Polio SIAs during the COVID-19 pandemic

An analysis of the additional operational costs of house-to-house polio vaccination campaigns in the context of COVID-19

BREAKING NEW GROUND

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SUMMARY

This analysis estimates the potential additional operational cost of a house-to-house oral polio vaccine (OPV) supplemental immunization activity (SIA) held during the COVID-19 pandemic. Many mass immunization campaigns have been suspended due to the COVID-19 pandemic, but as countries gain a better understanding of local transmission of the COVID-19 virus and given the increased risk of morbidity and mortality resulting from the disruption of immunization services, countries are exploring options for their eventual implementation. With support from the Bill & Melinda Gates Foundation, ThinkWell has estimated the added cost per dose of a number of potential operational changes due to COVID-19, specifically: additional infection prevention and control (IPC) measures to reduce the risk of COVID-19 transmission, additional per diems due to potential changes in the duration of the vaccination campaign, and increases of other operational cost components (such as additional social mobilization and training). The analysis uses data from polio SIA budgets from seven countries (Benin, Equatorial Guinea, Iraq, Mali, Papua New Guinea, South Sudan and Syria) to model each change at a low, medium, and high intensity level, as well as the combined effect on the cost per dose.

The results of this analysis suggest that the operational cost of house-to-house oral polio vaccine supplemental immunization activity could increase by up to 87% when additional IPC measures such as hand hygiene and personal protective equipment are implemented; up to 58% when accounting for additional per diems and incentives due to increased campaign length and; up to 77% when considering increases in other operational cost components due to COVID-related disruption.

In combination, additional IPC measures, increases in HR costs, and increases in other cost components could increase the operational cost of campaigns by 26-30% in the low intensity and 81-171% in the high intensity scenario.

INTRODUCTION

This analysis estimates the potential additional operational cost of a house-to-house oral polio vaccine (OPV) supplemental immunization activity (SIA) held during the COVID-19 pandemic. Many mass immunization campaigns have been suspended due to the COVID-19 pandemic, but as countries gain a better understanding of local transmission of the COVID-19 virus and given the increased risk of morbidity and mortality resulting from the disruption of immunization services, countries are exploring options for their eventual implementation.[1] With support from the Bill & Melinda Gates Foundation, ThinkWell has estimated the added cost per dose of a number of potential operational changes due to COVID-19, specifically: additional infection prevention and control (IPC) measures to reduce the risk of COVID-19 transmission, additional per diems due to potential changes in the duration of the vaccination campaign, and increases of other operational cost components (such as additional social mobilization and training). The analysis uses data from polio SIA budgets from seven countries to model each change at a low, medium, and high intensity level, as well as the combined effect on the cost per dose.

METHODOLOGY & DATA

The analysis uses data from seven country polio SIA budgets from 2019-2020: Benin, Equatorial Guinea, Iraq, Mali, Papua New Guinea, South Sudan and Syria. Countries were purposively selected in consultation with WHO to provide a representative diversity of SIAs.[i] All countries used house-to-house as the main delivery strategy, while Syria and Papua New Guinea also included a small fixed site component. Line items from each SIA budget were coded as either operational[ii] or non-operational[iii] costs, with operational costs further coded into discrete cost categories for analysis (e.g. human resources, training, transportation). Further, relevant input data were extracted from each country SIA budget, including: the target population, the number of SIA days, the number of vaccinators and other community-facing SIA staff, the number of vaccination teams (assumed to be 4 staff), and the number of fixed vaccination sites per campaign.

SCENARIOS & ASSUMPTIONS

The analysis evaluates the impact of three scenarios of operational changes to immunization campaigns that would have incremental fiscal cost implications. The scenarios reflect investments in line with pillar 6 (infection prevention and control) and pillar 9 (maintaining essential health services) of WHO's COVID-19 strategic preparedness and response plan.[2] The analysis estimates incremental costs only, thus including only one-off expenditures for the SIA, and excluding routine expenditures such as health worker salaries and capital costs. The incremental costs of each scenario were assessed at three different intensities of implementation– 'low', 'medium' or 'high'. The intensities are modelled on the GPEI minimum guidance for SIAs (low), as well as country experiences of SIA in pandemic settings (medium and high). The intensities reflect the level of operational changes (as depicted in Figure 1), and are not necessarily linked to the level of community transmission in a given country. Note that GPEI guidance suggests that community transmission should be assumed in settings where transmission dynamics are unknown (e.g. poor COVID-19 surveillance).[3]

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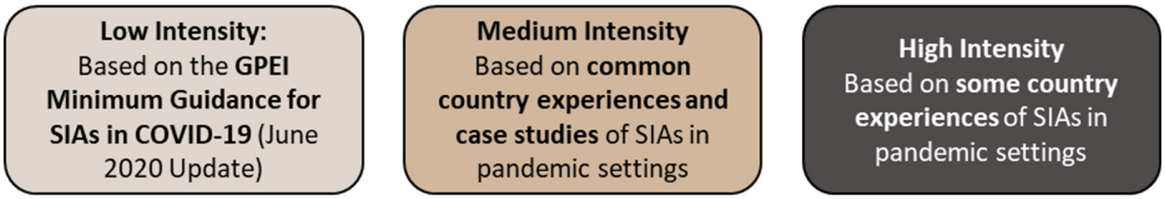
[i] Endemic countries were not included in this analysis, because they are semi-autonomous budget centers in the GPEI management structure, that do not submit activity budgets to headquarters.

[ii] Operational costs or immunization delivery costs are defined as the costs associated with delivering vaccinations to target populations

[iii] Non-operational costs include the direct procurement and shipping of the OPV, Vitamin A and finger markers

Figure 1 - Intensities of implementation



Scenario 1: Additional IPC measures to minimize the transmission risk of COVID-19

The first scenario captures the additional cost of IPC measures, including hand hygiene, personal protective equipment (PPE) and temperature screening. Unit costs included are described below in Table 1 and in more detail overleaf. To note, current WHO recommendations advise against the routine use of gowns, respirators, and other high-risk barrier methods during mass vaccination campaigns and so their costs are not considered here. The IPC measures and price assumptions are in line with WHO's methodology for estimating resource needs in response to COVID-19.[4]

Table 1 - Additional IPC measures to minimize the transmission risk of COVID-19

Scenario 1: Additional IPC measures to minimize the transmission risk of COVID-19[iv]		
Low	Medium	High
– All vaccinators receive one mask per day – One unit of hand sanitizer and hand soap per team per day – Simple hand washing station for each fixed vaccination site (2 x 60-liter bucket and 2 units of soap per post per day) – One biohazard bag per team per day for disposal of PPE supplies	– All vaccinators, team supervisors, drivers, social mobilizers, and others going out into the community receive two masks per day – One unit of hand sanitizer and hand soap per team per day – Simple hand washing station for each fixed vaccination site (2 x 60-liter bucket and 2 units of soap per post per day) – One biohazard bag per team per day for disposal of PPE supplies – One infrared thermometer per team	– All vaccinators, team supervisors, drivers, social mobilizers, and others going out into the community receive two masks per day – Vaccinators receive one set of reusable goggles per campaign, and one set of gloves per recipient – Other team members two sets of gloves per day – One unit of hand sanitizer and hand soap per team per day – One biohazard bag per team per day for disposal of PPE supplies – Advanced hand washing station for each fixed vaccination site (2 x 60-liter bucket, stand, basin and 2 units of soap per post per day) – One infrared thermometer per team

Masks: Current WHO and GPEI guidance recommends the use of masks by vaccinators only, and then only in areas where community transmission of COVID-19 is confirmed, or in areas where transmission is not well known or surveillance systems are weak.[2, 18] For the purposes of analysis, masks are therefore only included for the vaccinators at low intensity scenarios. In medium and high intensity scenarios, masks are included for all team members at either one[4] or two masks[1] per day. The modelled increase

[iv] Please note that this in addition to all regular immunization campaign protocols regarding e.g. injection safety and waste management

from 'vaccinator-only' to 'whole-team' mask wearing in these scenarios is a pragmatic adaptation built on operational guidance from several countries (e.g. Angola[5], Bangladesh,[6] DRC,[7 8] India,[9] Kenya[10]) which indicates the use of masks for vaccinators and other team members.

Gloves: The low and medium intensity scenarios reflect WHO's recommendation not to use gloves unless the skin is not intact, while the high intensity reflects practices in several countries to systematically use gloves during vaccination sessions. WHO recommendations do not require vaccinators to wear gloves unless the skin of the recipient is not intact. If gloves are necessary, they should be changed between every recipient. During recent measles campaign in DRC[11], as well as during post-Ebola immunization campaigns in Libera[12 13] and Sierra Leone in 2015,[14] vaccination teams were provided with gloves for each child vaccinated, even if their skin was intact. Guidance from country settings including Guinea[15], India[16] and Kenya[10] includes recommendations for vaccinators to wear masks and gloves. Therefore, although the low and medium intensity scenarios do not include gloves, they are included in the high intensity scenario.

Eye protection: The high intensity scenario also includes goggles for vaccinators. Although WHO's immunization-specific guidance does not prescribe the use of goggles, as WHO's list of Priority Medical Devices in the context of COVID-19 specifies gowns, goggles, or face shields as part of the supplies required even for triaging. During the Ebola vaccination campaigns late last year in DRC, vaccinators also wore goggles.[17] WHO's protocol on the rational use of personal protective equipment (PPE) indicates its use around patients without respiratory symptoms should depend on a risk assessment. GPEI guidance mentions that eye protection for vaccinators, although not required, can be considered, and that a final decision should be based on country-specific policies.[18]

Hand hygiene: To account for the cost of added infection prevention and control (IPC) materials, all scenarios include hand sanitizer and hand soap for vaccination teams, as well as hand washing stations at the entrance and exist of campaign sites. WHO urges countries to make hand sanitizer and handwashing stations with soap and water available for use by recipients and their companions at all vaccination sites, and that health workers should perform hand hygiene before and after each administered vaccine. In Burkina Faso, vaccinators were offered one bar of hand soap per person, in order to be able to wash their hands following house visits[19]. In all scenarios one unit of hand sanitizer is included for each vaccination team member per campaign, with an additional bar of soap for those team members not operating from a fixed site. In DRC, during the measles outbreak response campaign in Kinshasa in April and other campaigns held in late 2019, two simple handwashing stations (a bucket of water and 2 units of soap per day) were installed at each site.[7 8] The low and medium scenarios include two simple handwashing stations to accommodate both the entry and exit points of each fixed vaccination post. The high intensity scenario includes a more advanced handwashing station consisting of a tap and a basin.

The unit prices for PPE supplies used in the analysis equal those used in WHO's Emergency Global Supplies Catalogue (COVID-19),[20] and IPC prices are based on a WASH study in Kenya[22], as well as the WHO COVID-19 Essential Supplies Forecasting Tool (ESFT).[21] The price assumptions are shown in Table 2. The prices of the handwashing stations are based on a WASH study in Kenya[22], and have been converted to USD2020 values, and are in line with the latest UNICEF price ranges for low cost and low to medium cost hand washing stations.[23] The price used for the thermometer and bar soap come from the UNICEF Supply Catalogue.[23] The prices of the liquid soap for hand washing stations at fixed sites are from the WHO COVID-19 Essential Supplies Forecasting Tool (ESFT). All prices are exclusive of shipment costs.

Table 2 -- Unit costs for selected IPC commodities

Item	Unit cost (USD 2020)	Source
1 medical/surgical mask	$ 0.34	Emergency Global Supply Chain System (COVID-19) catalogue
1 set of gloves	$ 0.13	Emergency Global Supply Chain System (COVID-19) catalogue
1 pair of reusable goggles	$ 1.96	Emergency Global Supply Chain System (COVID-19) catalogue
1 biohazard bag	$ 0.19	Emergency Global Supply Chain System (COVID-19) catalogue
1 infrared thermometer	$ 26.19	UNICEF supply catalogue
1 bar of hand soap	$ 0.15	UNICEF supply catalogue
1 liter of liquid soap	$ 0.90	WHO Essential Supplies Forecasting Tool v2
1 60-liter bucket	$ 6.23	Freedman et al.
1 stand	$ 31.15	Freedman et al.
1 basin	$ 2.27	Freedman et al.
1 liter of hand sanitizer	$ 8.30	WHO Essential Supplies Forecasting Tool v2

Scenario 2: Additional per diems and incentives due to increased length of campaigns

Increased infection prevention and control measures, together with potential changes in delivery strategies may require the campaign to be completed over a longer period, and thus an increase in per diems for health workers. Polio vaccination campaigns generally assume a target of 150-200 children per team per day. Operational changes as a result of COVID-19 such as physical distancing measures and the screening of household members for COVID-19 symptoms may slow down the process of vaccination, resulting in lower coverage per day. For fixed site delivery (relevant to the polio SIAs in Syria and Papua New Guinea), WHO recommends planning for small vaccination sessions and extending the duration of the campaign as one potential strategy to avoid crowded waiting areas. An alternative potential cause for an increase in per diems could be to compensate for the increased risk that health workers are exposed to while participating in a campaign during the pandemic. The scenario only assessed the cost of additional SIA-related per diems and incentives, and did not assess changes to regular salaries, routine incentives or the need to recruit additional staff.

Table 3 - Scenario 2: Additional human resource costs due to increase length of campaigns

Scenario 2: Additional human resource costs due to increased length of campaigns		
Low	Medium	High
– Assuming a 20% reduction in the number of children vaccinated per day – e.g. a 25% increase in the duration of the campaign	– Assuming a 35% reduction in the number of children vaccinated per day – e.g. a 50% increase in the duration of the campaign	– Assuming an 50% reduction in the number of children vaccinated per day – e.g. a 100% increase in the duration of the campaign

Scenario 3: Increased costs due to COVID-19 related operational changes

This scenario assumes a cost increase of all activities and items that could reasonably be impacted by an extension of the campaign duration, a change in delivery strategy or other operational changes due to COVID-19. Lessons learned from the Ebola countries show that a reduction in demand for immunization services, a distrust in the health system and a fear for seeking healthcare are likely in the

case of a disease outbreak,[24] [25] which must be countered with extra awareness campaigns. WHO recommends that in order to sustain community demand for vaccination services, a tailored communication strategy should be implemented to provide accurate health information, address community concerns, enhance community linkages and encourage continued use of immunization services. Additionally, covering a larger number of vaccination sites to reduce the number of people per site or additional outreach sessions will require additional travel costs and revisions to micro plans. Using the cost categories as reported in the SIA country budgets, components that were assumed to be impacted by COVID-19 were isolated and increased. Examples included costs for training and transportation. As the analysis assumes that the targeted number of children would not change, the costs that were assumed to remain fixed include vaccination-related supplies, international shipment of vaccines and insurance fees, stationery, etc.

Table 4 - Scenario 3: Increased unit costs due to COVID-19 related operational changes

Scenario 3: Increased unit costs due to COVID-19 related operational changes		
Low	Medium	High
– An increase of 25% of all cost components potentially affected due to COVID-19	– An increase of 50% of all cost components potentially affected due to COVID-19	– An increase of 100% of all cost components potentially affected due to COVID-19

Table 5 - Cost components included/excluded from scenario 3

Cost components to include/exclude from scenario 3	
Include	Exclude
– Trainings – Social mobilization & communication – Cold chain costs (maintenance, fuel, etc.) – Waste management – Planning – Surveillance – Monitoring, supervision (other than per diems) – AEFI management	– Transport costs for national/district level staff – Vaccine transport down to frontline centers, insurance fees – Vaccination cards, tally sheets and stationery – Staff salaries – All non-operational costs, for instance the direct costs of procurement of OPV, Vitamin A or finger markers

RESULTS

The below graphs show the results of each scenario both in USD increments per targeted child, as well as a percentage increase from the original budgeted estimates.

Overview of the original SIA budgets

The campaigns reviewed varied significantly in terms of target population, operational budget at baseline, as well as in duration. The baseline operational costs of the campaigns ranged from ~$3.9 million (Iraq) to $165,000 (Benin), while the baseline operational cost per targeted child ranged from $0.23 (Mali) to $1.58 (Equatorial Guinea). In terms of duration, South Sudan was the shortest campaign assessed at 2 days, and Equatorial Guinea the longest at 8 days.

Table 6 - Overview of original SIA operational budgets

Country	WHO Region	Fixed Vaccination Sites?	Target Population for the Round	Original Ops Budget (USD 2020)	Ops Budget / Target Population	SIA Length (Days)
Mali	**AFRO**	**No**	7,224,223	$1,655,708.38	$0.23	4
Iraq (April)	**EMRO**	**No**	6,266,493	$3,775,085.11	$0.60	5
Iraq (Sept)	**EMRO**	**No**	5,802,745	$3,974,394.90	$0.68	5
South Sudan	**AFRO**	**No**	3,664,255	$949,528.00	$0.26	2
Syria	**EMRO**	**Yes**	3,489,882	$1,414,055.66	$0.41	4
Papua New Guinea	**WPRO**	**Yes**	2,809,519	$963,375.58	$0.34	5
Equatorial Guinea	**AFRO**	**No**	1,310,375	$2,076,659.64	$1.58	8
Benin	**AFRO**	**No**	159,249	$165,302.41	$1.04	4

Scenario 1: Additional IPC measures

The introduction of IPC measures increases the cost per targeted child by 2-8% in the low intensity scenario (daily masks for vaccinators, hand sanitizer and hand washing for all team members), and by 17-87% in the high intensity scenario (hand hygiene, twice daily masks for all team members, gloves for vaccinators and temperature screening), as seen in Figure 2. The use of gloves in the high intensity scenario is the largest cost driver identified, accounting alone for an additional 8-57% increase in operational costs per dose across countries. As seen in Figure 3, the highest overall cost increase was seen in Mali (87%, high intensity scenario), where the initial cost per targeted child in the original budget was the lowest out of the countries in the analysis. The increase was driven largely by gloves (65% of the total increase) and infrared thermometers (17% of the increase).

Figure 2 – Scenario 1: Additional IPC measures by intensity

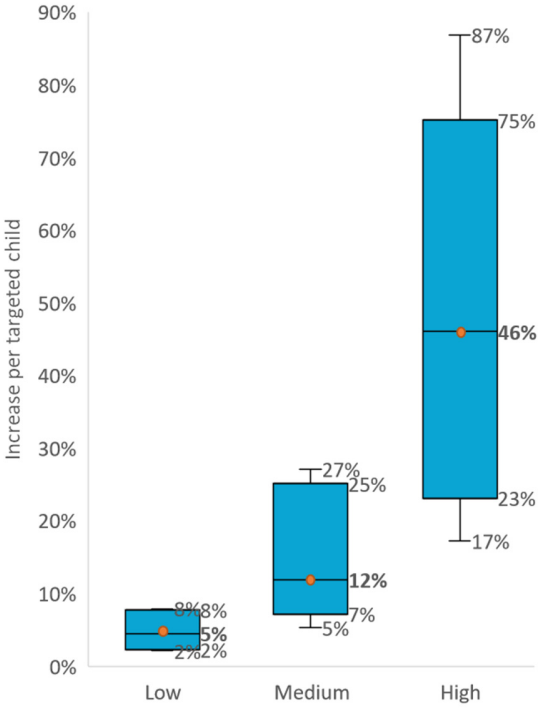
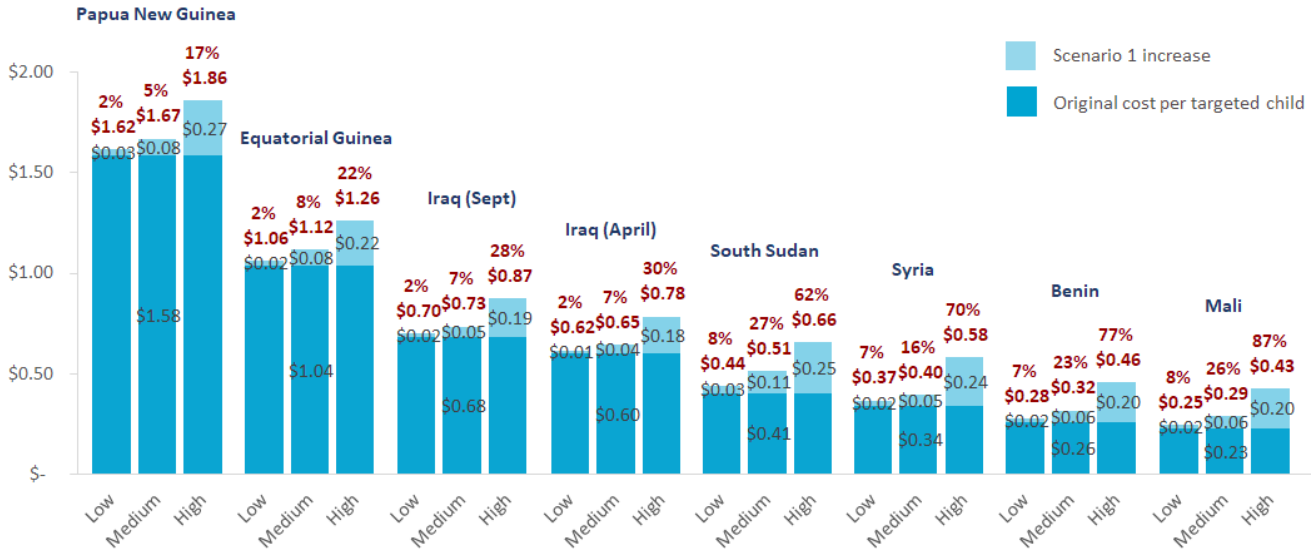


Figure 3 – Scenario 1: Additional IPC measures by country



Scenario 2: Additional per diems and incentives due to increased length of campaigns

The costs of increased per diems and incentives as a result of a campaign extension has the potential to increase the cost per targeted dose by 5-14% in the low intensity scenario (extending the duration by 25%) and 19-58% in the high intensity scenario (doubling the duration of the SIA), as seen in Figure 4. The country setting with the highest increase in per diem costs was Benin (58%, high intensity), followed by Syria and Mali (Figure 5). The highest scenario increases were noted in the countries where the per diem and incentives as a proportion of the original operational budgets were the highest.

Figure 4 – Scenario 2: additional per diems by intensity

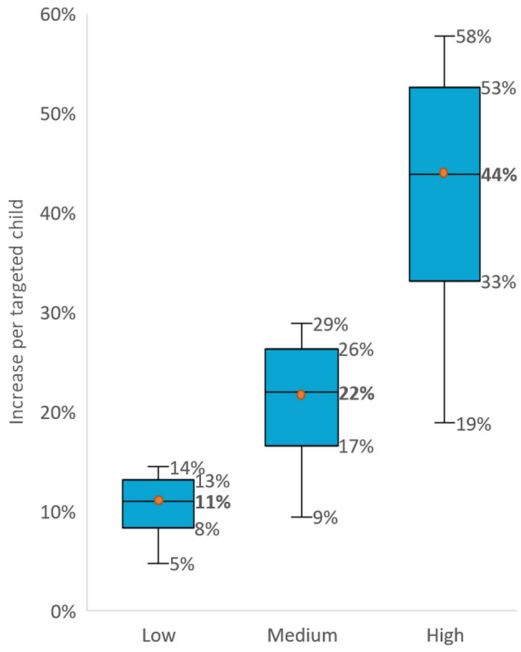
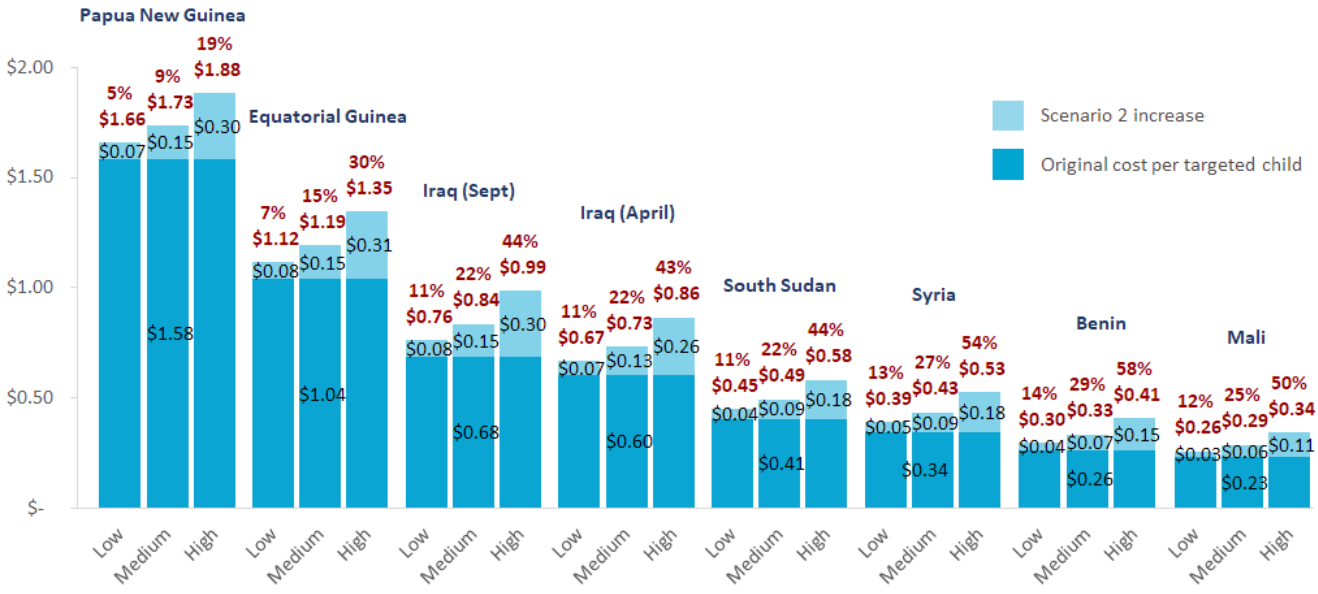


Figure 5 – Scenario 2: additional per diems by country



Scenario 3: Increased costs due to COVID-19 related operational changes

Cost increases in this scenario had the largest assessed effect on operational costs of all scenarios (Figure 6). The increase of non-HR costs has the potential to increase costs by 6-19% in the low intensity scenario (unit costs increased by 25%), and by 25-77% in the high intensity scenario (unit costs increased by 100%). As can be seen in Figure 7, the percentage increase was the largest for Papua New Guinea (19-77%), followed by Iraq (52%, high intensity). The transportation of vaccination teams is the largest cost driver for the majority of countries, accounting for an average of 58% of costs in this category, except for Benin for which the training of vaccine teams is the largest cost driver.

Figure 6 – Cost of operational changes by intensity

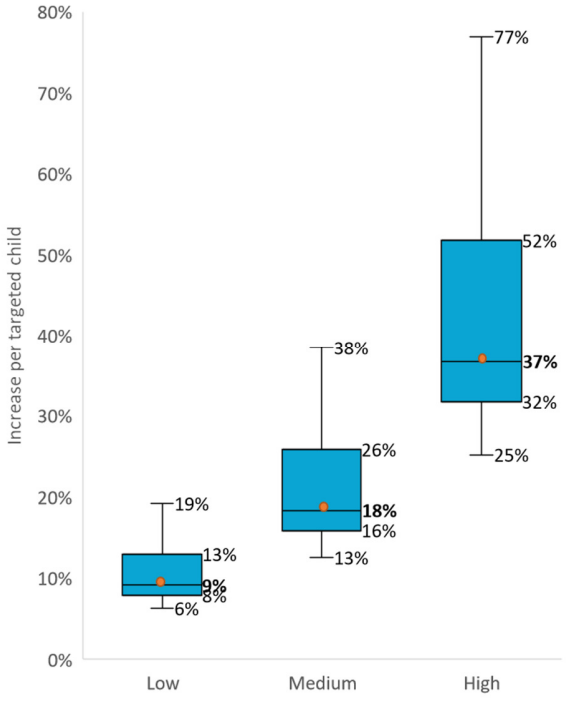
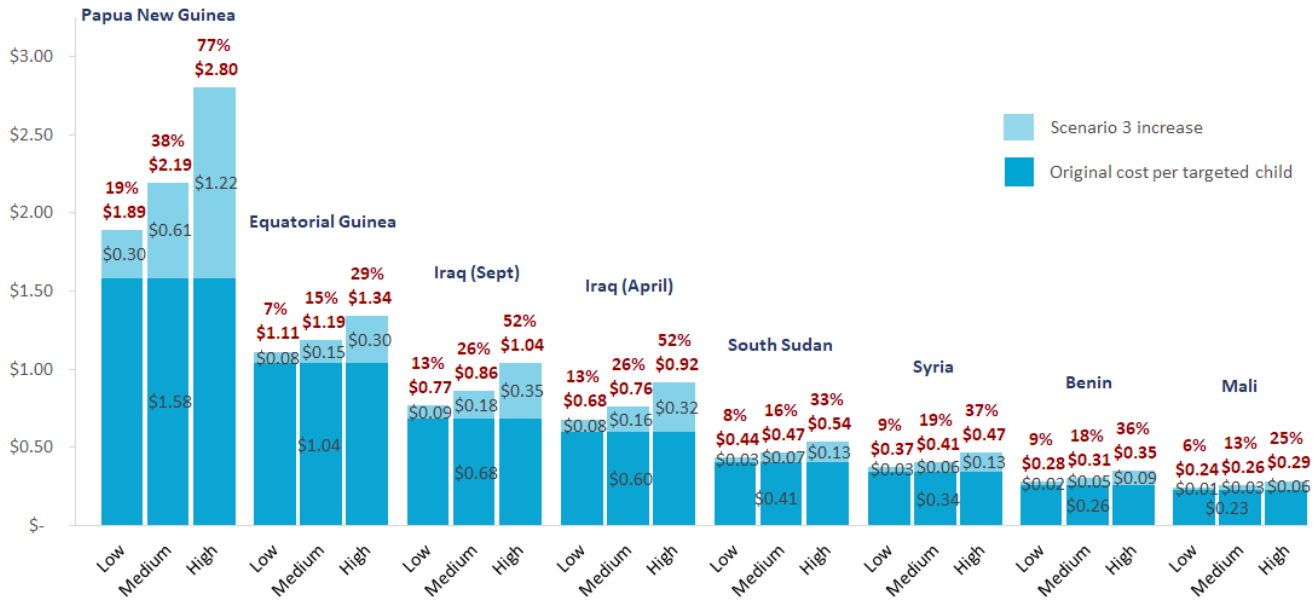


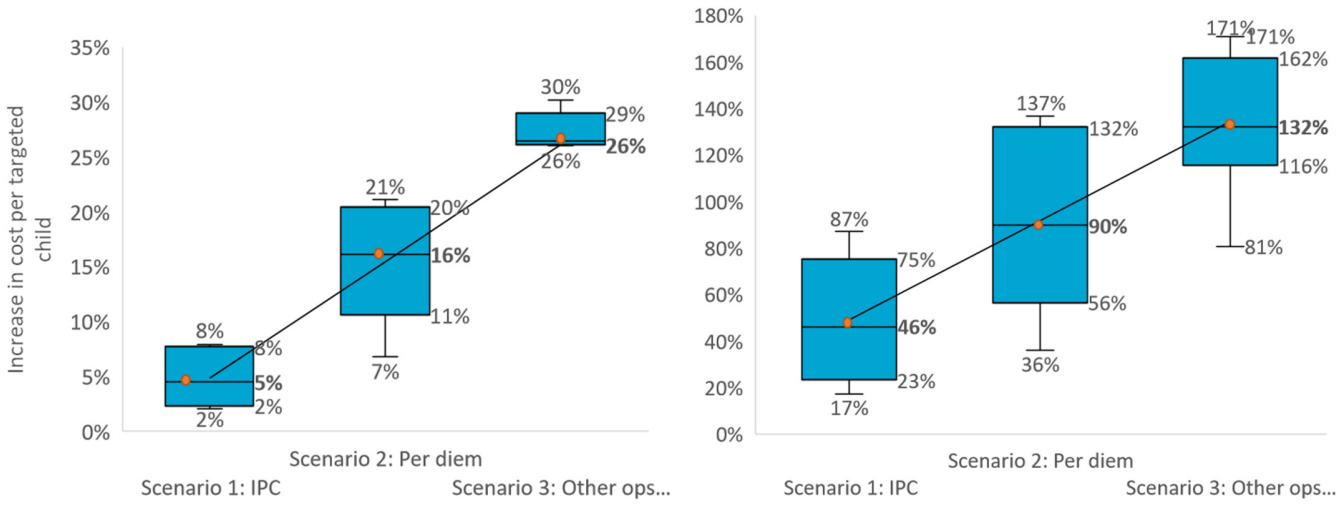
Figure 7 – Cost of operational changes by country



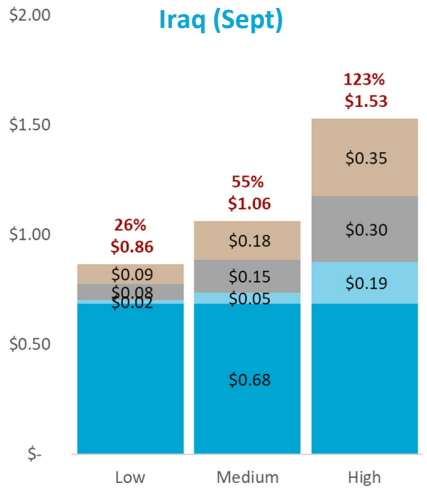
Combined effect of all scenarios of operational cost per targeted child

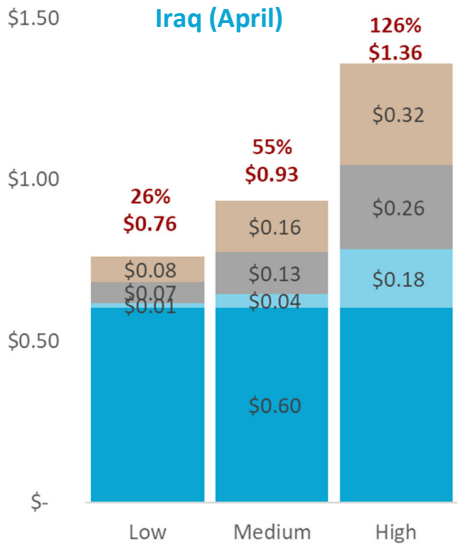
If hand hygiene measures, symptomatic screening and the provision of basic PPE are included; campaign length is increased by 25%; and other operational costs were to increase by 25%; this could increase the operational cost per dose by 26-30% (Figure 8). Under the high intensity scenario, with more elaborate PPE for vaccinators (including gloves); a doubling of the campaign duration; and a doubling of operational cost such as social mobilization, training and transport; the operational cost could jump to 81-171% of the original cost per dose.

*Figure 8 - Increase in operational costs per scenario at **LOW** and **HIGH** intensity*

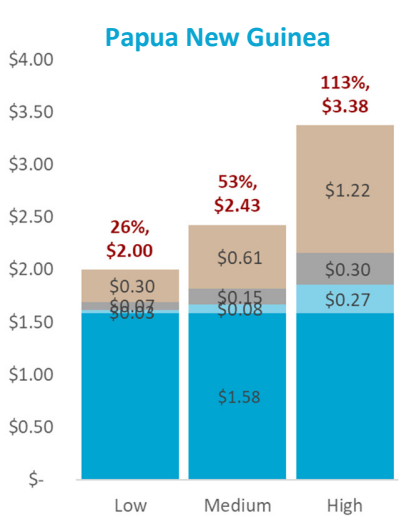


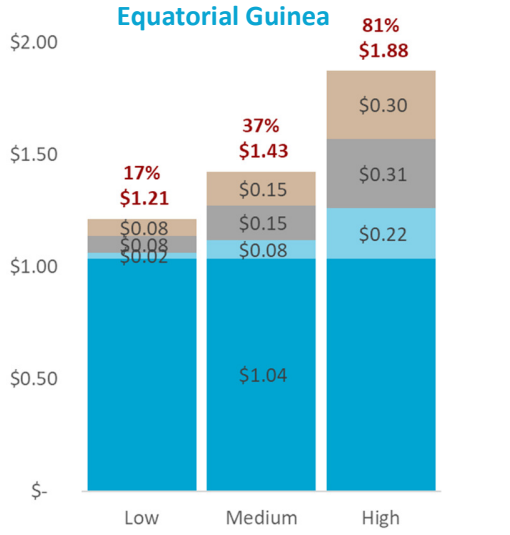
RESULTS BY COUNTRY





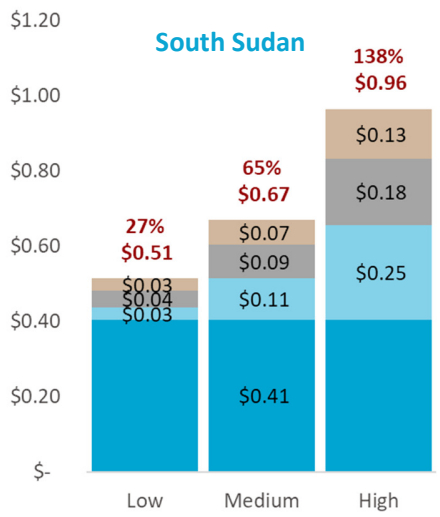
Budgets for two SIAs were analysed for Iraq (April & September 2020). The additional costs are comparable across budgets and scenarios, which is expected given the broad alignment between the baseline operational budgets for both campaigns. Across both campaigns, >90% of the additional costs in Scenario 2 relate to per diem costs for vaccinators and mobilizers.



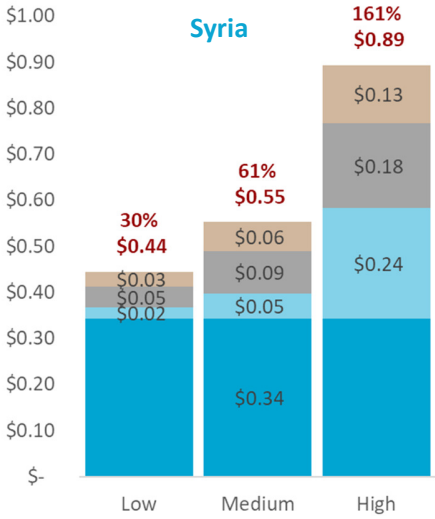


Papua New Guinea had the largest relative increase in baseline cost in Scenario 3 (increased unit costs) of any country. This is because >80% of PNG's original SIA budget was dedicated to non-HR costs, by far the highest among the countries analysed.

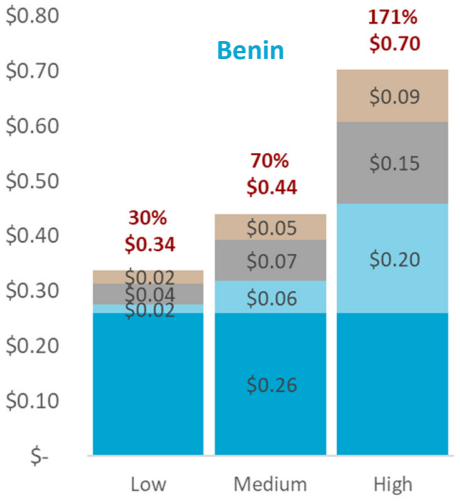
For Equatorial Guinea, the largest additional costs across all intensities arose in Scenario 2 (additional HR). This may be because Equatorial Guinea has the highest ratio of vaccinators to the target population of any country studied and is therefore more sensitive to price increases in human resources and incentives.

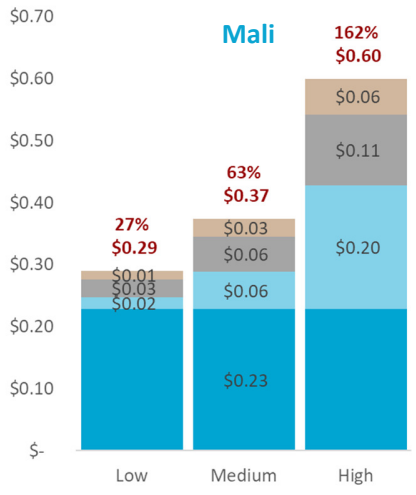


South Sudan is one of the only countries for which Scenario 2 (additional HR) represents the largest potential cost driver. This may because the number of teams in South Sudan is almost double the average among assessed countries (8,830 vs 4,704).



Syria had the second highest relative increase in campaign costs among assessed countries. One of the largest cost drivers for Syria, representing a 17% increase on the original operational budget at a high intensity level, were handwashing stations for the country's high number of fixed vaccination sites.





Benin had the highest overall relative increase in campaign costs among assessed countries. This may be because Benin's original operational cost was significantly below average for assessed countries ($0.26 vs $0.64).

Mali had the highest number of vaccinators of all assessed countries. Associated IPC/PPE for these team members is a significant driver of additional cost. In the highest intensity scenarios, for instance, gloves alone account for 24% increase in the operational budget.

LIMITATIONS

Several limitations apply to the methods and the results presented in this report. The original data included SIA budgets for the operational cost of the OPV SIAs, which consider the additional financial expenditures needed to implement an SIA, and do not include the cost of routine resource use. The budgets are also only in USD, and local currency and local contextual differences were not considered. The sample of SIA budgets included a number of countries to represent a broad range of strategies, though the estimates may not be applicable to countries, especially when considering the sample did not include the three key endemic countries (Afghanistan, Nigeria and Pakistan). The prices of several PPE and IPC supplies have fluctuated over time, and the cost assumptions may rapidly become outdated.

Comparing these results to larger studies that have costed not just the incremental costs for OPV house-to-house SIAs, but the full cost of a COVID-19 response across all pillars (such as the study of Tan-Torres Edejer et al.[4]), is challenging. Although the assumptions used in this analysis are comparable, it does not make assumptions on COVID-19 transmission scenarios nor any changes required to the routine health system (such as the need to hire more health workers on a longer term basis). The analysis only included a subset of the incremental cost components needed that should be considered in the broader context of a holistic COVID-19 response. Some of the incremental costs included would be shared costs across the immunization or broader primary healthcare system (such as handwashing stations at facilities) while others would incremental to the OPV SIAs only (e.g. hand sanitizer for the SIA). The analysis also did not consider the cost implications of an increase or reduction in community transmission of COVID-19 as a result of the SIA, implemented with or without any of the scenarios at any intensity level.

CONCLUSION

The analyses presented here suggest that the operational costs of polio SIAs could increase by between 30% and 171% as a result of operational changes related to the COVID-19 pandemic, and the additional per diem and incentive costs in Scenario 2 (additional per diems and incentives) and Scenario 3 (increases due to other operational changes) would be the main cost drivers. The relative drivers of cost increases varied significantly between countries, in line with the variation in the baseline operational budgets as well as target population size, number of outreach teams and number of fixed vaccination sites. The proportional contribution of Scenario 1 (IPC measures) to additional operational costs is modest when applied at low intensity (masks, hand sanitizer and hand washing only). At medium and high levels of intensity, however, the additional costs of infrared thermometers (medium intensity) and gloves (high intensity) act as significant cost drivers.

These estimates can be considered by WHO and countries when planning for OPV SIAs in the coming year, when these will have to be implemented in the context of COVID-19. These estimates can be used for high level planning purposes, and should be further refined at country level through microplanning and using country-specific data on delivery strategies and COVID-19 prevention guidelines. Furthermore, as more evidence is generated and further global guidance emerges on the conduct of immunization and other essential health services in the context of COVID-19, the analysis presented here should be further refined. Though clear operational guidance and case study evidence is now available on the optimal configuration of IPC measures in immunization campaigns and SIAs conducted during the COVID-19 pandemic, the impact of the pandemic on the duration of campaigns, as well as the required additional investments in activities like social mobilization and communication is less well understood. Additional evidence should be generated to improve the estimates for key parameters such as the additional social mobilization efforts required to ensure population demand for immunization services during a pandemic, and other adjustments to the implementation of SIAs.

ANNEX A: TABULATED BREAKDOWN OF ADDITIONAL COSTS PER SCENARIO

Scenario 1		Additional cost per targeted dose					
Country	Baseline	Low	% change	Medium	% change	High	% change
PNG	$ 1.58	$ 0.03	2%	$ 0.08	5%	$ 0.27	17%
Equatorial Guinea	$ 1.04	$ 0.02	2%	$ 0.08	8%	$ 0.22	22%
Iraq (Sept)	$ 0.68	$ 0.02	2%	$ 0.05	7%	$ 0.19	28%
Iraq (April)	$ 0.60	$ 0.01	2%	$ 0.04	7%	$ 0.18	30%
South Sudan	$ 0.41	$ 0.03	8%	$ 0.11	27%	$ 0.25	62%
Syria	$ 0.34	$ 0.02	7%	$ 0.05	16%	$ 0.24	70%
Benin	$ 0.26	$ 0.02	7%	$ 0.06	23%	$ 0.20	77%
Mali	$ 0.23	$ 0.02	8%	$ 0.06	26%	$ 0.20	87%

Scenario 2		Additional cost per targeted dose					
Country	Baseline	Low	% change	Medium	% change	High	% change
PNG	$ 1.58	$0.07	5%	$0.15	9%	$0.30	19%
Equatorial Guinea	$ 1.04	$0.08	7%	$0.15	15%	$0.31	30%
Iraq (Sept)	$ 0.68	$0.08	11%	$0.15	22%	$0.30	44%
Iraq (April)	$ 0.60	$0.07	11%	$0.13	22%	$0.26	43%
South Sudan	$ 0.41	$0.04	11%	$0.09	22%	$0.18	44%
Syria	$ 0.34	$0.05	13%	$0.09	27%	$0.18	54%
Benin	$ 0.26	$0.04	14%	$0.07	29%	$0.15	58%
Mali	$ 0.23	$0.03	12%	$0.06	25%	$0.11	50%

Scenario 3		Additional cost per targeted dose					
Country	Baseline	Low	% change	Medium	% change	High	% change
PNG	$ 1.58	$0.30	19%	$0.61	38%	$1.22	77%
Equatorial Guinea	$ 1.04	$0.08	7%	$0.15	15%	$0.30	29%
Iraq (Sept)	$ 0.68	$0.09	13%	$0.18	26%	$0.35	52%
Iraq (April)	$ 0.60	$0.08	13%	$0.16	26%	$0.32	52%
South Sudan	$ 0.41	$0.03	8%	$0.07	16%	$0.13	33%
Syria	$ 0.34	$0.03	9%	$0.06	19%	$0.13	37%
Benin	$ 0.26	$0.02	9%	$0.05	18%	$0.09	36%
Mali	$ 0.23	$0.01	6%	$0.03	13%	$0.06	25%

All scenarios		Additional cost per targeted dose					
Country	Baseline	Low	% change	Medium	% change	High	% change
PNG	$ 1.58	$0.41	26%	$0.84	53%	$1.79	113%
Equatorial Guinea	$ 1.04	$0.18	17%	$0.39	37%	$0.84	81%
Iraq (Sept)	$ 0.68	$0.18	26%	$0.38	55%	$0.84	123%
Iraq (April)	$ 0.60	$0.16	26%	$0.33	55%	$0.76	126%
South Sudan	$ 0.41	$0.11	27%	$0.26	65%	$0.56	138%
Syria	$ 0.34	$0.10	30%	$0.21	61%	$0.55	161%
Benin	$ 0.26	$0.08	30%	$0.18	70%	$0.44	171%
Mali	$ 0.23	$0.06	27%	$0.15	63%	$0.37	162%

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