Assessment of the impact of COVID-19 mitigation strategies on the costs of distributing insecticide treated nets in Nigeria a budget impact analysis

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Contents

Background and purpose

Vector control has contributed substantially to the global reduction in malaria burden that has been observed since 2000, primarily through regular mass distribution and increased use of insecticide-treated bed nets (ITNs) and the indoor residual spraying (IRS) of insecticides. The ITN is a core tool for malaria prevention and, as such, there has been a massive increase in mobilized funds and resources towards the procurement of ITNs to prevent the disease since 2000, resulting in unprecedented levels of vector control coverage across sub-Saharan Africa.[1] Between 2000 and 2020, global malaria incidence rates fell by 27 percent and mortality rates by 39 percent. Over 10 million deaths were averted, primarily among children less than five years of age.[2]

The Alliance for Malaria Prevention (AMP) is a workstream within the RBM Partnership to End Malaria. AMP is a partnership of more than 40 organizations, including government, private sector, faith-based and humanitarian organizations. AMP is housed and chaired by the International Federation of Red Cross and Red Crescent Societies (IFRC). AMP provides distance and in-country support to national malaria programmes and partners for mass ITN distribution campaigns as well as operational guidance on all aspects of ITN distribution.

With the WHO declaration of the COVID-19 pandemic, AMP focused on the development and dissemination of technical guidance for the conduct of ITN distribution campaigns during the COVID-19 pandemic and the provision of distance support for ITN mass campaigns. Over 25 countries accessed operational guidance and distance technical support from AMP to adapt ITN distribution strategies in 2020 in order to sustain gains achieved in the fight against malaria in the context of the COVID-19 pandemic. The cost implications of the adapted strategies across different country contexts are not well understood but are important to assess for planning and implementation of future campaign distributions in the context of COVID-19.

The main goal of this work is to assess the cost implications for COVID-19 adapted campaigns implemented in Nigeria in 2020 in an effort to facilitate planning and budgeting for campaigns in 2022 and 2023, which will likely still require adaptations based on the current timelines for vaccine roll out in most malaria-endemic countries. By evaluating campaigns with different COVID-19 adaptations in the 2020 targeted states, this work will be able to accurately identify the key cost drivers shared by campaigns in the country and provide a robust sensitivity analysis for the components driving costing changes in the campaigns.

Methods

Intervention description development

[1] Bhatt S, Weiss DJ, Mappin B, Dalrymple U, Cameron E. Coverage and system efficiencies of insecticide-treated nets in Africa from 2000 to 2017. Elife. 2015;4:e09672.
[2] WHO. World Malaria Report 2021.. https://www.who.int/teams/global-malaria-programme/reports/world-malaria-report-2021

A description of the intervention was developed based on document reviews and key stakeholder interviews.

Timeframe and perspective

The study analyzed cost data from the provider perspective and used a one-year time frame to reflect the height of the COVID-19 pandemic to date. These analyses follow a budget analysis approach. The major activities involved in producing cost estimates of ITN programs are information gathering, program description, data collation and cleaning, and analysis and reporting.

Types of costs included

All financial costs associated with the distribution of nets in the 2020 Nigeria ITN campaigns in selected states are included from the perspective of the providers of the intervention, including the National and State Malaria Elimination Programs, international donors, philanthropic organizations, and health care workers, but not household-level direct costs. No indirect costs, such as lost productivity or treatment seeking costs were included, nor were any purely economic costs such as volunteer time or donated space or equipment.

Data collection

Cost data were collected retrospectively mainly from budgets, but additional sources include operational records, after-campaign reports kept by implementing partners, a process evaluation on COVID-19 adaptations and interviews with stakeholders involved in the campaign implementation.

The target states for this analysis included all five Nigerian states that implemented campaigns during the COVID-19 pandemic in 2020. Adamawa, Benue, Kwara, Osun, and Zamfara states were planned for inclusion in the evaluation. Taraba state, representing a pre-COVID-19 campaign, was chosen as a comparison.

Cost classification and adjustments

Costs were collected in the Nigerian Naira. Costs collected in Naira were converted to USD at a rate of 1 USD to 416 NGN[3].

Assessment of the impact of COVID-19 mitigations on budgets

Specific COVID-19 mitigations (such as moving from a two-phase to a one-phase campaign) were identified through key informant interviews and document reviews. Budget line-items potentially affected by COVID-19 adaptations were identified using information on COVID-19 mitigations. Estimation of the impact of COVID-19 adaptation was conducted through two processes. The first was through direct line-item by line-item comparison to the budget for Taraba State (a pre-COVID-19 campaign). The second approach involved identifying all the line-items in the COVID-19 adapted state

[3] Exchange rate data were collected from www.exchange-rates.org

budgets which may have been affected by COVID-19 mitigation based on qualitative data and reports on the COVID mitigation steps taken in the campaigns.

Estimates of cost for these items were projected for a non-COVID-19-adapted counterfactual scenario by inflating or reducing their value relative to observed value. The amount of inflation or deflation in Global Fund budgets was determined by adjusting each line-item's per-net value, normalized to the number of nets distributed in the Taraba State (comparison budget). For PMI budgets, the amount of inflation or deflation was determined by review of documentation and stakeholder interviews (especially in the case where budget line-items were reduced to zero in counterfactual [*e.g.* personal protective equipment]).

These counterfactual, non-COVID-19-adapted budgets were then compared to the actual pandemic-adapted budgets as well as the Taraba comparison budget. Unit costs for line-items were not adjusted for pre-pandemic pricing. Line-items in each pre- and post-pandemic budget were categorized by activity code and line-item group and cross tabulated to facilitate comparison across budgeting formats and to facilitate identification of key cost drivers most impacted by COVID-19 adaptations.

Outputs and sensitivity analysis

Costs are reported in three general ways: total financial cost of the program, total cost by activity and line-item group, and cost per net distributed (also by activity group, line-item group and line-item). Percent change in total budget and change in price normalized by nets distributed will be presented to assess any impact of COVID-19 on the cost of ITN distribution. Changes are also presented by activity code, line-item group and specific line-items, where appropriate. Variation in the assumed impact of important cost drivers and line-items for the construction of counterfactual budgets were examined in a one-way sensitivity analysis. Joint assessment of best- and worst-case scenarios for these assumptions were also examined in scenario analysis.

Base case scenario

In this analysis, the base case scenario relies on a set of assumptions. The first of these is that budgets for all states except Taraba reflect COVID-19 mitigated campaigns. The impact of COVID-19 mitigation on specific line-items for estimating non-COVID-19 mitigated (or counterfactual budgets) is recorded in the accompanying spreadsheet (see Addendum). Some line-items were assessed as not being impacted by COVID-19 mitigation, these line-items were assumed to have the same total value in both COVID-19 mitigated and counterfactual (unmitigated) scenarios. The prices of input goods were assumed to be unaffected by the pandemic, either through direct effects on pricing or through secondary effects such as increases or decreases in volume discounting caused by changed quantity procurement due to COVID-19.

Determining the cost adjustment factor (CAF)

Inflation and deflation of each line-item when creating the counterfactual, non-COVID-19-adapted budgets for both PMI and Global Fund budgets was determined using a cost adjustment factor to keep track of the changes in a format comparable across all budget line-items. Line-items not impacted by COVID-19 mitigations had a CAF of 1 while line-items that were lower in pre-pandemic campaigns have a CAF between one and zero and line-items that would be higher in pre-pandemic campaigns have a CAF greater than one.

Adjustments to the cost adjustment factor

The impact of the CAF on the overall budget was assessed through sensitivity analysis. For Global Fund budgets, the highest and lowest CAF was taken for each cross-tabulated category of activity codes and line-item groups. These maximum and minimum CAF values were used to simulate a new counterfactual value for the individual line-items that had the highest total value change between the pre-pandemic and counterfactual, non-COVID-adapted budgets. For PMI budgets, two sensitivity analyses were run: first, the main line-items were analyzed in the same fashion as the Global Fund budgets and added to the same output table; second, a sensitivity analysis of the CAF assignments for the whole budget were assessed for impact. The base CAF used in all the main analysis in this report used a 0.25 point change in CAF; 1.25 for the high factor and 0.75 for the low factor. Sensitivity analysis utilized a 0.1 point change in CAF with 1.1 and 0.9 for high and low factors respectively. Additionally, the average increased and decreased CAF (2.3, 0.3) from the adjusted counterfactual using the pre-pandemic budget evidence were input in the PMI budget as well and results shared in the sensitivity analysis.

Results

Data collection

Data were collected from Nigeria partners, including NMEP, Society for Family Health (SFH), Catholic Relief Services (CRS), Global Health Supply Chain – Procurement and Supply Management (GHSC-PSM) and Breakthrough ACTION. Key stakeholder interviews conducted with personnel from NMEP, IFRC, AMP, Breakthrough ACTION, and from reported interview results by David Gittleman. Documents collected include an efficiency analysis, end process evaluations, campaign reports, and campaign budgets.

Intervention description

Mass ITN campaigns

The mass campaigns in Nigeria in 2020 aimed to distribute one ITN for every two persons in 11 states, targeting distribution of 31.5 million ITNs to nearly 56.7 million people. The 2020 COVID-19 pandemic mitigation strategy recommended each state adopt door-to-door distribution either as a double phase campaign when COVID-19 cases are sporadic (registration and net card issuing are completed on the first pass and net distribution is completed on the second pass), or as a single-phase campaign when there are known clusters of COVID-19 cases (household registration and ITN distribution simultaneously). This recommendation aimed to avoid crowding at fixed distribution points where people congregate to pick up their ITNs after receiving a net card. If an area has no confirmed cases NMEP recommended continuing the campaign per the pre-COVID-19 campaign implementation guidelines, and if an area had high community-level transmission NMEP recommended no campaign distribution activity.

Prior to the onset of the COVID-19 pandemic, most campaigns were conducted in “two phase” systems by which households were first enumerated and assessed for eligibility to receive ITNs and given coupons (net cards) that they could later redeem for ITNs at fixed distribution points established nearby. Following the household registration, data analysis was completed and ITN needs for fixed sites identified to facilitate planning for transport of sufficient ITNs to fixed distribution points.

Due to the desire to reduce crowding at distribution points with the onset of the COVID-19 pandemic, Global Fund-financed campaigns were shifted to a single-phase door to door approach in which ITNs were distributed during the household enumeration and eligibility phase. The distribution points were replaced with distribution hubs which served as the last node on the supply chain network for resupply and transfer of nets to household mobilization and distribution teams (MDT). The campaigns in the three Global Fund supported states eliminated the use of net cards to reduce possible COVID-19 exposure, though these were still included in some single-phase campaign budgets.

For the two PMI-supported states, a double phase strategy was maintained with mitigating measures to reduce possible COVID-19 exposure and transmission. Household mobilization teams registered households and issued net cards to be redeemed during the distribution phase at fixed distribution points.

Multi-product campaigns were implemented in two of the three GF-supported states (PBO and dual active ingredient [Dual AI] nets in Kwara and Osun), while Adamawa distributed PBO ITNs for the first time. Though net costs were not included in this report, evidence from other settings indicates that the change to new types of ITN is not likely to majorly influence the costs of distribution. While there are some additional potential implications of conducting multi-product campaigns at small geographic scales, as yet no specific evidence has demonstrated that such campaigns have substantially different costs than those of standard ITN distribution beyond the ITN unit costs.

In Zamfara state, the ITN distribution campaign and a seasonal malaria chemoprophylaxis (SMC) campaign were integrated. The Zamfara ITN distribution estimates in this report utilize an estimate of the cost to conduct the ITN campaign independently based on excluding all SMC only costs. The effect of the integration of SMC on the cost of ITN and SMC distribution is the subject of a separate report and is not discussed further here.

Table 1: State-specific characteristics of 2020 Nigeria ITN campaigns implemented during the COVID-19 pandemic

State	Dates of campaign (distribution phase)	Key partner	Integrated vs. vertical	Phases	Door-to-door or fixed distribution point	Standard or multi-product nets	Data collection modality	Complex Operating Environment
Zamfara	12 July – 12 Sept 2020	PMI	Integrated (SMC/ITN)	Two	Fixed Distribution point	Standard	Paper-based	Yes
Benue	04 Oct – 02 Nov 2020	PMI	Vertical	Two	Fixed Distribution point	Standard	Paper-based	No
Osun	13 Sept – 12 Dec 2020	Global Fund-NNP	Vertical	Single	Door-to-door with	Multi-product	Digital	Yes

					Distribution Hubs	(PBO, IG2)		
Kwara	28 Oct – 18 Dec 2020	Global Fund-NNP	Vertical	Single	Door-to-door with Distribution Hubs	Multi-product (PBO, IG2)	Digital	No
Adamawa	15 Sept – 13 Nov 2020	Global Fund	Vertical	Single	Door-to-door with Distribution Hubs	PBO	Digital	Yes
Taraba	11 June – 31 July 2019	Global Fund	Vertical	Two	Fixed Distribution point	Standard	Digital	No

Planning

Due to COVID-19, some classic campaign activities were altered or removed. Many state campaigns shifted significant numbers of planning and strategy meetings, microplanning meetings and higher-level training activities to virtual format. While higher-level meetings were sometimes transitioned to virtual, training of lower-level distribution personnel and others were generally still conducted in person due to the challenges of maintaining reliable internet connections, ensuring access to digital devices as well as the need to ensure training quality in remote settings. COVID-19 mitigation protocols limited the number of participants, ensured halls large enough for adequate physical distancing, and required the use of hand sanitizer and masks.

Waste management

Medical waste, including ITN campaign waste and personal protective equipment (PPE), is handled by the Government of Nigeria. Some local government areas (LGAs) had incinerators and, where they did not, waste was sent to the state level. Some LGAs without proper incinerators were encouraged to bury PPE waste rather than burning it. Waste management plans in Kwara and Osun specifically addressed disposal of PPE.

Training

NMEP had implementation guidelines for COVID-19 training adaptations at all levels of the health system. At the state and LGA level, in-person trainings were preferred to ensure quality of knowledge transfer, though some virtual trainings did take place. COVID-19 protocols for in-person trainings included:

- screening temperatures before meetings with infrared thermometers and not taking fingerprints for attendance
- limiting group size to no more than 20 people including trainers (for three to four days)
- disinfecting training locations

- having facilitators use gloves or sanitize their hands before distributing materials
- not sharing training materials and pens
- promoting hand sanitizing by participants
- holding a session on safety precautions to prevent COVID-19 and infection prevention control methods
- holding trainings and orientations in open space if available

Available PPE at trainings included thermometers, disinfectants, gloves, facemasks, and handwashing stations with soap, hand sanitizer, and water.

Logistics

The 2020 campaigns maintained existing national guidelines on micro-positioning of ITNs to LGA warehouses, transportation to distribution points, transport of materials, waste management, and ITN reverse logistics. In the single-phase campaigns, distribution points were replaced by distribution hubs which served as the last node of the supply chain to serve house-to-house teams. COVID-19 mitigation strategies, which included physical distancing, application of hand sanitizer and use of face masks, were adopted at all levels.

Distribution

Global Fund-supported states with a campaign starting after the onset of the COVID-19 pandemic transitioned from a double-phase campaign with fixed distribution points to a single-phase door-to-door distribution strategy with adaptations added throughout the campaign activities to minimize COVID-19 transmission. Planned adaptations included virtual planning meetings, remote training and supervision strategies, the introduction of distribution hubs where distributors could collect ITNs for their door-to-door distribution, and the removal of net cards. PPE for the campaign was included in the planning and budgeting. Both pre- and post-pandemic campaigns utilized digital data collection. Taraba, a Global Fund-supported pre-pandemic campaign implemented the more traditional double phase campaign with fixed distribution points.

US-PMI-supported states starting their campaigns post-pandemic kept the traditional double phase distribution campaign format with net cards for registration and fixed distribution points (DPs). The logistics chain and paper data collection methods also remained unchanged. To adhere to physical distancing needs, the number of distribution points was increased. PPE for all three US-PMI-supported campaigns was included in the planning and budgeting. To reduce overcrowding at the distribution points, the number of DPs was increased so that each DP served no more than 500 households, as compared to 500-1000 pre-pandemic. Benue managed overcrowding by assigning a specific day and time for households to redeem their nets. In spite of best efforts, overcrowding was reported, especially on the first and second days of distribution.

Zamfara, a US-PMI-supported state, integrated a seasonal malaria chemoprevention campaign with their two phase, fixed distribution point ITN campaign. Household registration and net card distribution was combined with sulphadoxine-pyrimethamine and amodiaquine (SPAQ) administration to children 3 months to 5 years of age for the first cycle of its scheduled SMC campaign. The ITN distribution was implemented separately between the first and second SMC cycles.

Demand creation

Demand creation activities aimed to reach the maximum number of people over a variety of communication channels with integrated COVID-19 prevention messaging whenever possible. Both Global Fund and US-PMI supported campaigns integrated social and behavior change messages covering prevention of malaria and COVID-19 into their social mobilization efforts. Engagement of civil society organizations at the state and LGA levels and community and religious leaders at the community level remained unchanged. In urban areas, adaptations focused on mass media channels, while rural areas increased non-contact interpersonal communication (IPC) methods such as town announcers. In single phase distribution campaigns, household mobilizers were also responsible for health education talks as they moved from house to house. For double phase campaigns, household mobilizers provided key messages to households when registering them, and at fixed sites distribution point health educators conducted health education talks.

The campaign flag off ceremonies at the state level were adapted to follow COVID-19 mitigation procedures and several were streamed live to reduce crowding.

Supervision and monitoring

In addition to their usual duties, supervisors were also required to oversee COVID-19 protocol compliance and to complete health checks for their campaign staff daily. The pandemic-adapted protocol replaced ward leaders who supervised household mobilization teams during pre-pandemic campaigns with cluster supervisors who were responsible for six to eight mobilization and distribution teams.

Adaptations implemented after the onset of COVID-19 pandemic

Table 2, taken from the Nigeria "Process evaluation - ITN distribution in the context of COVID-19" report, summarizes the main COVID-19 adaptations and mitigation strategies planned for ITN campaigns. While some adaptations/mitigation strategies are expected to have clear cost impacts in known directions (such as procurement of PPE) others are likely to have little cost impacts (*e.g.* advice to cough or sneeze into a bent elbow) or to have impacts in unknown directions (shifting meetings to virtual which may reduce room and travel costs in exchange for increased costs of digital equipment, software and connectivity charges).

Table 2: Key campaign adaptations for the COVID-19 context

Campaign elements	COVID-19 adaptation/mitigation
Priority prevention measures at the community level	● Cleaning hands with an alcohol-based sanitizer or soap and water ● Avoiding touching eyes, nose and mouth ● Coughing or sneezing into a bent elbow or tissue ● Staying home and not working if ill with respiratory symptoms ● Daily health checks by supervisors, referral to health facility

Risk mitigation strategies	● *For COVID-19 rumours and conspiracy theories causing poor uptake of ITNs*: intensify mass media messaging, incorporate COVID-19 messages into existing demand creation materials ● *For COVID-19 lockdowns limiting demand creation and advocacy*: conduct limited mobilization and advocacy visits while adhering to WHO guidelines on COVID-19 prevention
Microplanning	● Prioritize virtual meetings ● Use existing data sources from previous health campaigns ● Maintain face-to-face training with preventive measures ● Increase budgets for personal protective equipment (sanitizer, face mask, gloves, soap, disinfectant, mops, materials for handwashing stations and maintaining the water supply and cleanliness of the training rooms and warehouses/storage locations)
Capacity building (training)	● Disinfect training sites ● Distribute gloves or ensure hand cleaning before handling materials ● Train on COVID-19 prevention and incorporate into training materials ● Not to exceed 20 persons per class (including two trainers) ● Discontinue fingerprinting for attendance (digital data collection)
Social and behaviour change /demand creation (DC)	● Conduct advocacy and meetings virtually or in-person with $\leq$10 persons with COVID-19 precautions ● Procure PPE for SBC campaign personnel ● Promote use of face masks, hand sanitizers and physical distancing ● Increase town announcers and reduce days worked to decrease contact in community ● Train on COVID-19 protection including 1.5-metre physical distancing during announcements ● Include messaging through multiple channels on disassociating ITN use from COVID-19 transmission, correcting rumours, and preventing COVID-19
Procurement/ logistics	● Replace distribution points with distribution hubs for door-to-door net distribution ● Budget for infrared thermometers, disinfectants, gloves, face masks, handwashing stations with soap and sanitizers for loading and off-loading nets ● Collect and dispose of PPE waste into empty bales ● Adopt allowable net loss given door-to-door distribution

Implementation (registration and distribution)	● Maintain physical distancing during distribution ● Ensure use of hand sanitizer after every five households ● Screen team members daily before distribution or mobilization
Post-distribution/end process monitoring	● Reduce household sampling based on COVID-19 transmission classification and implementation strategies in states ● Administer questionnaires outside households with physical distancing

Costs

The total number of nets planned for distribution in each of the five study states in Nigeria is shown in Table 3, as well as the number of distribution points (or hubs) and the number of households predicted for coverage.

Table 3: Number of ITNs planned for distribution during the 2020 mass campaigns, disaggregated by state

State	Number of nets	Distribution points (or hubs)	Number of households
Zamfara	3,099,955	1,111	1,074,003
Benue	3,600,000	1,478	1,302,753
Osun	3,251,703	957 (DH)	1,154,596
Kwara	2,300,000	632 (DH)	772,648
Adamawa	-	-	-
Taraba	1,901,477	758	684,532

Cost breakdown

Activity codes/campaign steps were not consistently coded between PMI and Global Fund states. As such a unified line-item group coding system was applied to both PMI and GF states in order to identify major cost drivers in a uniform manner across both major funding partners. Costs are also presented by activity codes utilized directly by PMI or GF supported states in budgeting, although these are not directly comparable between states.

Table 4 shows the average financial cost per net distributed (not including the net) in Global Fund supported states. Costs are presented in Table 4 including estimates from real COVID-19 adapted/mitigated budgets as well as the pre-COVID-19 Taraba budget and the estimated counterfactual non-COVID-19 adapted budgets.

Table 4: Global Fund-supported states: Average financial costs per net, by activity code

Global Fund	NGN	NGN	NGN	USD	USD	USD
Campaign step	**Pandemic-adapted costs (NGN)**	**Counterfactual costs (NGN)**	**Taraba**	**Pandemic-adapted costs (USD)**	**Counterfactual costs (USD)**	**Taraba**
Logistics during campaigns	₦ 7	₦ 8	₦ 8	$0.02	$0.02	$0.02
Training	₦ 40	₦ 48	₦ 48	$0.10	$0.12	$0.11
Social mobilization	₦ 43	₦ 32	₦ 32	$0.10	$0.08	$0.08
Household registration	₦ 12	₦ 20	₦ 21	$0.03	$0.05	$0.05
Distribution to beneficiaries	₦ 83	₦ 54	₦ 53	$0.20	$0.13	$0.13
Monitoring and supervision	₦ 79	₦ 74	₦ 75	$0.19	$0.18	$0.18
Evaluation	₦ 4	₦ 3	₦ 3	$0.01	$0.01	$0.01
Other direct cost	₦ 2	₦ 1	₦ 1	$0.00	$0.00	$0.00
Total	₦ 271	₦ 240	₦ 241	$0.65	$0.58	$0.58

The highest differences observed between pandemic adapted and pre-pandemic costs were increases seen in social mobilization which increased by ~26%, and distribution which increased by ~35%, and decreases in training which decreased by 20% and household registration which decreased by ~66%. Despite these significant swings in specific activity elements the overall change in budget between pre-pandemic costs (whether estimated via counterfactual scenario analysis or by direct comparison to Taraba state) was much smaller (increase of ~11%). This is because the largest changes seen in specific activity codes occurred in activities with smaller overall budget share.

Figure 1 below shows the overall contributions of specific activities to overall budgets in both COVID-19 adapted, the simulated counterfactual, as well as in pre-pandemic Taraba state campaign.

Figure 1: Contributions of activity codes to overall Global Fund budget in post COVID-19, counterfactual, and pre COVID-19 campaigns

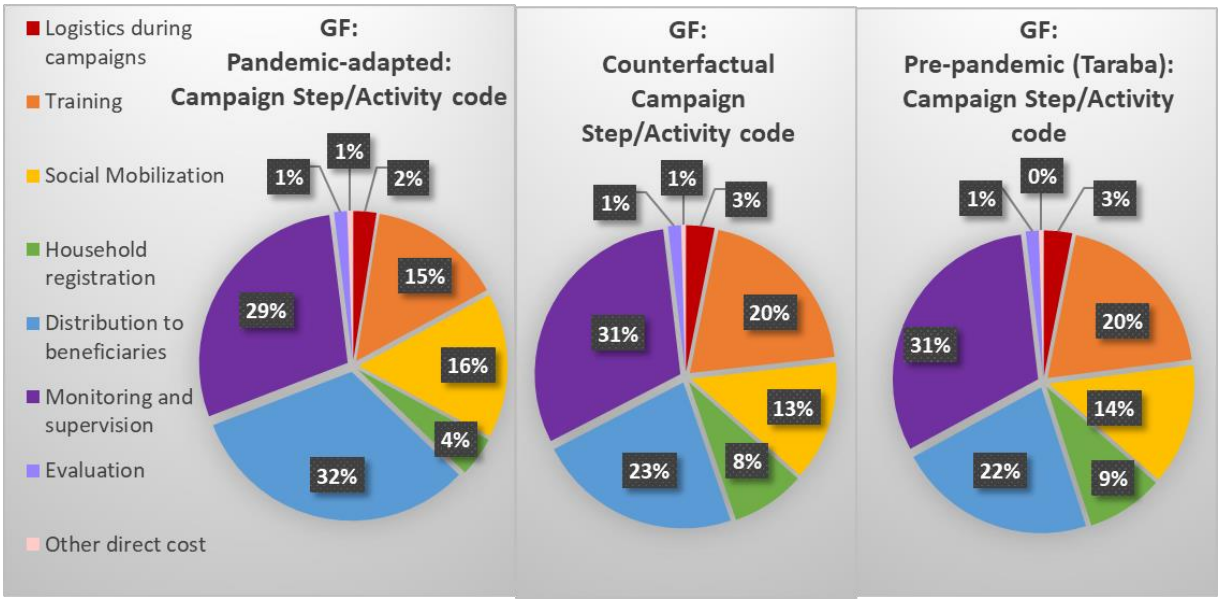

Table 5 shows the budgeted costs in US-PMI states and estimated counterfactuals, by campaign step, per US-PMI budget definitions.

Table 5: US-PMI-supported states: Average financial costs of the Nigeria 2020 pandemic-adapted campaigns per net, by activity code

PMI	NGN	NGN	USD	USD
Campaign step	**Pandemic-adapted costs (NGN)**	**Counterfactual costs (NGN)**	**Pandemic-adapted costs (USD)**	**Counterfactual costs (USD)**
Logistics during campaigns	₦ 23	₦ 22	$0.06	$0.05
Training	₦ 35	₦ 29	$0.09	$0.07
Social mobilization	₦ 35	₦ 38	$0.08	$0.09
Household registration	₦ 7	₦ 6	$0.02	$0.01
Distribution to beneficiaries	₦ 40	₦ 14	$0.10	$0.03
Monitoring and supervision	₦ 19	₦ 19	$0.04	$0.04
Evaluation	₦ 1	₦ 1	$0.00	$0.00
Other direct cost	₦ 0	₦ 0	$0.00	$0.00
Total	₦ 161	₦ 128	$0.39	$0.31

Seen in Table 5, the distribution cost was lower in US-PMI states than GF states, and the largest overall contribution to campaign costs was distribution, followed closely by training and social mobilization. The highest differences observed in the US-PMI budgets between pandemic adapted and counterfactual

were seen in distribution costs which decreased by ~65%, training costs which decreased by 17%, and social mobilization which increased by ~9%. The overall difference between the pandemic adapted and counterfactual budgets was 20.5%.

Figure 2 below shows the overall contributions of specific activities to overall budgets in both COVID-19 adapted and the simulated counterfactual campaigns.

Figure 2: Contributions of activity codes to overall PMI budget in post COVID-19 and counterfactual campaigns

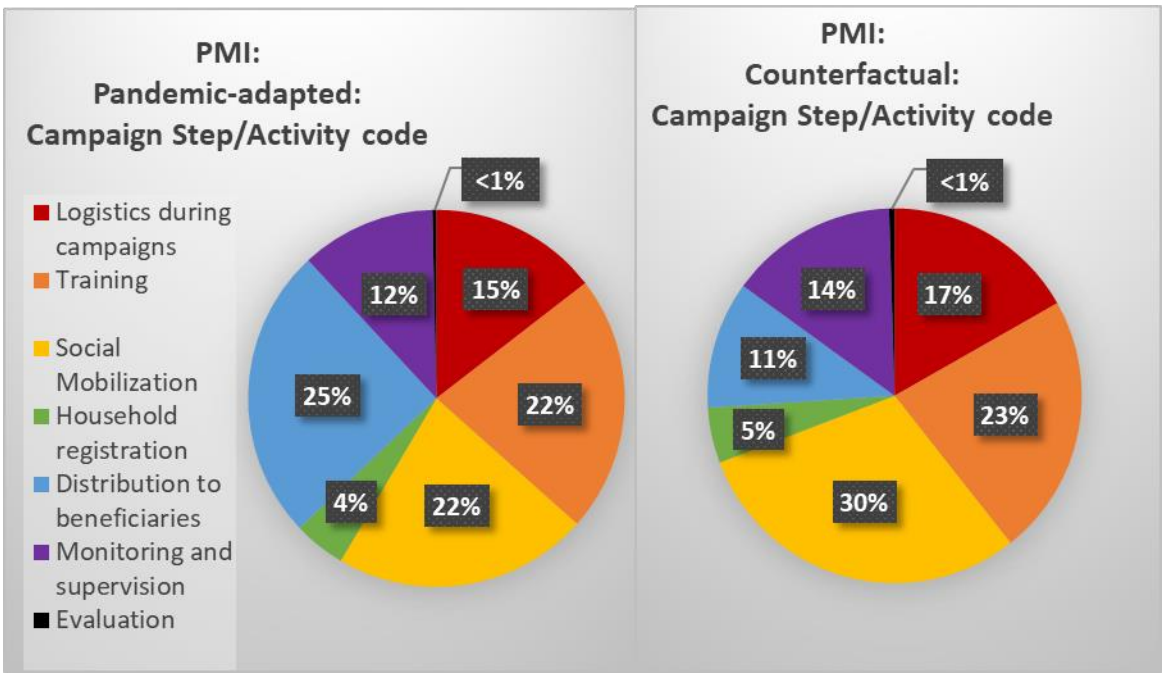

Table 6 shows Global Fund states with cost per net reclassified into line-item groups. The procurement line-item group includes all direct costs associated with ITN procurement and all physical supplies and tools used in the campaign aside from those included in the international purchase of ITNs and delivery of ITNs to Nigeria and those directly associated with meetings/training or PPE. Logistics includes costs associated with transporting and storing ITNs and distribution-related materials throughout the campaign. Personnel costs included all salaries, stipends, and fees associated with the hiring or reimbursement of people's work. Travel costs were separated from personnel to include any personnel-transport line-items, meals &incidental expenses (per diem), and travel-related accommodations. Other direct costs included incidentals and running costs, report and documentary production, and miscellaneous campaign costs.

Table 6: Global Fund-supported states: Averaged financial costs of the Nigeria 2020 pandemic-adapted campaigns per net distributed, by line-item group

Global Fund	NGN	NGN	NGN	USD	USD	USD

Line-item group	Pandemic-adapted costs (NGN)	Counterfactual costs (NGN)	Taraba	Pandemic-adapted costs (USD)	Counterfactual costs (USD)	Taraba
Procurement	₦ 30	₦ 24	₦ 25	$0.07	$0.06	$0.06
Logistics	₦ 13	₦ 21	₦ 22	$0.03	$0.05	$0.05
Personnel	₦ 130	₦ 116	₦ 116	$0.31	$0.28	$0.28
Meeting / workshop/ training costs	₦ 19	₦ 26	₦ 26	$0.05	$0.06	$0.06
Other direct cost	₦ 8	₦ 8	₦ 9	$0.02	$0.02	$0.02
PPE	₦ 23	₦ 0	₦ 0	$0.05	$0.00	$0.00
Travel	₦ 47	₦ 45	₦ 43	$0.11	$0.11	$0.10
Total	₦ 271	₦ 240	₦ 241	$0.65	$0.58	$0.58

In the Global Fund budgets, when separated by line-item group, personnel costs were the single largest line-item group in all COVID-19 and non-COVID-19 mitigated scenarios and increased by nearly 11% in COVID-19 mitigated campaigns relative to counterfactual or Taraba state costs. Meeting and workshop costs declined by ~37% and logistics costs declined by 59%, but both represent a much smaller share of overall costs. PPE costs, which were not present prior to COVID-19 mitigation also represent an increase in costs after COVID-19 mitigation but generally added less than USD 0.05 to the cost of distribution per net. Taken together, as above in Table 4, the total budget of COVID-19 mitigated campaigns were larger than pre-COVID-19 campaigns but the magnitude of change was approximately an 11% increase in distribution cost. When broken down by line-item group, we see minimal difference between the pre-COVID-19 campaign in Taraba state and the simulated counterfactual budget.

Figure 3 shows the distribution of budget by line-item group in counterfactual/pre-pandemic distribution campaigns and in COVID-19 adapted campaigns for Global Fund states.

Figure 3: Contributions of line-item groups to overall Global Fund budget in post-COVID-19, counterfactual, and pre-COVID-19 campaigns

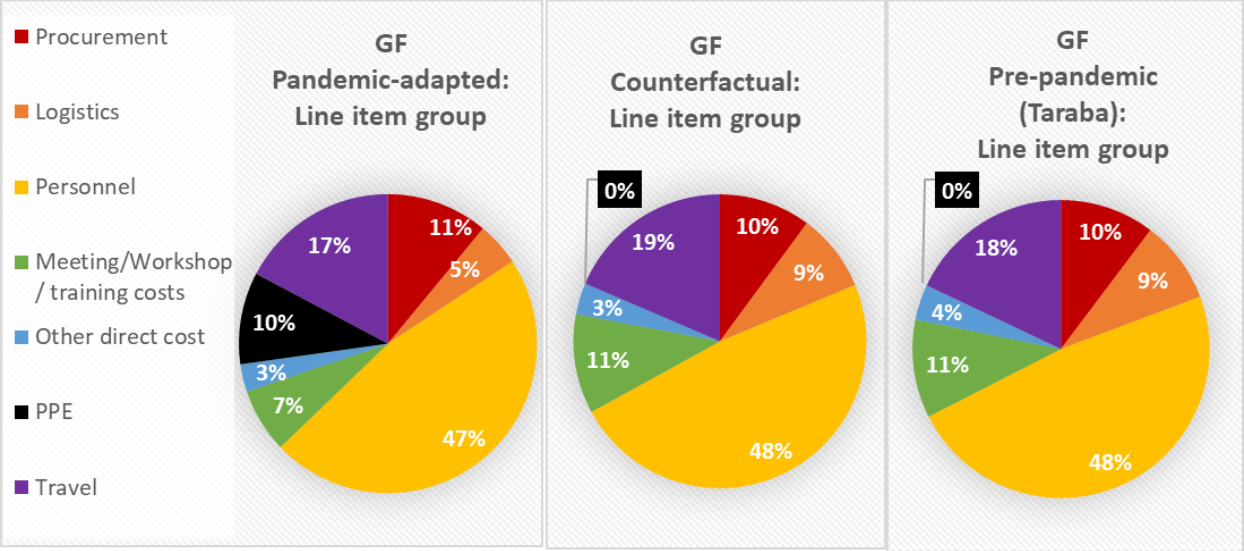

Table 7 shows the costs for US-PMI-supported states with costs reclassified to line-item groups. While the total costs for US-PMI-supported states were lower than GF states, the main line-item group was personnel in both settings.

Table 7: US-PMI-supported states: Averaged financial costs of the Nigeria 2020 pandemic-adapted campaigns per net distributed, by line-item group

US-PMI	NGN	NGN	USD	USD
Line-item group	**Pandemic-adapted costs (NGN)**	**Counterfactual costs (NGN)**	**Pandemic-adapted costs (USD)**	**Counterfactual costs (USD)**
Procurement	₦ 14	₦ 14	$0.03	$0.03
Logistics	₦ 28	₦ 26	$0.07	$0.06
Personnel	₦ 52	₦ 52	$0.12	$0.12
Meeting / workshop/ training costs	₦ 36	₦ 29	$0.09	$0.07
Other direct cost	₦ 6	₦ 6	$0.01	$0.01
PPE	₦ 23	₦ 0	$0.05	$0.00
Travel	₦ 2	₦ 2	$0.00	$0.00
Total	₦ 161	₦ 128	$0.39	$0.31

The line-item group for meetings, workshops, and trainings is where we saw the largest change between the pandemic adapted costs and the counterfactual, decreasing by ~19%. Procurement costs increased by 5.5% and logistics costs increased by 6%. These three line-item groups resulted in the majority of the change in the overall budget; it is estimated that COVID mitigations might have increased the ITN distribution budget by ~25% (not including net purchase costs).

Figure 4 shows the distribution of budget by line-item group in counterfactual/pre-pandemic distribution campaigns and in COVID-19 adapted campaigns for US-PMI states.

Figure 4: Contributions of line-item groups to overall US-PMI budget in post COVID-19 and counterfactual campaigns

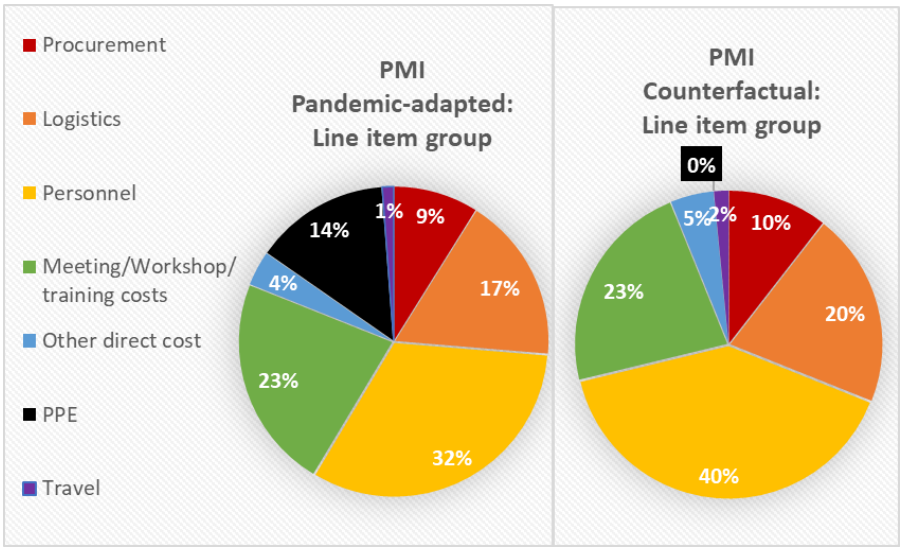

Table 8 compares the cost per net distributed and per year of protection between the 2020 pandemic-adapted costs and the pre-pandemic adjusted costs for each of the states.

Table 8: Average financial costs of the Nigeria 2020 pandemic-adapted campaigns per net distributed by state

	State	Pandemic-adapted costs per net distributed (NGN)	Counterfactual costs per net distributed (NGN)	Pandemic-adapted costs net distributed (USD)	Counterfactual costs per net distributed (USD)	% Change
PMI	Zamfara	₦ 169.04	₦ 115.23	$0.41	$0.28	31.83%
PMI	Benue	₦ 153.46	₦ 139.48	$0.37	$0.34	9.11%
GF	Osun	₦ 278.14	₦ 241.19	$0.67	$0.58	13.28%
GF	Kwara	₦ 255.35	₦ 238.29	$0.61	$0.57	6.68%
GF	Taraba	-	₦ 241.13	-	$0.58	

While the overall picture shows an increase in costs in COVID-19 mitigated campaign scenarios, there is some variation by state. The largest change is seen in Zamfara, which may be attributed to the unique situation of a dual ITN/SMC campaign carried out there.

One-way sensitivity analysis

Adjustments to the cost adjustment factor

The impact of the CAF on the overall budget was assessed through sensitivity analysis. For Global Fund budgets, the highest and lowest CAF was taken for each cross-tabulated category of activity codes and line-item groups. These maximum and minimum CAF values were used to simulate a new counterfactual value for the individual line-items that had the highest total value change between the pre-pandemic and counterfactual, non-COVID-19-adapted budgets. For US-PMI budgets, two sensitivity analyses were run: first, the main line-items were analyzed in the same fashion as the Global Fund budgets and added to the same output table; second, a sensitivity analysis of the CAF assignments for the whole budget were assessed for impact.

Table 9 shows the results of one-way and scenario analysis. Percentage change is calculated relative to base case scenario estimate of the counterfactual scenario.

Table 9: Sensitivity analysis of selected parameters (USD)

			Base case per net (USD)				USD	USD		
Funding org.	**Activity group**	**Line item**	*** Line-item value per net**	**Pandemic-adapted**	**Counter-factual**	**Alternative pandemic impact scenario**	**Counter-factual sensitivity**	**Absolute difference relative to base counterfactual**	**% Change**	**Rationale**
GF	Campaign materials and data tools	Net cards **&** net cards for training	($0.03)	$0.65 $0.62 (sensitivity)	$0.58	low	$0.58	$0.00 (Relative to baseline pandemic-adapted ($0.03))	0% (Relative to baseline pandemic-adapted (-5%))	Zero: all net card costs removed from single phase campaigns
PMI	Cross cutting campaign tools	Hand sanitizers (300mls)	$0.02	$0.39	$0.31	high	$0.29	$0.02	-6%	Cost value doubled
						low	$0.31	$0.00	0%	No change
GF	Personnel honorarium, daily rate, travels	Town announcers	$0.02	$0.65	$0.58	high	$0.56	$0.02	-3%	Cost value doubled
						low	$0.60	($0.02)	3%	Value not changed for counter-factual

GF	Travel for national & state level personnel	Out of station allowance	$0.02	$0.65	$0.58	high	$0.56	$0.02	-3%	Cost value doubled
						low	$0.60	($0.02)	3%	Value not changed for counter-factual
GF	Item/quantities per state	Community mobilization activities for mobilization and distribution	$0.01	$0.65	$0.58	high	$0.57	$0.01	-2%	Cost value doubled
						low	$0.59	($0.01)	2%	Value not changed for counter-factual
GF	Training of household mobilizers	Lunch	($0.01)	$0.65	$0.58	high	$0.59	($0.01)	2%	Cost value doubled
						low	$0.57	$0.01	-2%	Value not changed for counter-factual
GF	Personnel honorarium, daily rate, travels	TTA	$0.01	$0.65	$0.58	high	$0.57	$0.01	-2%	Cost value doubled
						low	$0.59	($0.01)	2%	Value not changed for counter-factual
GF	Item/ quantities per state	Community mobilization activities for distribution	($0.01)	$0.65	$0.58	high	$0.59	($0.01)	2%	Cost value doubled
						low	$0.57	$0.01	-2%	Value not changed for counter-factual
PMI	M&S-personnel	Household mobilizer	($0.01)	$0.39	$0.31	high	$0.32	($0.01)	3%	Cost value doubled
						low	$0.30	$0.01	-3%	Value not changed for counter-factual
Assessment of total impact of sensitivity analysis										
GF	Sum of sensitivity changes for Global Fund line items		$0.05	$0.65	$0.58	high	$0.57	$0.01	-2%	
						low	$0.62	($0.04)	7%	
PMI	Sum of sensitivity changes for US-PMI line items		$0.01	$0.39	$0.31	high	$0.30	$0.01	-3%	
						low	$0.30	$0.01	-3%	

* The 'Line-item value per net' is the amount that a particular line-item contributes to the change between the pre-pandemic counterfactual and the pandemic-adapted budget. A positive value indicates that the pandemic-adapted budgeted cost for that line-item is the indicated amount higher than in the pre-pandemic counterfactual. A negative value indicates that line-item cost decreased in the pandemic-adapted budget when compared to the pre-pandemic counterfactual.

The sensitivity-adjusted value per net represents the amount that a particular line-item contributes to the change between the pre-pandemic counterfactual and the pandemic-adapted budget. Sensitivity and scenario analysis show that the conclusion that COVID-19 mitigations increased the cost of the ITN campaigns is sensitive to assumptions about the size and magnitude of the effect of mitigation on specific line-items. However, it is only when these assumptions used in the base case scenarios are broadly incorrect in both direction and magnitude that it would be possible to conclude that the pandemic adaptations led to cost-savings relative to pre-pandemic.

The base CAF used in the main US-PMI analysis in this report used a 25% magnitude of change; 1.25 for the high factor (line items expected be higher pre-pandemic) and 0.75 for the low factor (line items expected to be lower pre-pandemic) based on the results of comparison of Global Fund budgets to the Taraba comparison. Sensitivity analysis shown in Table 10 assumed a 10% change with 1.1 and 0.9 for high and low factors respectively. Additionally, the average high and low CAF (2.3, 0.3) 130% increase or 70% decrease from the GF budget comparisons to Taraba state were applied to each line item in a high pandemic impact scenario.

Table 10: Sensitivity analysis of base case US-PMI counterfactual CAF assumptions

		Base Case per net (USD)			USD	USD		
	Description	**Pandemic-adapted (USD)**	**Counter-factual (USD)**	**CAF averages applied (high,low)**	**Counter-factual sensitivity**	**Difference**	**% Change**	**Rationale**
PMI	Smaller impact: PMI budget using sensitivity CAF 0.10 magnitude change	$0.39	$0.31	(1.1, 0.9)	$0.27	($0.04)	-13%	Assessing a smaller impact of COVID mitigations on budget costs
PMI	Larger impact: PMI budget using Global Fund average high and low CAF	$0.39	$0.31	(2.3, 0.3)	$0.25	($0.06)	-20%	Assessing a larger impact of COVID mitigations on budget costs using the average high and low CAF from Global Fund analysis using a

								pre-pandemic example

Both sensitivity analysis assessing a smaller magnitude without changing direction of mitigations on the budget for each affected line item and a larger magnitude without direction change on the US-PMI budget resulted in a lower cost per net in the counterfactual (*i.e.* a larger increase in distribution costs due to pandemic mitigation measures). This result implies that while estimation of specific line-item changes may affect our conclusions, in this particular case our base scenario may be conservative with respect to the overall impact of COVID-19 mitigation measures on pandemic mitigation budgets.

Discussion

COVID-19 mitigations likely increased the cost of insecticide treated net distribution in Nigeria in 2020. These increases were mainly driven by increases in personnel costs and the purchase of PPE and occurred mainly during the training and distribution phases of the campaign. While some activity and line-item costs (notably meeting costs and the costs of household registration/distribution point management) decreased due to the shift of many high-level meetings to virtual settings and the shifts to single-phase campaigns, these cost-savings were more than offset by the increased personnel costs in other domains and the cost of PPE procurement.

While the overall increase in cost of ~10% by distribution budget standards is relatively large and significant, this cost estimate neglects the cost of the ITNs themselves. Even assuming a relatively low cost of approximately 2 USD per ITN, the budget impact of COVID-19 mitigations becomes relatively small in the context of the total financial costs of implementing ITN campaigns; <5% increase in total campaign costs seems most likely. Because the overall impact on cost of ITN interventions is relatively modest, it is not expected to greatly impact the cost-effectiveness of ITN interventions, which remain some of the greatest value for money in malaria programming and global health in general.

Given that the major impact of the COVID-19 pandemic was on the global supply chain, including on the supply of ITNs, there was a significant potential for disruption in ITN distribution with devastating impacts on health from reduced access to malaria prevention (as only one aspect of many impacts of the pandemic). For this reason, it was critical that ITN campaigns be conducted as closely as possible to pre-planned schedules. At the time of planning for these campaigns in Nigeria there was no evidence base on the potential budget impacts of necessary mitigations to operate ITN distribution campaigns with COVID-19 mitigations. This work provides some of the first empirical evidence that COVID-19 mitigated campaigns can be conducted successfully for very small relative increases in cost.

This work has substantial limitations. Costs were estimated mainly from budget documents and may therefore reflect over or underestimates of true financial expenditure and/or resource use. While mass ITN campaigns tend to rely less on donated resources or local uncompensated use of facilities and personnel compared to continuous distribution strategies, they may still rely on local resources which are unbudgeted or financially recorded (such as state-level warehousing). These costs are not included in this analysis and therefore it likely underestimates of the true economic cost of distribution. Secondly,

while the Nigeria campaigns were fully COVID-19 mitigated, there was reportedly little actual COVID-19 disease in the community at the actual time these campaigns were conducted. This may have resulted in substantially smoother campaign operations than had the campaigns occurred at a time of high community transmission. While this may not affect the budget as planned or the analysis presented directly, it is unclear if the budgets provided in this analysis would have been sufficient to account for significant interruptions to campaign operations due to increased absenteeism, isolation or quarantine or lockdowns leading to campaign delays and additional storage, among other, costs. Notably no budget examined included explicit line-items or buffers to account for unexpected COVID-19 related expenditures.

Despite the limitations and including the sensitivity analysis results, we believe that these results provide some of the first estimates of the magnitude and types of budget impact of COVID-19 mitigation on ITN distribution in Nigeria and in sub-Saharan Africa in general.

Conclusion

COVID-19 mitigations increase the cost of ITN distribution. The overarching finding hides underlying heterogeneity in line-item and activity specific effects, with some areas, such as meeting costs and household enumeration/distribution costs declining, especially in the context of a shift to a single-phase campaign. The effect on distribution budgets is of the order of ~10% increase, but the impact on the overall campaign budget including the cost of nets is much smaller relatively, at less than 5%. Programs need to account for COVID-19 mitigation measures when planning future ITN campaigns, but these costs should not substantially affect the cost-effectiveness of the intervention itself.

Addendum

Addendum the line-items page

_Nigeria Costing Analysis_v3.xlsx

Nigeria Costing Analysis_v3.xlsx Contents:

- Assumptions
- Tables: all the tables in this report, and extras
- Master Budget (GF & PMI): multi-state integration and CAF designation for line items
- PMI Sensitivity Analysis: analysis of CAF variations
- List-Main Cost Drivers (GF & PMI): a list of the line items with altered CAFs. Used to determine largest changed line items for sensitivity analysis
- Individual state budgets: formatted
- RAW individual state budgets: in GF and PMI formatting