Group:	High coverage districts	Low coverage districts	Notes
Cohort size and incentive amounts			
Full cohort of those eligible for the program	1,000	1,000	Arbitrary
Percent of cohort in each group	68%	32%	We calculate the proportion of the birth cohort in Sindh eligible for IRD's mCCT program that resides in districts with high baseline vaccination coverage vs. low baseline coverage. In our cost-effectiveness analysis, the children in high-coverage districts only benefit from ZM, while the children in low-coverage districts benefit from both ZM and IRD's mCCT program. This is because IRD will only be providing incentives in low-coverage districts, but will be implementing ZM in all of Sindh.
Incentive amount per visit (current USD)	$0.00	$1.26	No incentive in high coverage. 200 PKR in low coverage. [1]
Cohort in each group	677	323	Calculation
Vaccine efficacy			
Vaccine efficacy for vaccine-preventable disease from meta-analyses	0.71	0.71	Calculated based on weighted average of RR for each vaccine in schedule and that vaccine's contributions to all vaccine-preventable disease deaths. See "Vaccine efficacy and deaths among unvaccinated" tab for details.
Adjustment for lower vaccine efficacy in Pakistan (includes "biomarkers adjustment")	0.94	0.94	We include a smaller adjustment, compared to New Incentives, because we do not have reason for concern about biomarkers and because mCCTs trial includes corroborating biomarkers evidence.
Adjustment for all-cause mortality effect	1.18	1.18	Set so that 0.5 deaths from non-vaccine-preventable disease are averted for every death averted from vaccine-preventable disease. (This is similar to what we assume in our CEA for New Incentives.) This is based on evidence that reductions in all-cause mortality from some vaccines are larger than what would be expected based on reductions in deaths due to vaccine-preventable diseases alone.
Adjustment for coverage in trials	0.95	0.95	Rough guess.
Vaccine efficacy for vaccine-preventable disease from meta-analysis, adjusted	**0.83**	**0.83**	**Calculation**
Deaths from vaccine-preventable disease			
Unadjusted probability of death from vaccine-preventable diseases among vaccinated and unvaccinated children in Sindh	0.6%	0.6%	Calculated based primarily on IHME GBD data. Takes probability of death for children under 5 from vaccine-preventable diseases, accounting for deaths before vaccination and etiological fraction of certain pathogens. We assume this value from IHME includes both vaccinated and unvaccinated children. See "Probability of death" tab for details. Assume Sindh is in line with Pakistan average.
Percent vaccinated at time of IHME data in Sindh	76.7%	76.7%	Calculated based on coverage of different vaccines (BCG, DTP1, etc.), weighted by their contribution to deaths from vaccine-preventable diseases. We use Sindh-wide estimates because the probability of death data we use are assumed to be the same as Sindh-wide average. See "Vaccine efficacy and deaths among unvaccinated" tab for details. [2]
Probability of death from vaccine-preventable diseases for unvaccinated	1.5%	1.5%	Calculation (see cell note for explanation of formula) [3]
Adjustment for higher/lower child mortality in Sindh/targeted area among unvaccinated	0.90	1.20	Rough guess. We assume the child mortality rate is higher in low-coverage districts, which may have lower overall health beyond vaccine access. For low-coverage districts, we use an adjustment similar to the adjustment we used for child mortality rates in North West Nigeria in our New Incentives CEA. These values are set so that average (weighted by population) is 1 across districts.
Adjusted probability of death from vaccine-preventable diseases for unvaccinated	**1.4%**	**1.8%**	**Calculation**
Effect of program on vaccination rates			
Increase in vaccination rates from ZM, excluding mCCTs (percentage points), weighted by vaccines' contributions to deaths	2.0%	2.6%	Effect size based on the trial.
Increase in vaccination rates due to mCCTs (percentage points), weighted by vaccines' contribution to deaths	0.0%	8.8%	Effect size estimate comes from (1) effect size observed in trial plus some adjustments for how this would look at scale and (2) effect size we would expect based on New Incentives. We have high uncertainty about this parameter.
Total increase in vaccination rates due to ZM and mCCTs (percentage points), weighted by vaccines' contribution to deaths	**0.020**	**0.114**	**Calculation**
Benefits from child deaths averted			
Ratio of the reduction in vaccine-preventable disease mortality to the reduction in vaccine-preventable disease	100%	100%	Assumption [4]
Child deaths averted in cohort	0.16	0.57	Calculation
Units of value from child deaths averted in the cohort	**18.6**	**66.3**	**Calculation**
Additional benefits			
Units of value from deaths averted for individuals older than 5	5.86	20.86	See "Deaths at older age groups" tab.
Units of value from development benefits per counterfactually vaccinated infant	0.23	0.30	We benchmark development benefits based on New Incentives. See "Development benefits" tab.
Units of value from development benefits	3.2	11.2	Calculation
Units of value from consumption benefits per vaccination paid by mCCTs	0.00	0.02	We benchmark consumption benefits based on New Incentives. See "Consumption benefits" tab.
Units of value from consumption benefits	0.00	4.31	Calculation
Units of value from additional benefits	**9.0**	**36.4**	**Calculation**
Benefits from inclusion/exclusion and downside adjustments			
Total adjustment for additional benefits and negative or offsetting impacts	22%	22%	This captures additional benefits and negative or offsetting impacts we haven't included in the model elsewhere. We assume similar values as we do for New Incentives. We may revise these with further work. See "Inclusion/exclusion" tab for details.
Downside adjustments for organizational quality, risk of wastage, quality of monitoring and evaluation, confidence in funds being used for intended purpose	-7%	-7%	We assume similar values as we do for New Incentives. We may revise these with further work.
Total units of value	**31**	**117**	**Calculation**
Costs			
Unweighted increase in vaccination rate from ZM and mCCTs	0.03	0.12	Calculation. We use unweighted for costs, since the cost is the same for each vaccine in the sequence.
Number of infants counterfactually vaccinated	23	40	Calculation
Cost of the program per eligible infant (current USD), mCCTs	$1.25	$9.50	We include incentive costs plus other costs to add mCCTs on top of ZM platform and cost of ZM platform itself, based on conversation with IRD. See "Costs" tab.
Government cost for additional full immunization	$16.29	$16.29	See "Costs" tab.
Gavi cost per additional full immunization	$19.91	$19.91	See "Costs" tab.
Total costs to IRD per cohort	$849	$3,072	Calculation
Total marginal costs to government per cohort (i.e., from additional infants induced to vaccinate)	$371	$657	Calculation
Total marginal costs to Gavi per cohort (i.e., from additional infants induced to vaccinate)	$453	$803	Calculation
Total costs per cohort	$1,673	$4,532	Calculation

Cost effectiveness			
Units of value generated per dollar spent, before accounting for leverage/funging	0.0188	0.0258	Calculation
Total units of value from GiveDirectly's cash transfer program generated per dollar [5]	0.00344		
Cost effectiveness (in multiples of cash transfers), before leverage/funging, by group	5.5	7.5	Calculation
Cost effectiveness (in multiples of cash transfers), before leverage/funging		**6.9**	Calculation
Cost effectiveness (in multiples of cash transfers), after accounting for leverage/funging, by group	6.4	8.9	Calculation
Cost effectiveness (in multiples of cash transfers), after leverage/funging		**8.3**	Calculation
% change in cost-effectiveness due to leverage/funging		20%	Calculation
Cost per additional child vaccinated (for reference; not used in calculations)	$73	$112	Calculation

Group:	High coverage districts	Low coverage districts	Notes
Incentive amount per visit (current USD)	$0.00	$1.26	Set in "CEA Main" tab. Do not adjust values in this spreadsheet.
Percent of cohort in each group	68%	32%	Set in "CEA Main" tab. Do not adjust values in this spreadsheet.
Incentive costs			
Transaction charges	13%	13%	IRD budget shared September 28 shows 10% cost of transaction and 3% withholding tax, in addition to 5% indirect cost (included below). See this spreadsheet: https://docs.google.com/spreadsheets/d/19cm2HCjOKvFUiYxnOEJznuKSBQ4JbuTLzFSySERC90g/edit#gid=1831308725&range=B22:K32
Charges per transaction	$0.00	$0.16	Calculation
Indirect costs on incentives	5%	5%	IRD budget shared September 22 shows 5% indirect cost. See this spreadsheet: https://docs.google.com/spreadsheets/d/19cm2HCjOKvFUiYxnOEJznuKSBQ4JbuTLzFSySERC90g/edit#gid=1831308725&range=B22:K32
Encashment rate, i.e., percent who redeem incentive	100%	100%	Encashment rate for mobile top-ups is assumed to be 100%.
Percent of transfers "wasted" due to fraud	10%	10%	This is a rough guess and is similar to the adjustment we use for New Incentives (see here).
Total incentive cost per visit	$0.00	$1.64	Calculation.
Number of visits possible	6	6	Birth, 6 weeks, 10 weeks, 14 weeks, 9 months, 15 months
Percent of visits completed by those eligible for program	66%	55%	Calculation. This is unweighted vaccination rate across sequence.
Average number of visits completed	3.99	3.32	Calculation
Total incentive costs for each eligible infant	$0.00	$5.45	Calculation
Additional (non-incentive) costs			
Annual costs to run ZM with mCCTs in Sindh	$3,200,542	$3,200,542	Based on budget provided by IRD on September 28. This is intended to capture costs once the program is at scale, so we use Year 3 costs, i.e., once the program has been rolled out Sindh-wide. See this spreadsheet: https://docs.google.com/spreadsheets/d/19cm2HCjOKvFUiYxnOEJznuKSBQ4JbuTLzFSySERC90g/edit#gid=1831308725&range=J20
Additional costs (phones and laptops)	$273,226	$273,226	Based on budged provided by IRD on September 28. Divide cost by 3 (assuming laptops and phones last 3 years). See this spreadsheet: https://docs.google.com/spreadsheets/d/19cm2HCjOKvFUiYxnOEJznuKSBQ4JbuTLzFSySERC90g/edit#gid=1831308725&range=H38 [6]
Total annual costs to run ZM with mCCTs in Sindh	$3,473,768	$3,473,768	Calculation
Percent of non-incentive costs due to ZM	60%	60%	This is a rough guess. [7]
Total annual (non-incentive) costs to run ZM in Sindh	$2,084,261	$2,084,261	Calculation
Total annual (non-incentive) costs to run mCCTs in Sindh	$1,389,507	$1,389,507	Calculation
Surviving infants in Sindh	1,749,785	1,749,785	1,715,475 is surviving infants estimate from 2021. We allow for 2% population growth from 2021 to middle of implementation period (assuming middle of implementation period is 2022). 2% population growth is from here: https://datacommons.org/place/country/PAK?utm_medium=explore&mprop=count&popt=Person&hl=en. We use surviving infants, rather than live birth cohort (which is larger), to be conservative. [8]
Percent of birth cohort that is eligible for mCCTs	95%	90%	Some caregivers may be ineligible to receive mCCTs or other services, such as SMS reminders, because they do not have a cell phone. In the Korangi trial, IRD reported 7.5% of households were ineligible to receive incentives due to lack of a cell phone and estimated that Korangi is representative of Sindh in terms of coverage. We estimate coverage is lower in low-coverage areas, though we are uncertain about to what extent. It also seems plausible coverage will increase potentially in the near future and also potentially increase in response to availability of incentives. [9]
Total additional (non-incentive) costs in each group	$1,410,595	$2,063,172	Calculation
Number eligible annually in each group	1,125,016	509,002	Calculation
Total additional (non-incentive) costs per each eligible infant	$1.25	$4.05	Calculation
Total (non-incentive) costs per each eligible infant, ZM	$1.25	$1.32	Calculation
Total (non-incentive) costs per each eligible infant, mCCTs	$0.00	$2.73	Calculation
Total costs per eligible infant (current USD)	$1.25	$9.50	Calculation
Room for more funding (all of Sindh, at scale)			
Annual room for more funding by group	$1,410,595	$4,837,997	Calculation
Annual room for more funding	$6,248,593		Calculation
Check: Alternative calculation	$6,248,593		
Check: IRD budget for year 3 [10]	$5,807,063		
Costs to government and Gavi			
Costs per routine immunization			
Average coverage	72%	Calc	
RI, Pakistan, spending 2019, $	$145,096,721	WHO, Immunization I	https://www.who.int/teams/immunization-vaccines-and-biologicals/vaccine-access/planning-and-financing/immunization-financing-indicators
U5, 2019	27,668,000	WHO vaccine-preven	https://apps.who.int/immunization_monitoring/globalsummary/countries?countrycriteria%5Bcountry%5D%5B%5D=PAK
U1, 2019	5,533,600	Calc	
Immunised, number	4,008,994	Calc	
Cost per RI	$36.19	Calc	
Split of costs between government and Gavi			
Of RI vaccinations costs in Pakistan, what % is paid by the government	45%	See note [11]	
% Gavi spending	55%	Calc	
Government cost for additional full immunization	$16.29	Calc	
Gavi cost per additional full immunization	$19.91	Calc	

Group:	High coverage districts	Low coverage districts		
Costs of ZM alone and ZM with mCCTs				
Percent of non-incentive costs due to ZM	60%	60%		
Total additional (non-incentive) costs per each infant enrolled	$1.25	$4.05		
Cost of the program per enrolled infant (current USD), ZM	$1.25	$1.32		
Cost of the program per enrolled infant (current USD), marginal cost of adding mCCTs	$0.00	$8.18		
Cost-effectiveness of ZM alone and ZM with mCCTs				
Total units of value from ZM (ZM vs. no ZM)	31	26		
Total cost of ZM alone [12]	$1,673	$893		
Marginal cost to government of additional vaccinations from ZM alone	$371	$209		
Marginal cost to Gavi of additional vaccinations from ZM alone	$453	$256		
Units of value generated per dollar spent, before accounting for leverage/funging, ZM alone	0.01877	0.02861		
Units of value generated per dollar spent, before accounting for leverage/funging, ZM with mCCTs	0.01877	0.02577		
Total expenditure attributable to different actors				
IRD, ZM	$849	$428		
IRD, mCCTs	$0	$2,644		
IRD, total	$849	$3,072		
Domestic government, ZM	$371	$209		
Domestic government, mCCTs	$0	$448		
Domestic government, total	$371	$657		
Gavi, ZM	$453	$256		
Gavi, mCCTs	$0	$547		
Gavi, total	$453	$803		
Upstream / downstream expenditure				
Expenditure causally upstream of our donation, ZM [13]	$849	$428		
Expenditure causally upstream of our donation, mCCTs [14]	$0	$2,644		
Expenditure causally upstream of our donation, total [15]	$849	$3,072		
Expenditure causally downstream of our donation, domestic government [16]	$371	$657		
Expenditure causally downstream of our donation, Gavi [17]	$453	$803		
Expenditure causally downstream of our donation [18]	$824	$1,460		
Counterfactual value of spending from non-philanthropic actors (units of value per dollar)				
Domestic government [19]	0.0050	0.0050		
Gavi [20]	0.0180	0.0180		
Probability of scenarios in absence of New Incentives' spending				
Scenario 1: Government costs would replace IRD's ZM costs (but not mCCT costs)	10%	10%		
Scenario 2: Government costs would replace IRD's ZM and mCCT costs	5%	5%		
Scenario 3: Government financial costs would stay the same	0%	0%		
Scenario 4: Distributions would go unfunded	85%	85%		
What fraction of the program would still happen?				
Scenario 1: Government costs would replace IRD's ZM costs (but not mCCT costs)	100%	100%		
Scenario 2: Government costs would replace IRD's ZM and mCCT costs	100%	100%		
Scenario 3: Government financial costs would stay the same	0%	0%		
Scenario 4: Distributions would go unfunded	0%	0%		
Expected change in amount of funding spent on the program by other actors in absence of IRD's spending				
Scenario 1: Government costs would replace IRD's ZM costs (but not mCCT costs)				
Government spending	$849	-$20		
Gavi spending	$0	-$547		
Scenario 2: Government costs would replace IRD's ZM and mCCT costs				
Government spending	$849	$3,072		
Gavi spending	$0	$0		
Scenario 3: Government financial costs would stay the same				
Government spending	$0	$0		
Gavi spending	$0	$0		
Scenario 4: Distributions would go unfunded				
Government spending	-$371	-$657		
Gavi spending	-$453	-$803		
Units of value generated by changes in amount of funding spent on the program by other actors in absence of IRD's spending				
Scenario 1: Government costs would replace IRD's ZM costs (but not mCCT costs)				
Government spending	15.9	-0.6		

Gavi spending	0.0	-15.7		
Scenario 2: Government costs would replace IRD's ZM and mCCT costs				
Government spending	15.9	79.2		
Gavi spending	0.0	0.0		
Scenario 3: Government financial costs would stay the same				
Government spending	0.0	0.0		
Gavi spending	0.0	0.0		
Scenario 4: Distributions would go unfunded				
Government spending	-7.0	-16.9		
Gavi spending	-8.5	-20.7		
Units of value generated by changes in amount of funding spent on counterfactual programs by other actors in absence of IRD's spending				
Scenario 1: Government costs would replace IRD's ZM costs (but not mCCT costs)				
Government spending	-4.2	0.1		
Gavi spending	0.0	9.8		
Scenario 2: Government costs would replace IRD's ZM and mCCT costs				
Government spending	-4.2	-15.3		
Gavi spending	0.0	0.0		
Scenario 3: Government financial costs would stay the same				
Government spending	0.0	0.0		
Gavi spending	0.0	0.0		
Scenario 4: Distributions would go unfunded				
Government spending	1.9	3.3		
Gavi spending	8.2	14.4		
Net units of value created by changes in spending by other actors in absence of IRD's spending				
Scenario 1: Government costs would replace IRD's ZM costs (but not mCCT costs)	11.7	-6.3		
Scenario 2: Government costs would replace IRD's ZM and mCCT costs	11.7	63.8		
Scenario 3: Government financial costs would stay the same	0.0	0.0		
Scenario 4: Distributions would go unfunded	-5.5	-19.9		
Net units of value created by IRD's spending				
Scenario 1: Government costs would replace IRD's ZM costs (but not mCCT costs)	4.2	85.5		
Scenario 2: Government costs would replace IRD's ZM and mCCT costs	4.2	15.3		
Scenario 3: Government financial costs would stay the same	15.9	79.2		
Scenario 4: Distributions would go unfunded	21.4	99.1		
Overall	18.8	93.5		
Total units of value generated, after accounting for leverage/funging	18.8	93.5		
Units of value generated per dollar spent by New Incentives	0.0222	0.0304		
Cost-effectiveness after accounting for leverage/funging, by group	6.4	8.9		
Cost effectiveness, after leverage/funging	**8.3**			

Note: This tab inputs data on probability of death among vaccinated and unvaccinated, vaccination coverage and vaccine efficacy in order to estimate probability of death among unvaccinated.

Probability of death from vaccine-preventable diseases and etiologies [21]

Disease	
Lower respiratory infections (S.Pneumoniae)	0.19%
Lower respiratory infections (HiB)	0.00%
Pneumococcal meningitis	0.01%
Whooping cough	0.08%
Diphtheria	0.00%
Tetanus	0.00%
H influenzae type B meningitis	0.00%
Measles	0.03%
Tuberculosis	0.08%
Rotavirus	0.17%
Total	0.56%

Vaccination coverage in Pakistan at time of IHME data [22]		2015	2016	2017	2018	2019	Notes
BCG	87%	86%	86%	86%	87%	88%	"Estimate." p. 3
PCV1	87%	91%	85%	87%	83%	86%	Set based on ratio of DTP3 to DTP1.
PCV2	82%	86%	82%	83%	78%	81%	Set to average of PCV2 and PCV3.
PCV3	77%	80%	78%	79%	73%	75%	"Estimate." p. 22
DTP1	84%	82%	82%	83%	85%	86%	"Estimate." p. 5
DTP2	79%	77%	79%	79%	80%	81%	Set to average of DTP1 and DTP3
DTP3	74%	72%	75%	75%	75%	75%	"Estimate." p. 7
HiB1	84%	82%	82%	83%	85%	86%	Set based on ratio of DTP3 to DTP1.
HiB2	79%	77%	79%	79%	80%	81%	Set to average of HiB1 and HiB3.
HiB3	74%	72%	75%	75%	75%	75%	"Estimate." p. 19
Rota1	33%	0%	0%	13%	66%	86%	Set based on ratio of DTP3 to DTP1.
Rota2	29%	0%	0%	12%	58%	75%	"Estimate." p. 21 [23]
MCV1	75%	75%	75%	76%	73%	75%	"Estimate." p. 12
MCV2	65%	54%	67%	67%	67%	71%	"Estimate." p. 14

Partial vaccination efficacy

Vaccines with three doses		
Doses	Value	Notes
Percent of full vaccine efficacy from 1 dose	40%	Guess [24]
Percent of full vaccine efficacy from 2 doses	95%	Guess [25]
Percent of full vaccine efficacy from 3 doses	100%	By construction [26]
Vaccines with two doses		
Doses	Value	Notes
Percent of full vaccine efficacy from 1 dose	68%	Guess [27]
Percent of full vaccine efficacy from 2 doses	100%	By construction [28]

Weights for estimating weighted vaccine efficacy and weighted effect of ZM and mCCTs on vaccination rates

Vaccine	Vaccine efficacy [29]	Probability of death from diseases prevented by vaccine	Coverage according to IRD data for Sindh, with adjustments for partial vaccination	Probability of death from diseases prevented by vaccine among unvaccinated	Probability of death from diseases prevented by vaccine among unvaccinated x Vaccine efficacy	Weight for weighted vaccine efficacy	Weight for weighted effect of ZM and mCCTs on vaccination rates (split into visits below) and coverage rate
BCG vaccine	0.85	0.08%	87%	0.29%	0.24%	24%	28%
PCV vaccine (3 doses)	0.58	0.20%	83%	0.38%	0.22%	31%	25%
DTP vaccine (3 doses)	0.84	0.09%	81%	0.27%	0.23%	22%	26%
HB vaccine (3 doses)	0.82	0.00%	81%	0.00%	0.00%	0%	0%
Rotavirus vaccine (2 doses)	0.50 [30]	0.17%	32%	0.20%	0.10%	16%	11%
Measles vaccine (2 doses)	0.90 [31]	0.03%	72%	0.08%	0.07%	7%	9%
Weighted vaccine efficacy	**0.71**						
Weighted coverage rate	**77%**						

Percent of vaccine-preventable disease per visit (for weighting effect sizes)

Visit	
BCG	28%
Penta-1	28%
Penta-2	32%
Penta-3	3%
Measles 1	6%
Measles 2	3%

				Percent of deaths caused by pathogens addressed by vaccine (etiology adjustment) [32]	% of under 5 deaths that occur after vaccine started [33]	Under 5	Under 5, adjusted for etiological fraction and % after recommended age of vaccination	5-14 years	15-49 years	50-74 years		
Probability of death in this age bracket if alive at start of age bracket												Vaccine
	Lower respiratory infections					0.70% [34]	0.70%	0.06% [35]	0.12% [36]	0.85% [37]		
		Of which S.pneumoniae [38]		42% [39]								
			Lower respiratory infections (S.Pneumoniae)		64%	0.29%	0.19%	0.02%	0.05%	0.36%		PCV vaccine (3 doses)
		Of which HiB		0% [40]								
			Lower respiratory infections (HiB)		64%	0.00%	0.00%	0.00%	0.00%	0.00%		HiB vaccine (3 doses)
	Pneumococc [41]			54% [42]	88%	0.01%	0.01%	0.00%	0.00%	0.01%		PCV vaccine (3 doses)
	Whooping cough				94%	0.09% [43]	0.08%	0.01% [44]	0.00% [45]	0.00% [46]		DTP vaccine (3 doses)
	Diphtheria				96%	0.00% [47]	0.00%	0.00% [48]	0.00% [49]	0.00% [50]		DTP vaccine (3 doses)
	Tetanus				13%	0.03% [51]	0.00%	0.00% [52]	0.02% [53]	0.05% [54]		DTP vaccine (3 doses)
	H influenzae [55]			1% [56]	88%	0.00%	0.00%	0.00%	0.00%	0.00%		HiB vaccine (3 doses)
	Measles				84%	0.04% [57]	0.03%	0.01% [58]	0.00% [59]	0.00% [60]		Measles vaccine (2 doses)
	Tuberculosis				100%	0.08% [61]	0.08%	0.05% [62]	0.88% [63]	2.20% [64]		BCG vaccine
	Diarrhea					0.49% [65]	0.00%	0.08% [66]	0.20% [67]	1.60% [68]		
		Of which rotavirus		37% [69]								
			Diarrhea (rotavirus)		91%	0.18%	0.17%	0.03%	0.07%	0.59%		Rotavirus vaccine (2 doses)
	Total						**0.56%**	**0.12%**	**1.03%**	**3.21%**		
	Percentage from different age groups						11.3%	2.5%	21.0%	65.3%		

Group:	High coverage districts	Low coverage districts
Best guess of counterfactual coverage in the near future among all infants in Sindh		
BCG	91%	68%
PCV1	94%	68%
PCV2	83%	56%
PCV3	69%	46%
DTP1	94%	68%
DTP2	83%	56%
DTP3	69%	46%
HiB1	94%	68%
HiB2	83%	56%
HiB3	69%	46%
Rota1	94%	68%
Rota2	83%	56%
MCV1	49%	31%
MCV2	13%	6%
Best guess of counterfactual coverage in the near future among infants enrolled in ZM		
BCG	97%	98%
PCV1	93%	90%
PCV2	81%	75%
PCV3	68%	61%
DTP1	93%	90%
DTP2	81%	75%
DTP3	68%	61%
HiB1	93%	90%
HiB2	81%	75%
HiB3	68%	61%
Rota1	93%	90%
Rota2	81%	75%
MCV1	48%	41%
MCV2	12%	9%
Coverage adjustment for those without a cell phone [70]	1.00	1.03
Share of population in each group [71	66.48%	33.52%
Coverage estimates by time period		
Weight to place on up to July vs. up to August estimates [72]	0.6	
Coverage from January 2020 to July 2021 [73]		
All infants		
	High coverage	Low coverage
BCG	91%	68%
PCV1	93%	67%
PCV2	81%	56%
PCV3	66%	44%
MCV1	43%	28%
MCV2	9%	5%
ZM-enrolled		
	High coverage	Low coverage
BCG	97%	98%
PCV1	92%	90%
PCV2	80%	74%
PCV3	66%	59%
MCV1	42%	37%
MCV2	9%	7%
Coverage from January 2020 to August 2021 [74]		
All infants		
	High coverage	Low coverage
BCG	92%	68%
PCV1	96%	68%
PCV2	86%	58%
PCV3	74%	48%
MCV1	58%	35%
MCV2	17%	9%
ZM-enrolled		
	High coverage	Low coverage
BCG	97%	98%
PCV1	93%	91%
PCV2	84%	77%
PCV3	72%	63%
MCV1	57%	47%
MCV2	17%	11%

GBD data, number of deaths by period									
	Under 5	Early neonatal	Late neonatal	< 1	1-4	% neonatal	% < 1 year	Discount	Notes
All causes	420,330.34	222,278.76	54,881.44	352,307.75	68,022.59	66%	84%	-	
Lower respiratory infections (S.Pneumoniae)	46,645.58	7,851.62	7,311.18	34,739.02	11,906.55	33%	74%	36%	First dose at 6 weeks, use neonatal share plus 10%
Lower respiratory infections (HiB)	46,645.58	7,851.62	7,311.18	34,739.02	11,906.55	33%	74%	36%	First dose at 6 weeks, use neonatal share plus 10%
Pneumococcal meningitis [75]	934.62	52.15	51.06	579.52	355.10	11%	62%	12%	First dose at 6 weeks, use neonatal share plus 10%
Whooping cough	5,803.57	Unavailable	Unavailable	2,329.35	3,474.23	Unavailable	40%	6%	First dose at 6 weeks, use 0.15 times % < 1 year
Diphtheria	40.88	Unavailable	Unavailable	11.39	29.49	Unavailable	28%	4%	First dose at 6 weeks, use 0.15 times % < 1 year
Tetanus	2,054.73	778.68	837.34	1,767.86	286.87	79%	86%	87%	First dose at 6 weeks, use neonatal share plus 10%
H influenzae type B meningitis [76]	5,563.76	307.75	300.82	3,361.03	2,202.73	11%	60%	12%	First dose at 6 weeks, use neonatal share plus 10%
Measles	2,276.93	Unavailable	Unavailable	495.27	1,781.66	Unavailable	22%	16%	Given at 9 months, use 0.75 times % < 1 year
Tuberculosis	Ignoring	Ignoring	Ignoring	Ignoring	Ignoring	Ignoring	Ignoring	0%	Administered at birth
Diarrhea	32,378.51	866.44	1,754.28	18,258.89	14,119.62	8%	56%	9%	First dose at 6 weeks, use neonatal share plus 10%
Source:	http://ghdx.healthdata.org/gbd-results-tool?params=gbd-api-2019-permalink/966f3e7aca8ff13bfa0cd330046d9ded								

Group:	High coverage districts	Low coverage districts	Notes
Incentive amount per visit (current USD)	$0.00	$1.26	Set in "CEA Main" tab. Do not adjust values in this spreadsheet.
Total increase in ln(consumption) per person per transfer	0.00614257	0.00614257	From New Incentives CEA
Household size	4.7	4.7	Default value from GiveDirectly
Value assigned to increasing ln(consumption) by one unit for one person for one year	1.44	1.44	Moral weights
Units of value from consumption per person receiving incentive from New Incentives	0.042	0.042	Calculation
New Incentives incentive size (current USD)	$11.04	$11.04	From New Incentives CEA
mCCTs incentive amount (current USD)	$0.00	$7.56	Calculation. 6 visits.
Adjustment for spending power - North West Nigeria during New Incentives trial vs. Pakistan today	1.1	1.1	From 'Effect size - mCCTs' (unpublished)
Adjustment for lower effect of mobile vs. direct cash transfers	0.70	0.70	Guess [77]
Encashment rate, i.e., percent who redeem incentive	1.00	1.00	See linked cells
Adjustment for lower/higher consumption in areas with lower/higher baseline vaccination rates	0.90	1.10	Groups with lower vaccination rates might also be poorer, which could cause effects as a percentage of consumption to be higher. We include a small adjustment for this.
Units of value from consumption per person receiving incentive from mCCTs	0.000	0.024	Calculation

Group	High coverage districts	Low coverage districts								
Discount rate for future averted deaths [78]	0.5%	0.5%								
Individuals 5-14 years old										
Unadjusted probability of death from vaccine-preventable diseases among vaccinated and unvaccinated children 5-14 years old	0.12%	0.12%								
Vaccine efficacy weighted by probability of death	0.72	0.72								
Relative risk for the incidence of vaccine-preventable disease from meta-analyses, adjusted	0.16	0.16								
Percent vaccinated in Pakistan during time of IHME data [79]	38.4%	38.4%								
Probability of death from vaccine-preventable diseases for unvaccinated in Pakistan (for individuals 5-14 years old)	0.18%	0.18%								
Adjustment for lower baseline probability of death in the future [80]	0.8	0.8								
Adjustment for long-term vaccine effectiveness [81]	0.7	0.7								
Adjusted probability of death from vaccine-preventable diseases for unvaccinated once they reach this age group	0.13%	0.18%								
Vaccine efficacy weighted by probability of death, adjusted	0.59	0.59								
Vaccine relative risk weighted by probability of death, adjusted	0.41	0.41								
Deaths averted in cohort	0.01	0.04								
Discounted deaths averted in cohort	0.01	0.04								
Value assigned to averting the death of an individual 5-14 years old from vaccine-preventable diseases	134	134								
Units of value from mortality reduction individuals 5-14 years old	1.4	4.9								
Individuals 15-49 years old										
Unadjusted probability of death from vaccine-preventable diseases among vaccinated and unvaccinated individuals 15-49 years old	1.03%	1.03%								
Vaccine efficacy weighted by probability of death	0.81	0.81								
Relative risk for the incidence of vaccine-preventable disease from meta-analyses, adjusted	0.05	0.05								
Percent vaccinated in Pakistan during time of IHME data [82]	15.3%	15.3%								
Probability of death from vaccine-preventable diseases for unvaccinated in Pakistan (for individuals 15-49 years old)	1.21%	1.21%								
Adjustment for lower baseline probability of death in the future [83]	0.6	0.6								
Adjustment for long-term vaccine effectiveness [84]	0.5	0.5								
Adjusted probability of death from vaccine-preventable diseases for unvaccinated once they reach this age group	0.66%	0.87%								
Vaccine efficacy weighted by probability of death, adjusted	0.47	0.47								
Vaccine relative risk weighted by probability of death, adjusted	0.53	0.53								
Deaths averted in cohort	0.04	0.15								
Discounted deaths averted in cohort	0.0	0.1								
Value assigned to averting the death of an individual 15-49 years old from vaccine-preventable diseases	104	104								
Units of value from mortality reduction individuals 15-49 years old	4	14								
Individuals 50-74 years old										
Probability of death from vaccine-preventable diseases among vaccinated and unvaccinated individuals 50-74 years old [85]	3.2%	3.2%								
Vaccine efficacy weighted by probability of death	0.75	0.75								
Relative risk for the incidence of vaccine-preventable disease from meta-analyses, adjusted	0.12	0.12								
Percent vaccinated in Pakistan during time of IHME data [86]	7.7%	7.7%								
Probability of death from vaccine-preventable diseases for unvaccinated in Pakistan (for individuals 50-74 years old)	3.4%	3.4%								
Adjustment for lower baseline probability of death in the future [87]	0.3	0.3								
Adjustment for long-term vaccine effectiveness [88]	0.2	0.2								
Adjusted probability of death from vaccine-preventable diseases for unvaccinated once they reach this age group	0.94%	1.24%								
Vaccine efficacy weighted by probability of death, adjusted	0.18	0.18								
Vaccine relative risk weighted by probability of death, adjusted	0.82	0.82								
Deaths averted in cohort	0.02	0.08								
Discounted deaths averted in cohort	0.02	0.06								
Value assigned to averting the death of an individual 50-74 years old from vaccine-preventable diseases	42	42								
Units of value from mortality reduction individuals 50-74 years old	1	2								
Total units of value from mortality reduction in individuals over 5	5.9	20.9								
Disease-specific probability of death by age group										
Disease	*Under 5, adjusted for etiological fraction and % after recommended age of vaccination*	*5-14 years*	*15-49 years*	*50-74 years*						
Lower respiratory infections (S.Pneumoniae)	0.19%	0.02%	0.05%	0.36%						
Lower respiratory infections (HiB)	0.00%	0.00%	0.00%	0.00%						
Pneumococcal meningitis	0.01%	0.00%	0.00%	0.01%						
Whooping cough	0.08%	0.01%	0.00%	0.00%						
Diphtheria	0.00%	0.00%	0.00%	0.00%						
Tetanus	0.00%	0.00%	0.02%	0.05%						
H influenzae type B meningitis	0.00%	0.00%	0.00%	0.00%						
Measles	0.03%	0.01%	0.00%	0.00%						
Tuberculosis	0.08%	0.05%	0.88%	2.20%						
Rotavirus	0.17%	0.03%	0.07%	0.59%						
Total	0.56%	0.12%	1.03%	3.21%						
Weighted vaccine efficacy by age group										
			Under 5, adjusted	*5-14 years*	*15-49 years*	*50 to 74 years*	*Under 5, adjusted*	*5-14 years*	*15-49 years*	*50 to 74 years*
Vaccine	*Vaccine efficacy (VE)*	*Risk reduction (RR, equals 1 - VE)*	*Probability of death from diseases prevented by vaccine*	*Probability of death from diseases prevented by vaccine*	*Probability of death from diseases prevented by vaccine*	*Probability of death from diseases prevented by vaccine*	*Percent of all vaccine-preventable deaths from diseases targeted by vaccine*	*Percent of all vaccine-preventable deaths from diseases targeted by vaccine*	*Percent of all vaccine-preventable deaths from diseases targeted by vaccine*	*Percent of all vaccine-preventable deaths from diseases targeted by vaccine*
PCV vaccine (3 doses)	0.58	0.42	0.20%	0.02%	0.05%	0.37%	35%	20%	5%	11%
DTP vaccine (3 doses)	0.84	0.16	0.09%	0.01%	0.02%	0.05%	16%	10%	2%	2%
HiB vaccine (3 doses)	0.82	0.18	0.00%	0.00%	0.00%	0.00%	0%	0%	0%	0%
Measles vaccine	0.90	0.10	0.03%	0.01%	0.00%	0.00%	5%	6%	0%	0%
BCG vaccine	0.85	0.15	0.08%	0.05%	0.88%	2.20%	14%	40%	85%	68%

Rotavirus vaccine	0.50	0.50	0.17%	0.03%	0.07%	0.59%	30%	24%	7%	18%
	Under 5, adjusted	*5-14 years*	*15-49 years*	*50 to 74 years*						
Weighted VE	0.65	0.72	0.81	0.75						
Weighted RR	**0.35**	**0.28**	**0.19**	**0.25**						
Note: These do not match up with weighted VE for under-5 because we're not weighting by probability of death among unvaccinated. These tab is intended to give a rough estimate for effects at older age groups.										

Group:	High coverage districts	Low coverage districts	Notes
Units of value from development effects per counterfactually vaccinated infant in cohort, New Incentive	0.49	0.49	New Incentives CEA
Probabilty of death from vaccine-preventable diseases for unvaccinated	1.39%	1.84%	From "CEA Main" tab
Probabilty of death from vaccine-preventable diseases for unvaccinated, New Incentives	2.96%	2.96%	New Incentives CEA
Adjustment factor	0.47	0.62	We scale down development effects based on lower probability of death among unvaccinated, relative to settings where New Incentives operates.
Units of value from development effects per counterfactually vaccinated infant in cohort, mCCTs	0.23	0.30	Calculation

What this is: This sheet calculates the adjustment factor on vaccine efficacy to account for non-specific effects of vaccines (i.e., increase in all-cause mortality that's higher than implied by effect on diseases and diseases' contributions to deaths)

RR without adjustment for non-specific effects	0.30
Percent vaccinated	0.77
Vaccine efficacy without adjustment for non-specific effects	0.70
Ratio of total averted deaths (due to both direct and non-specific effects) to directly averted deaths	1.50
X (Helper for calculations of vaccine efficacy with non-specific effects) [8	2.30
Vaccine efficacy with adjustment for non-specific effects	0.83
Adjustment factor	1.18

	Value
Value assigned to averting the death of an individual under 5	117
Value assigned to averting the death of an individual under 5-14	134
Value assigned to averting the death of an individual under 15-49	104
Value assigned to averting the death of an individual under 50-74	42
Explanation here:	https://docs.google.com/spreadsheets/d/11HsJLpq0Suf3SK_PmzzWpK1tr_BTd364j0l3xVvSCQw/edit#gid=1362437801&range=A11:A14

These estimates are based roughly on calculations for New Incentives here	
Adjustment factors for additional sources of evidence:	
Meta-analysis we use for main effect of measles vaccine [90]	1
Meta-analysis with South East Asia-specific effect (Uzicanin and Zimmerman 2011) [91]	0.91
Weight applied to each source of evidence: [92]	
Meta-analysis we use for main effect of measles vaccine in CEA	20%
Meta-analysis with South East Asia-specific effect (Uzicanin and Zimmerman 2011)	80%
Weighted average adjustment factor	0.92
Application to other vaccines besides measles:	
Contribution of measles to CEA	7%
Contribution of other vaccines to CEA	93%
Percent of adjustment that applies to non-measles vaccines [93]	75%
Measles adjustment	0.92
Non-measles adjustment	0.94
Overall adjustment for lower vaccine efficacy in Pakistan	0.94

These parameters have not been updated to reflect specific conditions for mCCTs in Pakistan. These are currently set at the same values as for New Incentives.

Items considered for inclusion	Included? [94]	Rough best guess of effect size [9	Can it be objectively justified?	Ease of modeling	Consistency	Notes	3 criteria score	Weighting of best guess of effect	Weighted best guess of effect (if excluded)	Impacts cost per life saved estimates? (if excluded)
	Color code	<15% = very low	0 = Not really	0 = It is impossible to mode						
		15-25% = medium	1 = Quantifying the effect is a gue	1 = It's unclear how we wo	1 = The effect would be equall					
		25-50% = high	2 = Quantifying the effect requir	2 = The methodology is clea	2 = The effect is included in ot					
		>50% = very high	3 = There is strong direct evidenc	3 = The methodology is clea	3 = The effect is included in ot					
Vaccine-preventable disease mortality for individuals under 5	Included		3	3	3	Main effect of intervention: meta-analysis of	9	90%	0.00%	-
Vaccine-preventable disease mortality for individuals 5 and older	Included		2	3	3	Extrapolation from effect on child mortality; s	8	80%	0.00%	-
Developmental effects	Included		2	1	3	Smallish effect; potentially quasi-experimenta	6	60%	0.00%	-
Consumption benefits	Included		3	3	3	Small effect; effect is mechanical (individuals	9	90%	0.00%	-
Lower likelihood of infecting others	Excluded	10%	2	2	2	Have not modeled effect; not included in othe	6	60%	6.00%	Yes
Herd immunity	Excluded	25%	2	1	2	Have not modeled effect; not included in othe	5	50%	12.50%	Yes
Morbidity effects from directly incentivized vaccines and rotavirus	Excluded	10%	3	2	1	Have not modeled effect explicitly; selected m	6	60%	6.00%	-
Mortality effects of indirectly incentivized vaccines besides rotavirus (i.e., polio	Excluded	4%	3	3	3	Main CEA only includes directly incentivized v	9	90%	3.60%	Yes
Morbidity effects of indirectly incentivized vaccines besides rotavirus (i.e., poli	Excluded	1%	3	3	1	Main CEA only includes directly incentivized v	7	70%	0.70%	-
Effects during outbreaks	Excluded	10%	2	1	1	Vaccination may reduce likelihood of outbreal	4	40%	4.00%	Yes
Decline in cost-effectiveness due to increases in vaccination coverage and reduction in vaccine-preventable disease over time	Excluded	-25%	2	3	2	It's possible counterfactual vaccination rates v	7	70%	-17.50%	Yes
Vaccine-derived polio outbreaks	Excluded	-5%	1	1	2	Have not modeled effect or explored evidence	4	40%	-2.00%	Yes
Serotype replacement	Excluded	-10%	1	1	2	Set to be consistent with "drug resistance" off	4	40%	-4.00%	Yes
Inflation	Excluded	-10%	1	2	2	Inflation may weaken effect of cash transfer; I	5	50%	-5.00%	Yes
Treatment costs/economic losses averted from prevention	Excluded	10%	3	2	1	Set to be consistent with "treatment costs ave	6	60%	6.00%	-
Increased timeliness of vaccination	Excluded	5%	2	3	2	RCT finds modest improvement in timeliness	7	70%	3.50%	Yes
Investment of income increases	Excluded	10%	1	2	2	Set to be consistent with SMC	5	50%	5.00%	-
Increased clinic utilization	Excluded	0%	2	1	2	We have not seen evidence for or against clini	5	50%	0.00%	Yes
Increased enrollment in ZM as a result of mCCTs	Excluded	5%	2	3	2	mCCTs may increase enrollment in ZM, which	7	70%	3.50%	Yes
							New Incentives adjustment factor		122.30%	
Cross-cutting / Structural										
Leverage/Funging	Included		1	2	3	Very big effect but difficult to model well				
Long-term funging (does it displace government funding in the long term?)	Excluded	?	0	0	1	Very difficult to model well; have not seen str				
Long-term funging (does it deter private actors, e.g., bednet manufacturers fr	Excluded	?	0	0	1	Very difficult to model well; have not seen str				
Other flow-through effects	Excluded	?	1	0	1	Extremely difficult to model well; read more a				
Subjective reported well-being	Excluded	?	1	2	1	Ultimately, we care about increasing the well-				

[1] From budget shared by IRD: 100 PKR (USD 0.63) "universal amount" plus 100 PKR (0.63 USD) "additional amount in high risk districts"

Note that IRD's budget has since been redacted to only include high-level figures. See the redacted budget here: https://docs.google.com/spreadsheets/d/19cm2HCjOKvFUiYxnOEJznuKSBQ4JbuTLzFSySERC90g/edit#gid=1831308725

[2] For example, suppose there are only two vaccines: BCG and measles.

If 100% of kids receive BCG and getting BCG prevents 20% of vaccine-preventable deaths and 50% of kids receive measles and measles prevents the remaining 80% of vaccine-preventable deaths, then the baseline coverage is 60%.

Full immunization coverage in this example would be 50%.

[3] Baseline mortality rates from IHME necessarily include some vaccinated and some unvaccinated infants. We need to adjust so that baseline mortality rates reflect mortality among unvaccinated infants.

We do this based on the following formula for each vaccine:

Probability of death in Pakistan population = (Percent vaccinated x RR x Probability of death without vaccine in Pakistan population) + (Percent unvaccinated in Pakistan population x Probability of death without vaccine in Pakistan population)

This implies:

Probability of death without vaccine in Pakistan population = Probability of death in Pakistan population / ((Percent vaccinated in Pakistan population x RR) + Percent unvaccinated in Pakistan population)

where RR = 1 - vaccine effectiveness

and Probability of death in Pakistan population = probability of death in IHME data (which includes both vaccinated and unvaccinated individuals) in Pakistan population.

[4] Our estimates of vaccine efficacy are based on vaccines' effects on incidence of vaccine-preventable disease. A 100% value for this input implies that vaccines reduce vaccine-preventable disease mortality by the same percent that vaccines reduce vaccine-preventable disease incidence. An input below 100% indicates that vaccine-preventable disease mortality does not drop as much as vaccine-preventable disease incidence when infants are vaccinated. Our best guess is that the reduction in vaccine-preventable disease incidence results in a similar reduction in mortality, but we are not aware of high-quality empirical evidence that we can use to test this assumption.

[5] https://docs.google.com/spreadsheets/d/1jPdaecfcva53zDe5DTbqrkBk47PoGUiKbqk-gfzmt6w/edit#gid=1680005064&range=A38:B38

[6] Assumption that laptops and cell phones last three years comes from a conversation with IRD:

"The need to replace phones and laptops used for ZM every three years. The mobile phones and laptops field workers are currently using were purchased between 2017 and 2018 and are currently experiencing memory and battery issues."

https://docs.google.com/document/d/1F_O31-l-eMiqJhfHvVFHMt70p-yV0KcdD8xhXYTjVZ4/edit#

[7] This is set to match the roughly $1.8m annual cost to run ZM that IRD has shared (excluding phones and laptops).

“The $1.8 million annual operating cost of ZM, which excludes IRD's mCCT program and the recurring replacement costs for old phones and laptops. IRD expects this to be an accurate projection of future costs, although they would increase over time due to inflation.” https://docs.google.com/document/d/1xWzpSIrteL61fJyaXJGbMnbdNAWCroXEcTdS3MbkDw0/edit

[8] These figures were provided to us by IRD in a detailed budget, which has since been redacted to only include higher-level figures. See the redacted budget here: https://docs.google.com/spreadsheets/d/19Zohw2wouwyEQksN7y7dMHKrKG3VTfxE3wKotP8a-3M/edit#gid=1831308725

[9] “Cell phone access in Sindh. Data from ZM shows that 30% of caregivers of enrolled children provide contact numbers. However, this figure significantly underestimates cell phone access in Pakistan, since IRD does not actively solicit phone numbers for ZM, and caregivers have no incentive to provide them. An RCT conducted on IRD's mCCT program excluded only 7.5% of potential participants due to lack of ability to provide a phone number, which better reflects cell phone access. The RCT was conducted in Korangi, which might have higher rates of cell phone access than rural areas of Pakistan but is a diverse town that should be broadly representative of the population of Sindh Province.” https://docs.google.com/document/d/1c2eYYzRlMXuo0UsXVcE_NB97ZBSKXYE1KhgtFSWNCZw/edit

[10] See this spreadsheet (budget shared by IRD on September 28): https://docs.google.com/spreadsheets/d/19cm2HCjOKvFUiYxnOEJznuKSBQ4JbuTLzFSySERC90g/edit#gid=1831308725&range=J48:K48

Should be slightly lower than we're estimating since they're not incorporating 10% wastage

[11] The WHO’s Immunization Financing Indicators show 32% of vaccination costs are spent by the government.

WHO, Immunization Financing Indicators, "Percentage of total expenditure on routine immunization financed by government", Pakistan, 2019. https://cdn.who.int/media/docs/default-source/immunization/financing/5-percentage-total-expenditure-routine-immunization-financed-government.xlsx?sfvrsn=63f05690_2

However, our understanding is that Gavi is planning to enter an “accelerating transitioning phase” that would require the government to bear a larger share of costs and eventually phase out of Gavi support.

“Country is projected to enter accelerated transition phase in 2021.” https://www.gavi.org/sites/default/files/document/co-financing-information-sheet-pakistanpdf.pdf, p. 1

As a result, we adjust this share upward under the assumption that the government will pay a smaller share of costs in the next few years. We’re uncertain about this parameter and have not reviewed vaccine financing plans from the Government of Pakistan or Gavi.

[12] This includes both the costs of the program per enrolled infant (for ZM alone) and the costs to government and Gavi from additional vaccinations caused by ZM alone.

[13] Upstream costs cause downstream costs. Assumes government financial costs and philanthropic actors are "upstream". The implication of government financial costs being "upstream" is they are not leveraged. We're uncertain whether this assumption is true for government financial costs, but because government financial costs are a small % of total costs it doesn't make much difference.

[14] Upstream costs cause downstream costs. Assumes government financial costs and philanthropic actors are "upstream". The implication of government financial costs being "upstream" is they are not leveraged. We're uncertain whether this assumption is true for government financial costs, but because government financial costs are a small % of total costs it doesn't make much difference.

[15] Upstream costs cause downstream costs. Assumes government financial costs and philanthropic actors are "upstream". The implication of government financial costs being "upstream" is they are not leveraged. We're uncertain whether this assumption is true for government financial costs, but because government financial costs are a small % of total costs it doesn't make much difference.

[16] Upstream costs cause downstream costs. Assumes government staff costs and Gavi's costs are "downstream". The implication of these costs being "downstream" is if the program shrinks (i.e. we make a smaller donation), less of these costs will go to the intervention. So they are leveraged

[17] Upstream costs cause downstream costs. Assumes government staff costs and Gavi's costs are "downstream". The implication of these costs being "downstream" is if the program shrinks (i.e. we make a smaller donation), less of these costs will go to the intervention. So they are leveraged

[18] Upstream costs cause downstream costs. Assumes government staff costs and Gavi's costs are "downstream". The implication of these costs being "downstream" is if the program shrinks (i.e. we make a smaller donation), less of these costs will go to the intervention. So they are leveraged

[19] See this spreadsheet: https://docs.google.com/spreadsheets/d/11HsJLpq0Suf3SK_PmzzWpK1tr_BTd364j0l3xVvSCQw/edit#gid=1176773164&range=A292

[20] See this spreadsheet: https://docs.google.com/spreadsheets/d/11HsJLpq0Suf3SK_PmzzWpK1tr_BTd364j0l3xVvSCQw/edit#gid=1176773164&range=A293

[21] These are taken from "Probability of death" tab.

[22] We use 2015-2019 coverage from UNICEF to correspond with 2019 under-5 mortality data from IHME. https://www.who.int/immunization/monitoring_surveillance/data/pak.pdf

[23] "RotaC: percentage of surviving infants who received the final recommended dose of rotavirus vaccine, which can be either the 2nd or the 3rd dose depending on the vaccine." p. 2. https://www.who.int/immunization/monitoring_surveillance/data/pak.pdf

[24] We've set these to be in line with the efficacy achieved by going from 0 to 1 doses, 0 to 2 doses, and 0 to 3 doses in our partial vaccine adjustment calculations.

These are described here: https://docs.google.com/spreadsheets/d/1Kzv-FJhGDuB59zwQS9JzGmszVXjlj40Y4kUVt-XVED8/edit#gid=1116590832

[25] We've set these to be in line with the efficacy achieved by going from 0 to 1 doses, 0 to 2 doses, and 0 to 3 doses in our partial vaccine adjustment calculations.

These are described here: https://docs.google.com/spreadsheets/d/1Kzv-FJhGDuB59zwQS9JzGmszVXjlj40Y4kUVt-XVED8/edit#gid=1116590832

[26] By construction, receiving all doses leads to the full efficacy observed in trials. (Note: This does not mean getting all doses leads 100% efficacy but that it leads to 100% of efficacy observed in the trial.)

[27] We've set these to be in line with the efficacy achieved by going from 0 to 1 doses, 0 to 2 doses, and 0 to 3 doses in our partial vaccine adjustment calculations.

These are described here: https://docs.google.com/spreadsheets/d/1Kzv-FJhGDuB59zwQS9JzGmszVXjlj40Y4kUVt-

XVED8/edit#gid=1116590832

[28] By construction, receiving all doses leads to the full efficacy observed in trials. (Note: This does not mean getting all doses leads 100% efficacy but that it leads to 100% of efficacy observed in the trial.)

[29] See "Meta-analyses of vaccines' effects on disease for children under five" here: https://www.givewell.org/international/technical/programs/new-incentives#Vaccine_efficacy

[30] This is different from vaccine efficacy used in New Incentives.

We use vaccine efficacy of rotavirus vaccination against severe rotavirus diarrhea from Southern Asia in this meta-analysis.

A meta-analysis finds vaccine efficacy of 50.0 (95% CI 34.4-61.9) against severe rotavirus diarrhea in Southern Asia.

Lamberti et al. 2016 (https://journals.lww.com/pidj/Fulltext/2016/09000/A_Systematic_Review_of_the_Effect_of_Rotavirus.16.aspx,%20Table%201)

[31] This is different from vaccine efficacy used in New Incentives.

We include higher efficacy to account for second dose (relative to first dose vaccine efficacy cited in footnote in cell B45).

We have not explored evidence on partial efficacy of two-dose vaccines (rotavirus and measles) in depth and have benchmarked our estimates based on partial vaccine efficacy for three-dose vaccines. For the measles vaccine specifically, our estimates of the efficacy of one dose of measles vaccine in the New Incentives CEA is 0.85 and our estimate for two doses for this CEA is 0.90. This implies that 94% of the efficacy comes from the first dose, which is higher than what we have assumed for two-dose vaccines in general (see cell B41). We do not have similar estimates for one vs. two doses of rotavirus vaccine.

Because measles constitutes a fairly small share of vaccine-preventable disease deaths and because adjusting percent of full vaccine efficacy from one dose is unlikely to substantially change cost-effectiveness, we have not made updates to these parameters, either to account for higher efficacy from a single dose or higher relative efficacy from a two doses vs. one dose of measles vaccine.

[32] We adjust the probability of death from specific diseases to account for the etiological fraction of different pathogens (i.e., the share of lLRTI deaths due to the S. pneumoniae and HiB, and the share of diarrhea deaths due to rotavirus).

This adjustment is based on our best guess of percent of deaths for children under 5 due to specific etiologies. We apply this same adjustment for deaths over 5 but have not investigated how accurate this assumption is and as a result are highly uncertain about it.

Details for specific adjustments are described in cell notes below.

[33] Some deaths from vaccine-preventable diseases occur before vaccine is administered. We need to exclude these from probability of death.

See 'Deaths before vaccine administered' tab for calculations

[34] http://ihmeuw.org/5ino

[35] http://ihmeuw.org/5iqi

[36] http://ihmeuw.org/5iqj

[37] http://ihmeuw.org/5iqk

[38] The contribution of different pathogens varies by pneumonia severity strata, with viral etiologies becoming relatively less important and most deaths in 2010 caused by the main bacterial agents - SP (33%) and Hib (16%), accounting for vaccine use against these two pathogens.

https://www.ncbi.nlm.nih.gov/pubmed/23826505

[39] Percent of lower respiratory infections due to S. pneumoniae is based on data from View-Hub.

For more explanation on why we use this source and discussion of alternative sources, see this write-up: https://docs.google.com/document/d/18FkjYLTVMRLHRXPwxh7IhiBsACKTWTGPozXCiZYKKwA/edit

Calculations are here:
https://docs.google.com/spreadsheets/d/1t6DjhT83o6b4wl1yc57f0stHZlOsL32m3R_HaT45tcU/edit#gid=0

[40] Percent of lower respiratory infections due to HiB is based on data from View-Hub.

For more explanation on why we use this source and discussion of alternative sources, see this write-up: https://docs.google.com/document/d/18FkjYLTVMRLHRXPwxh7IhiBsACKTWTGPozXCiZYKKwA/edit

Calculations are here:
https://docs.google.com/spreadsheets/d/1t6DjhT83o6b4wl1yc57f0stHZlOsL32m3R_HaT45tcU/edit#gid=0

[41] IHME

https://gbd2017.healthdata.org/gbd-search?params=gbd-api-2017-permalink/3de58a499d66dd2a4bc4027ae011b47d

Here we use data from IHME's GBD Results tool for 2017 because the GBD Compare tool from which we're gathering data for 2019 doesn't include probability of death estimates for pneumococcal meningitis.

[42] We compare deaths due to pneumococcal meningitis in IHME vs. View-Hub, which may be a more reliable source for deaths due to S. pneumoniae and HiB. We apply an adjustment to bring IHME data in line with data from View-Hub.

For more explanation on why we use this source and discussion of alternative sources, see this write-up: https://docs.google.com/document/d/18FkjYLTVMRLHRXPwxh7IhiBsACKTWTGPozXCiZYKKwA/edit

Calculations are here:
https://docs.google.com/spreadsheets/d/1t6DjhT83o6b4wl1yc57f0stHZlOsL32m3R_HaT45tcU/edit#gid=0

[43] http://ihmeuw.org/5inp

[44] http://ihmeuw.org/5iqm

[45] http://ihmeuw.org/5iqn

[46] http://ihmeuw.org/5iqo

[47] http://ihmeuw.org/5iqp

[48] http://ihmeuw.org/5iqq

[49] http://ihmeuw.org/5iqr

[50] http://ihmeuw.org/5iqs

[51] http://ihmeuw.org/5iqt

[52] http://ihmeuw.org/5iqu

[53] http://ihmeuw.org/5iqv

[54] http://ihmeuw.org/5iqw

[55] IHME

https://gbd2017.healthdata.org/gbd-search?params=gbd-api-2017-permalink/3de58a499d66dd2a4bc4027ae011b47d

Here we use data from IHME's GBD Results tool for 2017 because the GBD Compare tool from which we're gathering data for 2019 doesn't include probability of death estimates for H influenzae type B meningitis.

[56] We compare deaths due to pneumococcal meningitis in IHME vs. View-Hub, which may be a more reliable source for deaths due to S. pneumoniae and HiB. We apply an adjustment to bring IHME data in line with data from View-Hub.

For more explanation on why we use this source and discussion of alternative sources, see this write-up: https://docs.google.com/document/d/18FkjYLTVMRLHRXPwxh7IhiBsACKTWTGPozXCiZYKKwA/edit

Calculations are here: https://docs.google.com/spreadsheets/d/1t6DjhT83o6b4wl1yc57f0stHZlOsL32m3R_HaT45tcU/edit#gid=0

[57] http://ihmeuw.org/5iqx

[58] http://ihmeuw.org/5iqy

[59] http://ihmeuw.org/5iqz

[60] http://ihmeuw.org/5ir0

[61] http://ihmeuw.org/5ir1

[62] http://ihmeuw.org/5ir2

[63] http://ihmeuw.org/5ir3

[64] http://ihmeuw.org/5ir4

[65] http://ihmeuw.org/5ir5

[66] http://ihmeuw.org/5ir6

[67] http://ihmeuw.org/5ir7

[68] http://ihmeuw.org/5ir8

[69] The meta-analysis we use to estimate the effect of rotavirus vaccine on severe diarrhea suggests an etiological fraction of 37%. In that meta-analysis, for Southern Asia, the effect on severe rotavirus diarrhea is 0.50, and effect on all severe diarrhea is 0.186, which implies 37%.

Meta-analysis of rotavirus: Lamberti et al. 2016 (https://journals.lww.com/pidj/Fulltext/2016/09000/A_Systematic_Review_of_the_Effect_of_Rotavirus.16.aspx), Table 1

[70] We estimate effect of mCCTs among those with access to a cell phone and who are therefore eligible to receive mobile-based incentives. We estimate that coverage is higher for those with a cell phone.

We're highly uncertain about the appropriate value for this adjustment.

[71] IRD, Coverage estimates by EPI targets, 2021 (unpublished)

[72] IRD has indicated that the increase in coverage from July to August is likely to reflect temporary expanded outreach activities (EOAs) by the government and that rates will decline to previous levels in the near future.

As a result, we put some weight on the estimates up to July and some weight on the estimates up to August in order to generate our best guess of coverage in the near future.

We're highly uncertain about what to expect coverage to look like in the near term.

[73] IRD, Coverage estimates by EPI targets, 2021 (unpublished)

[74] IRD, Coverage estimates by EPI targets (through August 31), 2021 (unpublished)

[75] GBD 2019 does not include breakdowns between deaths caused by different types of meningitis. For this row, we rely on estimates from GBD 2017:

https://gbd2017.healthdata.org/gbd-search?params=gbd-api-2017-permalink/3de58a499d66dd2a4bc4027ae011b47d

[76] GBD 2019 does not include breakdowns between deaths caused by different types of meningitis. For this row, we rely on estimates from GBD 2017:

https://gbd2017.healthdata.org/gbd-search?params=gbd-api-2017-permalink/3de58a499d66dd2a4bc4027ae011b47d

[77] We guess mobile transfers (delivered via top-ups) have a lower effect than transfers delivered in cash. This parameter is highly speculative.

[78] This discount factor is intended to reflect a higher relative value on deaths averted now vs. deaths averted in the future and potentially that there are fundamental changes that render the program ineffective.

See this section of our New Incentives intervention report for more information on our reasoning for applying this discount rate:

https://www.givewell.org/international/technical/programs/new-incentives#Effects_on_deaths_above_age_five

[79] We guess that vaccination rates have increased over time in Pakistan, so percent vaccinated is lower for older cohorts in the current IHME data. Our specific estimate (0.5x the current IHME data) is a rough best guess.

[80] Probability of death from diseases addressed by vaccines may fall over time. This would lower the baseline mortality rate for individuals once they enter into older age groups.

Current parameters are highly speculative.

We have set these adjustments lower than we have for New Incentives. Using the same values we use for New Incentives would imply a larger benefit from deaths averted after age 5. We use lower adjustments for this in order to place a cap on the percentage of the benefits that are due to deaths over 5 so that they are not substantially higher than for New Incentives. Since the IHME data show a larger percentage of vaccine-preventable disease deaths occurring for children older than 5 in Pakistan relative to Nigeria, we think it is plausible the effects on deaths above age 5 constitute a larger share of benefits than for New Incentives, but we do not want to put too much weight on this difference, especially since estimates for deaths above age 5 are highly uncertain.

[81] The meta-analyses we use are based on short-term vaccine effects. We guess effects are muted in the long-term. Current parameters are highly speculative.

We have set these adjustments lower than we have for New Incentives. Using the same values we use for New Incentives would imply a larger benefit from deaths averted after age 5. We use lower adjustments for this in order to place a cap on the percentage of the benefits that are due to deaths over 5 so that they are not substantially higher than for New Incentives. Since the IHME data show a larger percentage of vaccine-preventable disease deaths occurring for children older than 5 in Pakistan relative to Nigeria, we think it is plausible the effects on deaths above age 5 constitute a larger share of benefits than for New Incentives, but we do not want to put too much weight on this difference, especially since estimates for deaths above age 5 are highly uncertain.

[82] We guess that vaccination rates have increased over time in Pakistan, so percent vaccinated is lower for older cohorts in the current IHME data. Our specific estimate (0.2x the current IHME data) is a rough best guess.

[83] Probability of death from diseases addressed by vaccines may fall over time. This would lower the baseline mortality rate for individuals once they enter into older age groups.

Current parameters are highly speculative.

We have set these adjustments lower than we have for New Incentives. Using the same values we use for New Incentives would imply a larger benefit from deaths averted after age 5. We use lower adjustments for this in order to place a cap on the percentage of the benefits that are due to deaths over 5 so that they are not substantially higher than for New Incentives. Since the IHME data show a larger percentage of vaccine-preventable disease deaths occurring for children older than 5 in Pakistan relative to Nigeria, we think it is plausible the effects on deaths above age 5 constitute a larger share of benefits than for New Incentives, but we do not want to put too much weight on this difference, especially since estimates for deaths above age 5 are highly uncertain.

[84] The meta-analyses we use are based on short-term vaccine effects. We guess effects are muted in the long-term. Current parameters are highly speculative.

We have set these adjustments lower than we have for New Incentives. Using the same values we use for New Incentives would imply a larger benefit from deaths averted after age 5. We use lower adjustments for this in order to place a cap on the percentage of the benefits that are due to deaths over 5 so that they are not substantially higher than for New Incentives. Since the IHME data show a larger percentage of vaccine-preventable disease deaths occurring for children older than 5 in Pakistan relative to Nigeria, we think it is plausible the effects on deaths above age 5 constitute a larger share of benefits than for New Incentives, but we do not want to put too much weight on this difference, especially since estimates for deaths above age 5 are highly uncertain.

[85] See calculations in "Probability of death" sheet in our supplemental spreadsheet here:

https://docs.google.com/spreadsheets/d/1Y4mfEplnI6kngyv7CeMqVCKMU8gQU-_vxSaJocohy7s/edit#gid=1898938765

[86] We guess that vaccination rates have increased over time in Pakistan, so percent vaccinated is lower for older cohorts in the current IHME data. Our specific estimate (0.1x the current IHME data) is a rough best guess.

[87] Probability of death from diseases addressed by vaccines may fall over time. This would lower the baseline mortality rate for individuals once they enter into older age groups.

Current parameters are highly speculative.

We have set these adjustments lower than we have for New Incentives. Using the same values we use for New Incentives would imply a larger benefit from deaths averted after age 5. We use lower adjustments for this in order to place a cap on the percentage of the benefits that are due to deaths over 5 so that they are not substantially higher than for New Incentives. Since the IHME data show a larger percentage of vaccine-preventable disease deaths occurring for children older than 5 in Pakistan relative to Nigeria, we think it is plausible the effects on deaths above age 5 constitute a larger share of benefits than for New Incentives, but we do not want to put too much weight on this difference, especially since estimates for deaths above age 5 are highly uncertain.

[88] The meta-analyses we use are based on short-term vaccine effects. We guess effects are muted in the long-term. Current parameters are highly speculative.

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[89] In the row below, we back out vaccine efficacy with non-specific effects included. This row is a “helper” to break up those calculations.

The adjustment factor is calculated using:

Probability of death among unvaccinated x VE with adjustment for non-specific deaths
/ Probability of death among unvaccinated x VE without adjustments for non-specific deaths
= 1.5

where

Probability of death among unvaccinated = Probability of death among vaccinated and unvaccinated / (Vaccination coverage * (1 - VE) + (1 - Vaccination coverage))

Based on this, we estimate

VE with adjustments = X / (1 + X*percent vaccinated)

where

X = 1.5 x VE without adjustment / (percent vaccinated x (1 - VE without adjustment) + % unvaccinated)

[90] We use a vaccine efficacy estimate of 85% for measles vaccines. (See "Vaccine efficacy from meta-analyses" section above). See here for more information: https://www.givewell.org/international/technical/programs/new-incentives#Efficacy_analysis

We use this as the benchmark for weighting the effect size, so it is set to 1 by definition.

[91] Table 2. By WHO Region: SEAR, Median, p.S145.

https://pubmed.ncbi.nlm.nih.gov/21666154/

0.85 is VE for 1 dose.

[92] These weights are our rough best guess at the relevance of each source of evidence to IRD's program.

[93] This estimate is our rough best guess about the extent to which poor measles vaccine efficacy would imply problems with other vaccines.

[94] This column indicates whether an item is explicitly included in the CEA. Some items that are not explicitly included may be accounted for indirectly through the parameter values individuals use.

[95] In most cases, we have not done detailed modeling of excluded effects.

These estimates should be viewed as extremely rough. The actual impact of adding or removing an item from the CEA will differ from person to person.

Note that we do not update these estimates with every CEA release. The estimates displayed here may be out-of-date.