



Estimating Costs of Services of the Bangladesh National TB Control Program using One Health Tool

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Study objectives

General objective

- ❑ To conduct a detailed costing of services of the Bangladesh National TB Control Program using One Health Tool (OHT)

Specific objectives

- ❑ To estimate unit cost of TB services (prevention, diagnosis, treatment) and cost per patient in base year 2016 and target years 2017-22
- ❑ To estimate total cost of the program for the base year 2016 and target years as per operational plan



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Methodology

- ❑ “Ingredients costing” approach using OneHealth Tool (OHT)
- ❑ All inputs of base year 2016 and following five years (considering the time-frame of operational plans of 4th HPNSP) were identified, quantified and valued
- ❑ *Document/database review, consultative meetings, key informant interviews and field visit* to purposively selected facilities (Rajshahi CDH, CDC & RTRL, NIDCH, NTRL, Damien TB hospital in Mymensing, BRAC TB Diagnostic Centre, icddr,b TB Diagnostic Centre, Tangail CDC, DOTs corner in selected UHCs of Tangail district)
- ❑ Price source included Global Drug Facility website (medicine & diagnostic catalogue), MOHFW price list of tests, NTP source (microscopy, xpert, x-ray)
- ❑ The study is being guided by a technical working group and 2 expat consultants (Nadia Carvalho, Carel Pretorius)



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Process of estimating unit cost and total cost

Unit costs of interventions were estimated using OHT treatment input module (health service module)

Total cost per patient was estimated using unit costs of interventions organized according to NTP guidelines

Number of services was estimated by the TIME module (using diagnostic algorithm and NTP's annual report 2017) and multiplied by unit cost of intervention to estimate total cost of services

Total cost of program was estimated adding up total cost of services with health system related costs (HR, infrastructure, program management cost)



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Data Sources

Information	Source
Treatment inputs	<ul style="list-style-type: none"> - National guidelines & operational manual for TB control, 5th edition 2013, - National guidelines for programmatic management of drug resistant TB (PMDT), 2nd edition 2013 - National guidelines for management of childhood TB, 2nd edition 2016, - Consultative meetings with program officials/experts
Drugs, tests, reagents & other consumable supplies	<ul style="list-style-type: none"> - Global Drug Facility website (medicine & reagent catalogue) - MOHFW's price list of diagnostic tests - SOP: Quality assurance of AFB microscopy (ZN & FM method) 2nd edition, 2013 - Consultation with NTP microbiologist, service providers, and store keepers – - Operational plans, NTP's revised diagnostic algorithm, IPH
Average staff time per service	- Consultation with supervisors during field visit, expert opinion
Number of services/coverage data for base year 2016	<ul style="list-style-type: none"> - Annual Report 2017 of NTP, Health Bulletin 2017 - National guidelines on programmatic management of DR TB (PMDT), 2nd edition, - Estimates from TIME module
Number of service/coverage data for target years	- TB Operational Plan 2017-22, estimates from TIME module using revised diagnostic algorithm, PMDT, expert opinion
Human resources	- HRM database of DGHS, consultation with BRAC & Damien program officials



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TB service delivery channels selected by Technical Working Group for costing

1. Community: (preventive therapy, awareness campaign)
2. DOTS centres/corner (outpatient/domiciliary treatment)
3. Microscopy centres (sputum test)
4. Hospitals (hospitals providing TB inpatient treatment, X-ray, Culture & DST)
5. Xpert centres



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TB interventions of Bangladesh NTP during 2016

- Tests for TB diagnosis:** Microscopy (Z–N & F-M method), Gene Xpert, X-ray, Culture (solid, liquid) & DST (solid, liquid) in follow up, HIV testing for risk group
- First line treatment:**
 - Category-1: treatment for new adult patient
 - Category-2: previously treated adult patient**Treatment for childhood TB**
- Second line treatment:**
 - Long regimen for MDR TB
 - Short regimen for MDR TB
 - 24-month regimen for XDR TB
- Prevention:** IPT for children under 5 years of age
- Follow up tests for adult and child TB patients**
- Supplementary tests for MDR TB patients:** CBC, X-ray, ECG, Audiometry, Blood glucose, Serum creatinine, Serum electrolyte, Serum bilirubin, Liver function tests, Thyroid function tests.



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Updated TB interventions of Bangladesh NTP: 2019

- Tests for TB diagnosis:** All as before + LPA
- First line treatment:**
Category-I: as before
Lfx based retreatment for adult patient (6 months for Pul +ve/EPTP,
12 month for TB meningitis, Bone TB,
Neurological TB)
- Treatment for childhood TB for new cases**
Lfx based retreatment for children (Do)
- Second line treatment:** New long regimen for MDR TB (20 months),
New short regimen for MDR TB (9 months),
Pre-XDR TB (20 months)
- Preventive therapy**
 - 3HP therapy (for >2 yrs of age for 3 months weekly therapy)
 - IPT therapy (for <2 yrs of age for 6 months)
- Follow up tests for adult and child TB patients**
- Supplementary tests for MDR TB patients: As before**



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New treatment regimen

Management category	New Regimen (2019 onwards)
1st Line TB treatment: Re-treatment for adult and children	Pulmonary+ve/EPTB: Levofloxacin + 4FDC (RHZE) - 6 months Pulmonary-ve: 4FDC (RHZE) -6 months TB Meningitis, BoneTB, Neurological TB: Levofloxacin + 4 FDC (RHZE) ----- for 12 months
2nd Line TB treatment: Shorter Regimen (9 months)	Inj. Amikacin (Am) + Prothionamide(Pto)+ Isoniazide(H) – for first 4 months. + Clofazimine(Cfz) + Ethambutol(E)+ Moxifloxacin (Mfx)+ Pyrazinamide(Z) – ----- for 9 months
2nd Line TB treatment: Longer Regimen (20 months)	Bedaquiline – for first 6 months. + Pyrazinamide(Z) + Levofloxacin(Lfx)+Cycloserine(Cs)+ Clofazimine(Cfz), Linezolid(Lzd)+ Pyridoxin – for 20 months.
2nd Line TB treatment: Pre XDR Regimen (20 months)	Bedaquiline(Bdq) + Delamanide (Dlm) – for first 6 months. + Pyrazinamide(Z) + Cycloserine(Cs)+ Clofazimine(Cfz), Prothionamide(Pto)+Linezolid(Lzd)+Pyridoxin – for 20 months
TB Preventive Therapy	TB Contact >2 years old will get 3HP Therapy (3 months weekly therapy): H(Isoniazide) and Rifapentin(P) . TB Contact <2 years old will get IPT (Isoniazide Preventive Therapy): H/INH: for 6 months



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Findings

1. **Unit cost of services (investigation, treatment, prevention)**
2. **Cost per patient (drugs, supplies, investigations only)**
 - Previous regimen 2016 – 2018
 - New regimen 2019 - onwards
3. **Total cost 2016 - 2022 (cost of services plus system costs)**



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Unit cost of TB services (Investigation, treatment & prevention in 2016)

Services in 2016	Unit cost (2016)		Inflation adjusted for 2019	
	BDT	USD*	BDT	USD*
TB investigations				
Diagnosis by microscopy (Z-N 18% & LED 82%)	23.44	0.30	28.4	0.33
Follow up microscopy (Z-N 18% & LED 82%)	23.44	0.30	28.4	0.33
Z-N microscopy (100%)	26.00	0.33	31.5	0.37
LED microscopy (100%)	23.00	0.29	27.8	0.33
Culture (solid 80%, liquid 20%)	327.00	4.18	395.7	4.71
Drugs susceptibility test (solid 80%, liquid 20%)	630.29	8.05	1491.2	17.75
Gene-Xpert test (100%)	927.78	11.85	1122.8	13.36
X-ray chest (100%)	350.00	4.47	423.6	5.04



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Unit cost of TB services (Investigation, treatment & prevention in 2016) contd.

Services in 2016	Unit cost (2016)		Inflation adjusted for 2019	
	BDT	USD*	BDT	USD*
Treatment (Anti-TB drugs plus baseline and follow-up tests)				
First-line TB treatment: Initial treatment for adult; Category I (cost per adult patient)	3104.58	39.64	3757.1	44.7
Treatment for children (cost per child)	1663.09	21.24	2012.6	23.96
First-line TB treatment: Previously treated adult, Category II	8064.42	102.98	9759.4	116.2
Long regimen treatment for MDR TB (20 months)**	1,38,998.4	1775.2	1,68,212.4	2002.5
Short regimen treatment for MDR-TB (9 months)**	97,338.59	1243.14	1,17,797.8	1402.35
XDR TB treatment regimen (24 months)**	5,81,175.54	7422.42	7,03,324.4	8,372.9
Prevention				
IPT for children under 5 years of age	2,370.74	30.27	3,472.0	41.30



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Cost per patient: Category-I & Category II



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Cost per patient: New smear+ve/ Xpert MTB/Rif +ve Pulmonary TB (Category 1 TB patients): 2016

Investigation	Unit Cost 2016 (BDT)	Baseline investigation		Follow up investigation		Total Investigation cost/pt.	Total Drug cost/pt.	Total cost/pt.
		# tests	Cost (BDT)	# tests	Cost (BDT)			
Smear Microscopy	23.44	2	46.88	3	70.32	1394.98	1709.60	3104.58
Xpert	927.78	1	927.78					
CXR	350	1	350					
Total cost: BDT			1324.66		70.32			
* USD						17.81	21.83	*40.00
Inflation adjusted total cost for 2019; BDT (USD)								3,757.1 (45.00)

*Exchange rate of 2016: 1 USD= BDT 78.3 and 2019: 1 USD=84 BDT



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New Smear-ve Xpert MTB/Rif -ve Pulmonary TB Patient (Category I TB patient): 2016

Investigation	Unit cost 2016 (BDT)	Baseline investigation		Follow up investigation		Total Investigation cost/pt. (BDT)	Drug cost/pt (BDT)	Total cost/pt (BDT)
		# tests	Cost (BDT)	# tests	Cost (BDT)			
Smear Microscopy	23.44	2	46.88	1	23.44	1348.14	1709.60	3057.7
Xpert	927.78	1	927.78					
CXR	350	1	350					
Total: BDT			1324.7		23.44	1348.14	1709.60	3057.7
USD						17.21	21.83	*39.04
Inflation adjusted total cost for 2019 BDT (USD):								3,700.4 (44.1)

*Exchange rate of 2016: 1 USD= BDT 78.3 and 2019: 1 USD=84 BDT



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**Re-treatment case of smear+ve/ Xpert MTB/Rif +ve Pulmonary TB
(Category II TB patient): 2016**

Investigation	Unit cost 2016 (BDT)	Baseline investigation		Follow up investigation		Total Investigation Cost (BDT)	Drug Cost/pt. (BDT)	Total Cost/pt (BDT)
		# tests	Cost (BDT)	# tests	Cost (BDT)			
Smear Microscopy	23.44	2	46.88	3	70.32	1395.02	6669.42	8064.42
Xpert	927.78	1	927.78					
CXR	350	1	350					
Total BDT			1324.7		70.32	1395.02	6669.42	8064.42
USD						17.81	85.17	*102.98
Inflation adjusted total cost for 2019; BDT (USD)								9,759.4 (116.2)

*Exchange rate of 2016: 1 USD= BDT 78.3 and 2019: 1 USD=84 BDT



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**Cost per patient:
Levofloxacin based new treatment regimen
2019 onwards**



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New Levofloxacin (Lfx) based regimen for adult retreatment cases: Pulmonary+ ve/EPTB for 6 months DOTS: July 2019 onwards

Investigation	*Unit Cost (BDT) tests	Baseline investigation		Follow up Investigation		Total Investigation Cost (BDT)	Total drug Cost (BDT)	Total Cost/pt (BDT)
		# tests	Cost (BDT)	# tests	Cost (BDT)			
Smear Microscopy	28.4	2	56.7	3	85.1	3,703.1	4,924.8	8,627.9
Xpert	1122.8	1	1,122.8					
CXR	423.6	1	423.6					
LPA	2100	1	2100					
Total BDT			3,503.1		85.1	3,703.1	4,924.8	8,627.9
USD								102.7

*Inflation adjusted for 2019 except drug cost and LPA
Exchange rate of 2019: 1 USD=84 BDT



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New Lfx based regimen for adult retreatment cases: Pulmonary-ve for 6 months DOTS: 2019 onwards

Investigation	*Unit cost BDT	Baseline Invest.		Follow up invest.		Total Invest. Cost (BDT)	Drug Cost (BDT)	Total Cost/pt (BDT)
		# of tests	Cost (BDT)	# of tests	Cost (BDT)			
Smear Microscopy	28.4	2	56.7	3	85.1	3,364.6	3,558.6	6,923.2
Xpert	1122.8	1	1,122.8	-	-			
LPA	2100.0	1	2,100.0	-	-			
Total BDT	-	-	3,279.5	-	85.1	3,364.6	3,558.6	6,923.2
USD								82.4

(Exchange rate of 2019: 1 USD=84 BDT) *Inflation adjusted for 2019



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**New Lfx based regimen for adult retreatment cases:
TB Meningitis, Bone TB and Neurological TB for 12 months
DOTS: 2019 onwards**

Investigation	*Unit cost (BDT)	Baseline Invest.		Total Invest. Cost (BDT)	Drug Cost (BDT)	Total Cost/pt (BDT)
		# of tests	Cost (BDT)			
Smear Microscopy (CSF/Joint Fluid)	28.4	2	56.7	3,279.5	9,849.6	13,129.1
Xpert	1122.8	1	1,122.8			
LPA	2100.0	1	2,100.0			
Total BDT	-	-	3,279.5	3,279.5	9,849.6	13,129.1
USD						156.3

(Exchange rate of July 2019: 1 USD=84 BDT) *Inflation adjusted for 2019



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**New Lfx based regimen for child retreatment cases:
Pulmonary+ ve/EPTB for 6 months DOTS: 2019 onwards**

Investigation	*Unit cost BDT	Baseline Invest.		Follow up invest.		Total Invest. Cost (BDT)	Drug Cost (BDT)	Total Cost/pt (BDT)
		# of tests	Cost (BDT)	# of tests	Cost (BDT)			
Smear Microscopy	28.4	2	56.7	3	85.1	3,788.2	6,271.2	10,059.4
Xpert	1,122.8	1	1,122.8	-	-			
CXR	423.6	1	423.6	-	-			
LPA	2,100.0	1	2,100.0	-	-			
Total (BDT)			3,703.1		85.1	3,788.2	6,271.2	10,059.4
USD								119.8

(Exchange rate of July 2019: 1 USD=84 BDT) *Inflation adjusted for 2019



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**New Lfx based regimen for child retreatment cases:
Pulmonary -ve for 6 months DOTS: 2019 onwards**

Investigation	*Unit cost BDT	Baseline Invest.		Follow up invest.		Total Invest. Cost (BDT)	Drug Cost (BDT)	Total Cost/pt (BDT)
		# of tests	Cost (BDT)	# of tests	Cost (BDT)			
Smear Microscopy	28.4	2	56.7	3	85.1	3,364.6	5,815.8	9,180.0
Xpert	1,122.8	1	1,122.8	-	-			
LPA	2,100.0	1	2,100.0	-	-			
Total (BDT)	-	-	3,279.5	-	85.1	3,364.6	5,815.8	9,180.0
USD								109.3

(Exchange rate of July 2019: 1 USD=84 BDT) *Inflation adjusted for 2019



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**New Lfx based regimen for child retreatment cases: Meningitis,
Bone TB and neurological TB for 12 months DOTS:
2019 onwards**

Investigation	* Unit cost (BDT)	Baseline Invest.		Total Invest. Cost (BDT)	Drug Cost (BDT)	Total Cost/pt (BDT)
		# of Tests	Cost (BDT)			
Smear microscopy (CSF/Joint fluid)	28.4	2	56.7	3,279.5	12,542.4	15,821.9
Xpert	1122.8	1	1,122.8			
LPA	2100.0	1	2,100.0			
Total BDT	-	-	3,279.5	3,279.5	12,542.4	15,821.9
USD						188.4



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Cost per patient: MDR TB cases



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Drugs and investigation cost per MDR long regimen patient for 20 months in 2016

Investigation	Unit cost (BDT)	Baseline investigation		Follow up investigation				Total Invest. Cost (BDT)	Drug cost/pt. for long regimen (BDT)	Total Cost per patient (BDT)
		# tests	Cost (BDT)	During treatment		After treatment				
				# of tests	Cost (BDT)	# of tests	Cost (BDT)			
Audiometry	700	1	700	8	5600					
ECG	300	1	300							
Chest X-ray	350	1	350	3	1050					
Smear microscopy	23.4	1	23.4	29	679.8	4	93.8			
Culture(solid)	137.3	1	137.3	12	1647.7	4	549.2			
Xpert MTB/Rif	927.8	1	927.8	-	-	-	-			
DST(if culture positive)	1232.2	1	1232.2	-	-	-	-			
Complete Blood Count (CBC)	300	1	300	2	600	-	-	30,141.2	1,08,857.3	1,38,998.4
Serum Creatinine	300	1	300	8	2400	-	-			
Serum Electrolytes	850	1	850	8	6800	-	-			
Serum Bilirubin	300	1	300			-	-			
SGPT	300	1	300	3	900	-	-			
Alkaline Phosphatase	300	1	300	-	-	-	-			
Blood Glucose	250	1	250	-	-	-	-			
Thyroid-stimulating hormone (TSH)	800	1	800	3	2400	-	-			
HIV	50	1	50	-	-	-	-			
Pregnancy Test	300	1	300	-	-	-	-			
Total cost BDT	-	-	7,420.7	-	22,077.5	-	643.0	30,141.2	1,08,857.3	1,38,998.4
USD			94.8	-	282.0	-	8.2	385.0	1,390.3	1,775.2
Inflation adjusted for 2019 BDT (USD)										
										1,68,212.4 (2,002.5)

*Exchange rate of 2016: 1 USD= BDT 78.3 and 2019: 1 USD=84 BDT



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Grand total cost per patient under MDR long regimen for 20 months in 2016

Cost centre	Cost per patient BDT	Cost per patient USD
Drug cost/ MDR (Long Regimen) TB pt	1,08,857.3	1,390.25
*Ancillary drugs (Tk.550per month x 20months)	11,000	140.48
Investigation cost/ MDR (Long Regimen) TB pt	30,141.20	385
*Specimen transportation cost (Tk.200 per month X 18 months)	3,600	46
Social support/pt (Tk.1500/month x 18months)	27,000	345
Provider's incentive (Tk.1800 per month x 18months)	32,400	414
Total cost	2,12,998.5	2,721
Inflation adjusted for 2019 BDT (USD**)	2,57,765.5	3,068.60

*National Guidelines and Operational Manual for Programmatic Management of Drug Resistant TB (PMDT), April 2013
 **Exchange rate of 2016: 1 USD= BDT 78.3 and 2019: 1 USD=84 BDT



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Cost per patient: MDR TB under new longer regimen (20 months) treatment from 2019

Investigation	Unit cost (BDT)*	Baseline Investigation		Follow up Investigations				Total Invest. cost (BDT)	Total drug cost (BDT)	Total cost (BDT)			
		# of tests	Cost (BDT)	During Treatment		Post Treatment Phase							
				# of tests	Cost (BDT)	# of tests	Cost (BDT)						
Chest X-ray	423.6	1	423.6	3	1,270.7			38,576.1	222,037.5	260,613.6			
Smear microscopy	28.4	1	28.4	29	822.6	4	113.5						
Culture(solid)	166.2	1	166.2	12	1,994.0	4	664.7						
Xpert MTB/Rif	1,122.8	1	1,122.8		-								
DST(if culture positive)(2 nd line DST)	1,491.1	1	1,491.1		-								
LPA	2,100	1	2100		-								
Complete Blood Count (CBC)	363.1	1	363.1	2	726.1								
Serum Creatinine	363.1	1	363.1	8	2,904.4								
Serum Electrolytes	1,028.6	1	1,028.6	8	8,229.2								
Serum Bilirubin	363.1	1	363.1		-								
SGPT	363.1	1	363.1	3	1,089.2								
Alkaline Phosphatase	363.1	1	363.1		-								
Blood Glucose	302.5	1	302.5		-								
Thyroid-stimulating hormone	968.1	1	968.1	3	2,904.4								
ECG	363.1	1	363.1		-								
Audiometry	847.1	1	847.1	8	6,777.0								
HIV test	60.5	1	60.5		-								
Pregnancy Test*	363.1	1	363.1		-								
Total BDT			11,080.4		26,717.6	778.1							
USD*			131.9		318.1	9.3					459.2	2,643.3	3,102.5

*Exchange rate of 2019: 1 USD= 84 BDT



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Grand total cost per patient under MDR long regimen for 20 months from 2019

Cost centre	Cost per patient (BDT)	Cost per patient (USD**)
Drug cost/ MDR (Long Regimen) TB pt	222,037.5	2,643.3
*Ancillary drug (Tk.550per month x 20months)	13,311.9	158.5
Investigation cost/ MDR (Long Regimen) TB pt	38,576.1	459.2
*Specimen transportation cost (Tk.200 Per month X 18 months)	4,356.6	51.9
Social support/pt (Tk.1500/month x 18months)	32,674.7	389.0
Provider's incentive (Tk.1800 per month x 18months)	39,209.7	466.8
Total cost	3,50,166.5	4,168.6

*National Guidelines and Operational Manual for Programmatic Management of Drug Resistant TB (PMDT), April 2013
 **Exchange rate of 2019: 1 USD= 84 BDT



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Drugs and investigation cost per MDR patient under 9-month short regimen in 2016

Investigation	Unit cost BDT	Baseline investigation		Follow up investigation				Total Invest. cost (BDT)	Drug cost/pt . (BDT)	Total cost/pt. (BDT)		
		Number of tests	Cost (BDT)	During Treatment		Post Treatment						
				Number of tests	Cost (BDT)	Number of tests	Cost (BDT)					
Audiometry	700	1	700	4	2800			27,142.9	70,195.6	97, 338.6		
ECG	300	1	300	7	2100							
Chest X-ray	350	1	350	1	350	2	700					
Smear microscopy	23.44	2	46.88	10	234.4	2	46.88					
Culture(solid)	137.31	1	137.31	10	1373.1	2	274.62					
Xpert MTB/Rif	927.78	1	927.78			2	1855.5					
DST (if culture positive) (2nd line DST)	1232.2	1	1232.16	2	2464.32	-	-					
Complete Blood Count	300	1	300	2	600	-	-					
Serum Creatinine	300	1	300	4	1200	-	-					
Serum Electrolytes	850	1	850	4	3400	-	-					
Serum Bilirubin	300	1	300			-	-					
SGPT	300	1	300	5	1500	-	-					
Alkaline Phosphatase	300	1	300			-	-					
Blood Glucose	250	1	250			-	-					
Thyroid-stimulating hormone (TSH)	800	1	800	1	800	-	-					
HIV	50	1	50			-	-					
Pregnancy Test	300	1	300			-	-					
Total cost: BDT			7,444.13		16,821.82	2877	27,142.95				70,195.64	97,338.59
USD*			95.1		214.8	36.7	346.65				896.49	1243.14
Inflation adjusted for 2019 BDT (USD**)												1,17,797.8 (1402.3)

*Exchange rate of 2016: 1 USD= BDT 78.3 ; **Exchange rate of 2016 1USD= BDT 84



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Grand total cost per MDR patient under 9 months short regimen in 2016

Cost centers	Cost per patient in BDT	Cost per patient in USD**
Drug cost/ MDR (Short Regimen) TB pt	70195.64	896
*Ancillary Drugs (550per month x 9 months)	4,950	63
Investigation cost/ MDR (Short Regimen) TB pt	27,142.95	347
*Specimen transportation cost (200 Per month X 7 months)	1,400	18
Social support/pt (Tk.1500/month x 7 months)	10,500	134
Provider's incentive (Tk.1800 per month x 7 months)	12,600	161
Total cost	1, 26,789	1,619
Inflation adjusted for 2019	1,53,436.90	1,826.6

*National Guidelines and Operational Manual for Programmatic Management of Drug Resistant TB (PMDT), April 2013

**Exchange rate of 2016: 1 USD= BDT 78.3 and for 2019 1USD= BDT 84



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MDR TB patient under new shorter regimen (9 months) from 2019

Investigation	Inflation adjusted unit cost for 2019 (BDT)	Baseline investigation		Follow up investigations				Total Invest. cost (BDT)	Total drug Cost (BDT)	Total Cost (BDT)			
				During Treatment		Post treatment phase							
		# tests	Cost (BDT)	# tests	Cost (BDT)	# tests	Cost (BDT)						
Chest X-ray	423.6	1	423.6	1	423.6	2	847.1	34,958.7	53,659.8	88,618.5			
Smear microscopy	28.4	2	56.8	10	283.7	2	56.7						
Culture(solid)	166.2	1	166.2	10	1,661.7	2	332.3						
Xpert MTB/Rif	1,122.8	1	1,122.8	-	-	2	2,245.6						
DST(if culture positive)	1,491.2	1	1,491.2	2	2,982.4								
LPA	2,100	1	2,100	-	-								
Complete Blood Count	363.1	1	363.1	2	726.1								
Serum Creatinine	363.1	1	363.1	4	1,452.2								
Serum Electrolytes	1,028.6	1	1,028.6	4	4,114.6								
Serum Bilirubin	363.1	1	363.1	-	-								
SGPT	363.1	1	363.1	5	1,815.3								
Alkaline Phosphatase	363.1	1	363.1	-	-								
Blood Glucose	302.5	1	302.5	-	-								
TSH	968.1	1	968.1	1	968.1								
Audiometry	847.1	1	847.1	4	3,388.5								
ECG	363.1	1	363.1	7	2,541.4								
HIV	60.5	1	60.5	-	-								
Pregnancy Test	363.1	1	363.1										
Total BDT			11,119.6		20,357.4		3,481.7						
USD													1,055.0



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Grand total cost per MDR patient under new short regimen for 9 months from 2019 onwards

Cost centre	Cost per patient in BDT	Cost per patient in USD**
Drug cost/ MDR (Short Regimen) TB pt	53,659.80	638.8
*Ancillary Drugs (550per month x 9 months)	5,990.40	71.3
Investigation cost/ MDR (Short Regimen) TB pt	34,958.70	416.2
*Specimen transportation cost (200 Per month X 7 months)	1,694.20	20.2
Social support/pt (Tk.1500/month x 7 months)	12,706.80	151.3
Provider's incentive (Tk.1800 per month x 7 months)	15,248.20	181.5
Total cost	1, 24,258.1	1479.30

*National Guidelines and Operational Manual for Programmatic Management of Drug Resistant TB (PMDT), April 2013

**Exchange rate of 2019: 1 USD=84 BDT



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Cost per patient: XDR & Pre-XDR



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Drugs and investigation cost per XDR patient under long regimen for 24 months in 2016

Investigation	Unit cost (BDT)	Baseline invest.		Follow up invest.				Total Invest. Cost (BDT) for XDR regimen	Drug cost/pt. (BDT)	Total Cost/pt. (BDT)
		# of tests	Cost (BDT)	# of tests	Cost (BDT)	# of tests	Cost (BDT)			
Chest X-ray	350.0	1	350.0	3	1,050.0	-	-	30,690.4	5,50,485.1	5,81,175.5
Smear microscopy	23.4	1	23.4	29	679.8	4	93.8			
Culture(solid)	137.3	1	137.3	16	2,197.0	4	549.2			
Xpert MTB/Rif	927.8	1	927.8	-	-	-	-			
DST(if culture +)(2nd line DST)	1,232.2	1	1,232.2	-	-	-	-			
Complete Blood Count (CBC)	300.0	1	300.0	2	600.0	-	-			
Serum Creatinine	300.0	1	300.0	8	2,400.0	-	-			
Serum Electrolytes	850.0	1	850.0	8	6,800.0	-	-			
Serum Bilirubin	300.0	1	300.0	-	-	-	-			
SGPT	300.0	1	300.0	3	900.0	-	-			
Alkaline Phosphatase	300.0	1	300.0	-	-	-	-			
Blood Glucose	250.0	1	250.0	-	-	-	-			
TSH	800.0	1	800.0	3	2,400.0	-	-			
Audiometry	700.0	1	700.0	8	5,600.0	-	-			
ECG	300.0	1	300.0	-	-	-	-			
HIV test	50.0	1	50.0	-	-	-	-			
Pregnancy Test	300.0	1	300.0	-	-	-	-			
Total cost 2016 BDT			7,420.7		22,626.7		643.0	30,690.4	5,50,485.1	5,81,175.5
USD								391.95	7030.46	7422.42
Inflation adjusted for 2019 BDT (USD)										7,03,324.4 (8,372.9)



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Grand total cost per XDR patient for 24 months in 2016

Areas of Expenditure	Cost/pt. (BDT)	Cost/pt. (USD)
Drug cost/XDR TB pt	5,50,485.1	7,030.46
*Ancillary Drugs (550per month x 24 months)	13,200.0	169.00
Investigation cost/ XDR TB pt	30,690.4	391.95
*Specimen transportation cost (200 Per month X 22months)	4,400.0	56.00
Social support/pt (Tk.1500/month x 22 months)	33,000.0	421.45
Provider's incentive (Tk.1800 per month x 22months)	39,600.0	506.00
Total cost (2016)	6,71,376.0	8,575.00
Inflation adjusted for 2019 BDT (USD)	8,12,482.7	9,672.40

*National Guidelines and Operational Manual for Programmatic Management of Drug Resistant TB (PMDT), April 2013 *Exchange rate of 2016: 1 USD= BDT 78.3 and 2019: 1 USD=84 BDT



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Drugs and investigation cost of MDR TB patient under Pre- XDR 20 months regimen from 2019 onwards

Investigation	Unit cost (BDT)	Diagnosis		Follow up investigations				Total Invest. cost (BDT)	Total drug cost (BDT)	Total Cost (BDT)			
				During treatment		Post treatment phase							
		# of tests	Cost (BDT)	# of tests	Cost (BDT)	# of tests	Cost (BDT)						
Audiometry	847.1	1	847.1	8	6,777.0			38,576.1	360,403.4	3,98,979.50			
ECG	363.1	1	363.1		-								
Chest X-ray	423.6	1	423.6	3	1,270.7								
Smear microscopy	28.4	1	28.4	29	822.6	4	113.4						
Culture(solid)	166.2	1	166.2	12	1,994.0	4	664.7						
Xpert	1,122.8	1	1,122.8		-								
DST(if culture +ve)	1,491.1	1	1,491.1		-								
LPA	2,100.0	1	2,100.0		-								
CBC	363.1	1	363.1	2	726.1								
Serum Creatinine	363.1	1	363.1	8	2,904.4								
Serum Electrolytes	1,028.6	1	1,028.6	8	8,229.2								
Serum Bilirubin	363.1	1	363.1		-								
SGPT	363.1	1	363.1	3	1,089.2								
Alkaline Phosphatase	363.1	1	363.1		-								
Blood Glucose	302.5	1	302.5		-								
TSH	968.1	1	968.1	3	2,904.4								
HIV	60.5	1	60.5		-								
Pregnancy Test	363.1	1	363.1		-								
Total BDT			11,080.3		26,717.6		778.1						
USD													4,749.8



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Grand total cost per Pre-XDR patient under 20 months regimen from 2019

Cost centre	Cost per patient (BDT)	Cost per patient (USD**)
Drug cost/ Pre XDR TB pt	360,403.40	4,290.50
*Ancillary drug (Tk.550per month x 20months)	11,000.00	131
Investigation cost/ TB pt	38,576.10	459.2
*Specimen Pre XDR transportation cost (Tk.200 Per month X 18 months)	3,600.00	42.9
Social support/pt (Tk.1500/month x 18months)	27,000.00	321.4
Provider's incentive (Tk.1800 per month) 18months)	32,400.00	385.7
Total cost	4,72,979.5	5,630.70

*National Guidelines and Operational Manual for Programmatic Management of Drug Resistant TB (PMDT), April 2013

**Exchange rate of 2019: 1 USD=84 BDT



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Cost per patient: Preventive therapy



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Isoniazid Preventive Therapy (IPT) for <5 years old Children for 6 months (applicable for 2016-2018)

Investigation	Unit cost (BDT)	Tests to exclude TB disease		Follow up tests (every 2 monthly)		Total Invest. cost (BDT)	Drug cost (BDT)	Total cost (BDT)
		# of tests	Cost (BDT)	# of tests	Cost (BDT)			
Smear Microscopy	23.4	2	46.9	3	70.3	467.2	1,903.5	
CXR	350	1	350					
Total BDT			396.9		70.3	467.2	1,903.5	2,869.0
Total USD								= 34.2
Inflation adjusted for 2019 BDT (USD)								3,472.0 (41.3)

(Exchange rate of 2016: 1 USD=78.3)



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New 3HP Preventive Therapy for children 2 -11 years old
(3 months weekly therapy, H=Isoniazid, P=Rifapentin)
Applicable from 2019 onwards

Investigation	Unit cost (BDT)*	Tests to exclude TB disease		Follow up tests (monthly)		Total Investigation Cost (BDT)	Drug Cost (BDT)	Total Cost (BDT)
		# of tests	Cost (BDT)	# of tests	Cost (BDT)			
Smear Microscopy	28.4	2	56.7	3	85.1	565.39	1,851.2	2,416.6
CXR	423.6	1	423.6					
Total BDT			480.3		85.1	565.39	1,851.2	2,416.6
Total USD**								28.8

*Inflation adjusted costs for 2019

**Exchange rate of 2019: 1 USD=84 BDT



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3HP Preventive therapy for adults and children aged 12 years and older
(3 Months weekly therapy, H= Isoniazid, P= Rifapentin)
Applicable from 2019 onwards

Investigation	Unit cost (BDT)	Tests to exclude TB disease		Follow up tests (monthly)		Total Invest. cost (BDT)	Drug Cost (BDT)	Total Cost (BDT)
		# of tests	Cost (BDT)	# of tests	Cost (BDT)			
Smear Microscopy	28.4	2	56.7	3	85.1	565.4	3,515.4	4,080.8
CXR	423.6	1	423.6					
Total(BDT)			480.3		85.1	565.4	3,515.4	4,080.8
Total USD**								48.6

*Inflation adjusted costs for 2019

**Exchange rate of 2019: 1 USD=84 BDT)



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Isoniazid Preventive Therapy (IPT) for <2 years old children for 6 months: Applicable as before from 2019 onwards

Investigation	Unit cost (BDT)	Tests to exclude TB disease		Follow up tests		Total Invest. cost (BDT)	Drug cost (BDT)	Total cost (BDT)
		# of tests	Cost (BDT)	# of tests	Cost (BDT)			
Smear Microscopy	28.4	2	56.7	3	85.1	565.4	1,269.02	
CXR	423.6	1	423.6					
Total BDT			480.3		85.1	565.4	1,269.02	1,833.5
Total USD								21.8

(Exchange rate of 2019: 1 USD=84 BDT)



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Total Cost



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Total cost of TB program including Health Systems cost : 2016- 2022. (Inflation adjusted for 2017-22)

Cost components	2016	2017	2018	2019	2020	2021	2022	Total cost
<i>OHT estimates 2016-22</i>								
Human Resources	2,296.19	2,596.25	2,919.20	3,173.55	3,446.19	3,743.10	4,013.94	22,188.42
Infrastructure (medical equipment, renovation, construction of new facilities)	185.76	806.73	537.12	507.24	496.49	1,609.21	1,691.10	5,833.65
Medicines, supplies, and Investigations (including wastage)	804.51	953.48	1,141.57	2,885.52	3,570.80	4,276.18	5,063.55	18,695.61
Programme costs*	428.51	674.11	826.83	1,094.31	1,193.88	1,279.80	1,333.90	6,831.33
Grand Total of OHT estimate: (In million BDT)	3,714.97	5,030.57	5,424.71	7,660.62	8,707.35	10,908.29	12,102.49	53,549.01
In million USD	47.45	62.49	64.97	91.20	101.24	123.94	134.37	625.66
<i>NSP budget estimates 2018-22 In million USD</i>								
	-	-	54.75	56.99	60.85	63.23	65.90	301.72
OP budget 2017-22 million BDT	-	913.42	2,095.81	2,524.72	2,385.29	2,376.26	2,416.55	12,712.05
<i>In million USD</i>	-	11.35	25.10	30.06	27.73	27.00	26.83	148.07

*Freight, transport/vehicle, social support, provider's incentive, ancillary drugs, advocacy campaign, in-service training, monitoring supervision, repair & maintenance etc.



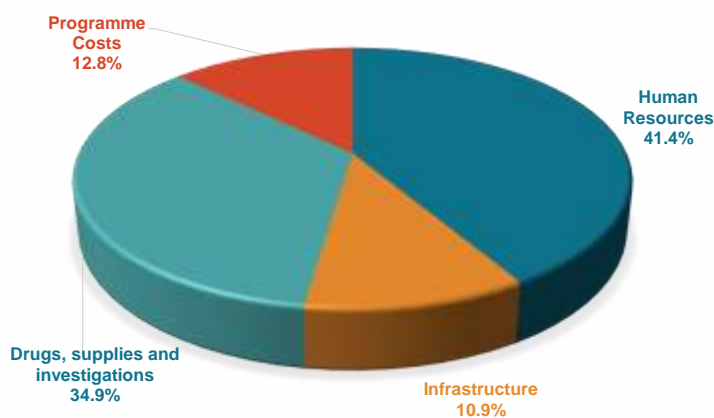
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Percentage distribution of total cost by cost components during 2016-22



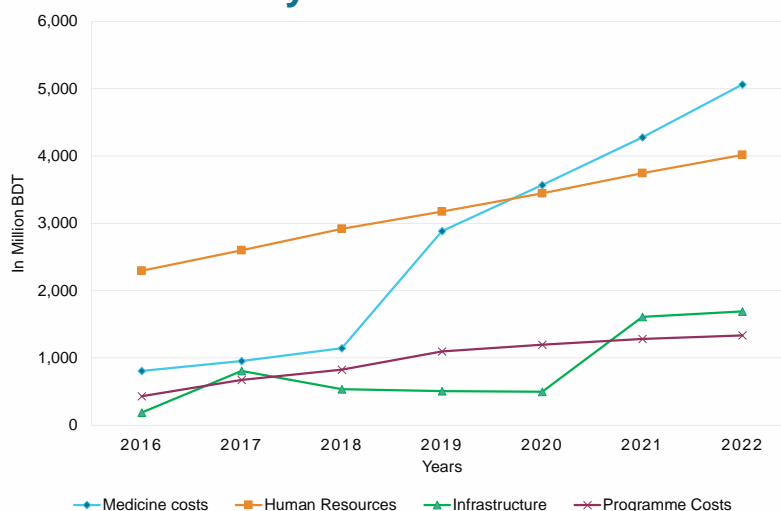
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Cost of core components of health systems 2016-22



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Cost of drugs, supplies and investigations of TB interventions by delivery channels in million BDT* 2016-22

Delivery Channels	2016	2017	2018	2019	2020	2021	2022	Total
Community	90.5	104.5	121.0	786.9	980.6	1,198.0	1,443.9	4,725.5
DOTs Centre	551.9	642.0	744.1	1,636.0	2,008.0	2,369.2	2,731.0	10,682.2
Microscopy Centre	94.3	101.0	107.9	115.7	123.2	131.0	137.7	810.9
Hospitals	34.6	51.8	75.7	187.7	248.4	310.5	390.8	1,299.5
X-pert centers	10.4	28.0	62.8	80.5	114.2	152.9	226.6	675.4
Total	781.7	927.3	1,111.7	2,806.8	3,474.4	4,161.7	4,930.0	18,193.6

*excluding wastage



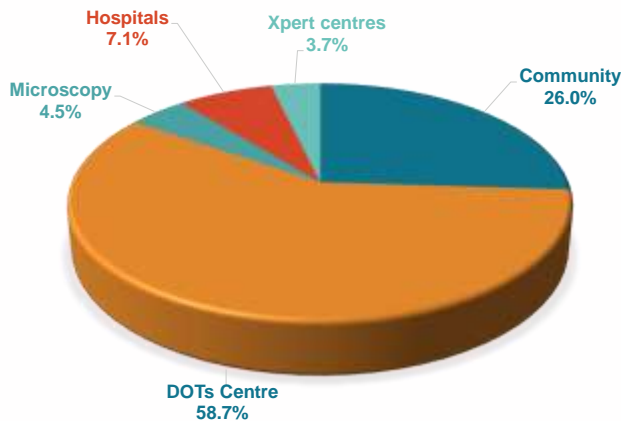
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Costs of drugs, supplies and investigations by delivery channels



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Conclusions

1. Under the new treatment regimen of 2019; the cost per patient for shorter treatment regimen of MDR and Pre-XDR TB patients are substantially less than previous treatment regimens of 2016.
2. The total cost for base year 2016 was estimated to BDT 3,714.97 million which would increase to BDT 12,102.49 million in 2022 given the availability of resources committed, attainment of service coverage and efficient use of fixed assets.
3. The highest proportion of the total cost (41%) was from human resources followed by medicine, supplies and investigations including wastage (35%) and program cost (13%) while the infrastructure accounted for 11% of the total cost. The program cost included freight, transport/vehicle, social support cost, providers incentive, cost of ancillary drugs, advocacy campaign, in-service training, monitoring supervision, repair & maintenance



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Conclusions-----contd.

4. Around 80% of the human resources costs represent salaries followed by benefits (15%) and in-service trainings (5%) from base year to projected years.

5. Medicines and supplies cost show a sharp increase from 2018 through 2022- which is attributable to purchase of new drugs for implementing new treatment regimen and preventive therapy from 2019 onwards. As per procurement and expansion plan detailed in OP, OHT estimated that the cost of infrastructure (e.g. medical equipment, renovation, construction of new facilities) would increase from 2020 to 2022. However; the HR shows a linear increase of cost over the target years.

6. The majority of the costs consumed at the facility level appeared as capital cost of the facility per year except for the base year 2016. Most of the capital investments were made in 2017 followed by 2021 and 2022 according to the resources committed in the OP.



Conclusions-----contd.

7. According to OHT estimate, the total cost of drugs, supplies and investigations in base year 2016 was BDT 781.7 million - which is BDT 97.9 million more than the actual expenditure (BDT 683.8 million; *Expenditure Report, 2015-16, Bangladesh NTP*) incurred upon NTP for drugs and supplies in the fiscal year 2015-16.

8. Among the five selected delivery channels; DOTs Centre accounted for the highest proportion of the total cost for drugs, supplies and investigations (58.7%) followed by community (26%). This is linked to higher number of cases treated at DOTs and preventive therapy at the community compared to other delivery channels.



Recommendations

1. The OHT estimates related to unit costs of TB treatment inputs (drugs, supplies and investigations) and cost per patient should be considered for costing of the next National Strategic Plan for TB control.
2. These results indicate an annual investment required for delivering TB services effectively. Therefore; policy planners may consider these estimates and use them to advocate for increased funding for Bangladesh NTP to match the costs.
3. Based on the current estimates; further studies should look at the cost of providing TB services with future changes in diagnostic and treatment algorithm.



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- All key informants, participants of consultative meetings & facility managers



Thank you for your attention



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Study rationale

Program perspectives:

- NTP has been scaling up new technologies: GeneXpert, Digital X-ray machine, LED microscopy, new drugs and planning to introduce preventive therapy. *All these have additional cost implications.*
- Costing can make an investment case for additional funding required to fill in future funding gap
- Unit cost of TB services is required for upcoming costed NSP and budgeting.
- Request from the Planning Wing of the Ministry in 2016 to do a comprehensive cost analysis for planning and budgeting purposes



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Study rationale (contd.)

Development perspective:

- Bangladesh has attained the status of lower-middle income country in 2017
- Likely impact on donor's funding policy. Gradual decrease in external funding is anticipated in health programs including TB
- NTP purchased first line drugs since 2018
- Need to plan for more domestic financing for other components of the program



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OneHealth Tool and TIME module **Health Services module:**

- ✓ Use information on drugs, tests, supplies consumed (treatment inputs) per patient by delivery channel
- ✓ Produce unit cost of interventions for recurrent items

} unit cost of
services
estimated

 Health Systems module:

- Use information on HR, infrastructure, equipment, logistics, ICT etc.
- Produce total cost of interventions including recurrent cost

 TIME (TB Impact Module & Estimates):

- Use information of current treatment/diagnostic algorithm and future plan on diagnostic and treatment coverage
- Projects the number of cases to be detected and treated in target years.



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Steps of cost calculation: Anti-tubercular drugs

Step 1: Identified the required drugs as per *NTP's treatment guidelines*

Step 2: Identified proportion of the patients receiving the drug

Step 3: Identified dosages (e.g. number of units, times per day, days per case) for each drug ----- *NTP guidelines, consultation*

Step 4: Identified the price of each unit of drug ----- *GDF medicine catalogue*

Step 5: Multiply the total quantity of drugs required for the intervention with their corresponding unit price



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Steps of cost calculation: Culture and DST

Step-1: Identified procedure and requirements of a test with input quantity and price - *consultation with microbiologist*, (Referred by NTRL)
 - *laboratory manual (National)*
 - *GDF price catalogue for diagnostic product*

Step- 2: Taken cost of reagents/supplies from GDF (e.g.1 liter, 500 ml)

Step- 3: Calculated cost of required amount of reagent for the test

Step- 4: Summing up cost of all requirement (test tube, reagent, sputum container, media, gloves, N95 mask etc.) to find out the unit cost of a test



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Assumptions

1. All required drugs, supplies and staff were available at the service delivery channels during the base year 2016 and all resources committed in the current TB operational plan for target years (2017-22) would be available.
2. With an assumption of future replacement of Z-N microscopy by LED, we considered higher percentage of coverage of LED (82%) compared to Z-N microscopy (18%). Similarly; we assumed greater coverage of solid culture (80%) compared to liquid culture (20%) in estimating unit cost.
3. Number of medicines (3FDC, 4FD, 2FDC) required per patient was calculated assuming bodyweight 38-54 kg for adult and 12-15 kg for children.
4. Assumed body weight of <5-year-old child is 10 - 15 kg and for <2 years old child 5-10 kg for IPT (IPHN growth chart was used to make assumptions of body weight for different age group of children)



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Assumptions-----contd.

5. For 3HP; body weight assumptions are as following: 8-12 years= 20-25 kg, 2-8 years=10-20 kg (IPHN growth chart was used to make assumptions of body weight for different age group of children)
6. Cost of ancillary drugs per DR cases (TK. 550/pt. or USD 7/pt.), specimen transportation cost is included here based on assumption as shown in "Expansion plan of programmatic management of drug resistant TB (PMDT), 2013-17" by Bangladesh NTP.



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