pdf

Age	Girls (median weight in kg)	Boys (median weight in kg)
0	3.2	3.3
1	8.9	9.6
2	11.5	12.2
3	13.9	14.3
4	16.1	16.3
5	18.2	18.3
6	20.2	20.5
7	22.4	22.9
8	25	25.4
9	28.2	28.1
10	31.9	31.2

¹⁸ U.S. Census Bureau, International Data base. <http://www.census.gov/ipc/www/idb/informationGateway.php>

Proxy Data (Refer to Studies for Detailed Information)

Uncomplicated malaria:

If the total of malaria cases is not available but the total of fever cases is, you may use the following proxy data to determine the percentage of fever cases caused by malaria¹⁹. Different stratifications are listed below, so you may choose one that best fits your situation. Multiply fever cases by the appropriate percentage to find the number of malaria cases. Remember that ACTs may not treat all malaria cases. That figure may be more or less with over- or under-treatment. The year 2000 was selected to represent the start of increased malaria control efforts.

Fevers associated with *P. falciparum* parasitaemia (PF Pf) in sub-Saharan Africa:

- Median of PF Pf across all age groups, seasons and setting is 35% (44% before 2000; 22% afterward).

PF Pf by age group:

- 36% for children under five years old (56.8% before 2000; 21.9% afterward).
- 26% for those above five (33.3.% before 2000; 17.5% afterward).

PF Pf by season:

- 37% in rainy season (54.9% before 2000; 32.6% afterward).
- 5% in dry season (4.6% before 2000; 11.9% afterward).

PF Pf by setting:

- 38% in rural areas (45.1% before 2000; 16.8% afterward).
- 31% in urban areas (39.8% before 2000; 25.7% afterward).
- 35% in primary care settings (43.2% before 2000; 25.8% afterward).
- 40% in hospitals (52.3% before 2000; 15.1% afterward).

¹⁹ D'Acromont et al.: Reduction in the proportion of fevers associated with *Plasmodium falciparum* parasitaemia in Africa: A systematic review. *Malaria Journal* 2010, 9:240.

Severe malaria:

If no data exist on percentage of malaria cases diagnosed as severe malaria, one of the following studies may be similar enough to the area forecast to use as a proxy.

Study	Dzeing-Ella (2005) ²⁵		Reyburn (2004) ²²		Mockenhaupt (2004) ²⁴		Chanda (2009) ²⁰	
Country	Gabon		Tanzania		Northern Ghana		Zambia	
Entomological inoculation rate (bites /person year)	50		1-300		300			
Intensity of malaria transmission	hyperendemic		range from low to high		not given		High and low transmission seasons (March-November 2005)	
Setting	country's tertiary referral hospital (children up to 10 years)		six district, one regional and one referral hospital (children under 13)		Teaching hospital (children 6 months to 9 years)		12 facilities in four districts	
Percentage of positive malaria cases	uncomplicated	severe	uncomplicated	severe	uncomplicated	severe	uncomplicated	severe
	81.5%	18.5%	33.1%	66.9%	38.2%	61.8%	98.5%	1.5%

Please note that most of the studies were at referral facilities, so the percentage of severe malaria cases is much higher than would be found at lower-level facilities.

²⁰ Chanda et al.: Cost-effectiveness analysis of the available strategies for diagnosing malaria in outpatient clinics in Zambia. *Cost Eff Resour Alloc.* 2009; 7:5.

Several studies have shown that as the intensity of *P. falciparum* transmission increases, the mean age of severe malaria decreases.²¹ Refer to the study for detailed information.

PfPR (transmission intensity)	Percentage in less than one-year-olds admitted to hospitals for severe malaria
>40% (mesoendemic to hyperendemic)	40%
5-39% (Hypoendemic to mesoendemic)	20%
<5% (hypoendemic)	10%

Hypoendemic (<10%), Mesoendemic (10-50%), Hyperendemic (50-75%)

Proxy percentage of patients with severe malaria conditions:

Condition	Average percentage of severe malaria patients with condition from the referenced studies^{22, 23, 24, 25}
Severe anemia	47.63%
coma or convulsions	23.4%
respiratory distress	22.7%
hyperlactatemia	29.47%
hypoglycemia	8.77%

²¹ Okiro et al.: Age patterns of severe paediatric malaria and their relationship to *Plasmodium falciparum* transmission intensity. *Malaria Journal* 2009 8:4.

²² Reyburn, et al.: Overdiagnosis of malaria in patients with severe febrile illness in Tanzania: a prospective study. *BMJ* 2004, doi:10.1136/bmj.38251.658229.55.

²³ Oduro, et al.: Severe falciparum malaria in young children of the Kassena-Nankana district of northern Ghana. *Malaria Journal* 2007, 6:96.

²⁴ Mockenhaupt, et al.: Manifestation and outcome of severe malaria in children in northern Ghana. *Am. J. Trop. Med. Hyg.* 2004, 7(2).

²⁵ Dzeing-Ella, et al.: Severe falciparum malaria in Gabonese children: clinical and laboratory features. *Malaria Journal* 2005, 4:1.

Impact of Interventions:

Authors	Bouyou-Akotet, et al ²⁶	Otten, et al ²⁷		Barnes, et al ²⁸	
Date published	December 2009	January 2009		October 2009	
Country	Gabon	Rwanda	Ethiopia	KwaZulu-Natal, South Africa	Zambia
Period under review	2000-08	reference period of 2001-05 in Rwanda and 2001-06 in Ethiopia, intervention period of 2007		2001-05	Reference period of 2001-02, intervention period of 2006
Setting	Largest hospital in-country, malaria unit	Nine hospitals and 10 national health centers from all five provinces	One hospital and one outpatient health center of two districts in four major regions		
Population	children <11, inpatient and outpatient	Inpatients of all ages, further segregated by under and over 5			
Interventions	ACTs in 2002; free ACTs and ITNs in 2005; ITN coverage reached 49.8% in 2006 and 57% in 2008.	LLIN and ACT in late 2006	LLIN distribution from 2005-07; ACTs launched in 2005	ACTs launched in 2001; IRS before and strengthened after 2005	ACTs launched in 2003 and in all districts by 2004; IRS from 2003-07; ITN distribution from 2003-05
Reductions	Percentage with malaria in 2000 was 45%, dropped to 12% in 2007 and 15% in 2008.	Inpatient cases declined 64% for <5 and 59% for 5+; laboratory-confirmed cases declined 63% for <5 and 54% for 5+.	Inpatient cases declined 83% for <5 and 69% for 5+; laboratory-confirmed cases declined 3% for 5+ (too little data for <5).	Malaria-related outpatient cases reduced by 85% in 2001 and by 97% by 2003.	Rates of inpatient malaria cases decreased by 61% from 2001-06; 91%-93% reduction in severe malaria cases at health facilities from 2002-05.

²⁶ Bouyou-Akotet, et al.: Evidence of decline of malaria in the general hospital of Lireville, Gabon from 2000-2008. *Malaria Journal* 2009, 8:300.

²⁷ Otten, et al.: Initial evidence of reduction of malaria cases and deaths in Rwanda and Ethiopia due to rapid scale-up of malaria prevention and treatment. *Malaria Journal* 2009, 8:14.

²⁸ Barnes, et al.: Impact of the large-scale deployment of artemether/lumefantrine on the malaria disease burden in Africa: case studies of South Africa, Zambia and Ethiopia. *Malaria Journal* 2009, 8(Suppl 1):SB.

Impact of RDTs:

Study	Uzochukwu ²⁹	Ansah ³⁰	Chinkhumba ³¹	Kyabayinze ³²	Bisoffi ³³	Msellem ³⁴
Average percentage of prescriptions for febrile patients with ACTs	Before intro of RDTs: 1.5% (79% placed on chloroquine and 19.5% on SP) After intro of RDTs: 86% (chloroquine dropped to 11.5% and SP to 2.5%)	In clinics that previously had microscopy, slight change was from 54.6% to 53.7%. In clinics that did not, RDT arm received fewer ACTs—57.8% compared to clinical arm (73.6%)				Before RDTs: 85%; after: 36%
Average percentage of prescriptions for febrile patients with antibiotics	Before RDTs: 75% after RDTs: 62%	3.1% with clinical arm; 14.1%-14.5% with RDT and microscopy arms				Before RDTs: 27%; after: 37%
Percentage of positive RDT result that received ACTs	100%	98.3%-99.6%	98%		95.6%-98.2%	
Percentage of negative RDT results that received ACTs	74%	46%-49.5%	58%	30% (children <5 were 2-3 more times likely to receive antimalarials)	79.8%-82.6%	
Percentage of positive RDT result that received antibiotics		11.2%-14.4%			46.2%-61%	

²⁹ Uzochukwu, et al. :Improving rational treatment of malaria: perceptions and influence of RDTs on prescribing behavior of health workers in southeast Nigeria. PLoS ONE 2011, 6:1.

³⁰ Ansah, et al.: Rapid testing for malaria in settings where microscopy is available and peripheral clinics where only presumptive treatment is available: a randomized controlled trial in Ghana. BMJ, 340:c930.

³¹ Chinkhumba, et al.: Comparative field performance and adherence to test results of four malaria rapid diagnostic tests among febrile patients more than five years of age in Blantyre, Malawi. Malaria Journal 2010, 9:209.

³² Kyabayinze, et al. Use of RDTs to improve malaria diagnosis and fever case management at primary health care facilities in Uganda. Malaria Journal 2010, 9(Suppl 2):P18.

³³ Bisoffi, et al. Rapid malaria diagnostic tests vs. clinical management of malaria in rural Burkina Faso: safety and effect on clinical decisions. A randomized trial. Tropical Medicine and International Health 2009, 14:5.

³⁴ Msellem, et al.: Influence of rapid malaria diagnostic tests on treatment and health outcome in fever patients, Zanzibar—A crossover validation study. PLoS ONE 2009, 6:4.

Percentage of negative RDT results that received antibiotics		28.6%-35%			54.7%-59.9%	
Other notes	Average number of prescriptions dropped from 6.2 to 3.3 after introduction of RDTs; number of medicines per prescription for positive RDTs were 2.1 and for negative RDTs were 3.8.			90% of patients were offered RDT; 38% reduction in antimalarial prescriptions.		

Appendix C

Procurement Checklist (adapted from the WHO Global Malaria Programme)³⁵

STEP 1	Select safe, effective antimalarial medicines Select medicines in accordance with WHO Guidelines for the Treatment of Malaria, national standard treatment guidelines, and program needs.
STEP 2	Estimate requirements Investigate opportunities for joint quantification. Quantify national need for treatment courses. Forecast numbers of packages needed, based on available funding. Prepare delivery schedules based on shelf life and storage and distribution capacity.
STEP 3	Secure funding Calculate the expected total cost of procuring and distributing required quantities of products (determined in STEP 2). Identify and secure funding (national budget, subsidies, donors).
STEP 4	Define product specification List required product formulations (see STEP 1). List required quality specifications.
STEP 5	Select procurement method and prepare tender documents Determine tender format and scope. Prepare tender documentation with invitation to bid, instructions to bidders, technical specifications, and schedule of requirements.

³⁵ http://whqlibdoc.who.int/publications/2010/9789241598927_eng.pdf

STEP 6	<p>Invite tenders</p> <p>In a fair, transparent process, identify and contact potential suppliers of stringently assessed products approved by the WHO PQP or an SRA.</p> <p>If too few such products are on the market, identify potential suppliers of alternative products and communicate the call for tender among them.</p>
STEP 7	<p>Investigate bid responses and validity</p> <p>Conduct a preliminary evaluation of offers on the basis of predetermined criteria.</p> <p>Examine suppliers' records, administrative information and licensing status.</p>
STEP 8	<p>Evaluate product quality</p> <p>Identify offers that comply fully with the technical specifications</p>
STEP 9	<p>Evaluate bids commercially</p> <p>From bids recommended on the basis of technical evaluation, select that which offers optimal value in terms of service and financial and logistic conditions.</p> <p>Tender evaluations should be based on criteria specified in tender documents (see STEP 4).</p>
STEP 10	<p>Prepare contracts</p> <p>On the basis of tender documentation and results of bid evaluation, prepare contracts with selected supplier(s).</p> <p>Include additional or specific requirements, such as language or packaging for the country of use.</p>
STEP 11	<p>Conduct preshipment inspection and quality control</p> <p>Identify opportunities for joint quality control testing.</p> <p>Contract a qualified laboratory (preferably WHO-prequalified or ISO-17025- accredited) in a competitive process.</p> <p>Ensure sampling, batch testing, handling of results, and reporting according to agreed procedures and funders' requirements.</p>
STEP 12	<p>Port clearance and receipt</p> <p>For international procurement, liaise with the supplier, consignee, and staff at port of entry before each shipment.</p> <p>On receipt, check products against orders and specifications.</p> <p>Report procurement outcomes as required by program and funders.</p>
STEP 13	<p>Post-shipment quality control</p> <p>Identify opportunities for joint quality control testing.</p> <p>Contract a qualified laboratory (preferably WHO-prequalified or ISO-17025-accredited) in a competitive process.</p> <p>Ensure sampling, batch testing, handling of results, and reporting according to agreed procedures and funders' requirements.</p>

STEP 14	<p>Storage and distribution</p> <p>Liaise with stock control officers or warehouse staff responsible for storage and distribution of medicines in accordance with good practice.</p>
STEP 15	<p>Monitor supplier performance</p> <p>Check that deliveries match orders over time. Keep a record of lead times and other procurement outcomes.</p>
STEP 16	<p>Monitor variations</p> <p>Ensure continuing compliance with contractual specifications. Handle any changes as contractually agreed.</p>

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