# The cost of routine immunization outreach in the context of COVID-19: estimates from Tanzania and Indonesia

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## SUMMARY

**This analysis assesses changes in the cost of delivering immunization through outreach in Tanzania and Indonesia, where detailed costing studies of outreach services have recently been conducted.** The COVID-19 pandemic is disrupting immunization services due the additional burden and constraints it places on the health system, and reluctance in communities to visit health facilities. Reduced attendance during immunization sessions at facilities and the closing of schools requires countries to innovate to keep coverage high. WHO guidance advises countries to explore innovative methods for vaccine delivery to optimize service delivery while minimizing the risks of COVID-19 transmission. Countries may increase the frequency with which outreach is conducted to compensate for reductions in coverage of other delivery strategies and keep session sizes small. On the other hand, they may limit outreach to reduce community touchpoints. In addition, providing health workers with personal protective equipment (PPE) for immunization activities, ensuring physical distancing and screening, and setting up hand washing stations and offering hand sanitizer at session sites all impact the cost of delivering immunization.

**The results of this analysis show that the cost of delivering immunization through outreach could increase by 20-129% depending on the way outreach strategies will be adapted**. Based on data from Tanzania and Indonesia, adding hand washing stations and hand sanitizer at outreach sites could increase the delivery cost per dose by 11-14% or if health workers would be provided with PPE (masks, gloves and goggles) as well, the increase could be 45-61%. An additional crowd controller during outreach sessions to manage physical distancing and screening may increase the incremental financial cost if they would receive per diems (9%) and adding two staff and infrared thermometers could increase the cost per dose by up to 42%. If facility-based coverage drops by 50%, the cost of increasing outreach to compensate for this could add up to 11% per dose. Cost savings from halving the frequency of outreach are likely limited (-2 to -16%), while doubling the frequency to reduce the size of outreach sessions can increase the cost per dose by 18-40%.

## BACKGROUND

**To prevent disruptions in essential health services such as immunization during the COVID-19 pandemic, facilities must be adequately equipped to provide services in a manner that is safe for health workers and communities.** The COVID-19 pandemic risks disrupting immunization services, due to the additional burden and constraints that it places on the health system, and to a potential reduction in demand for vaccination by the community.[1] Experiences from the Ebola epidemic in 2014-16 show that

a drop in routine immunization coverage is a real risk, as resources were diverted for the Ebola response, communities distrusted the safety of the health system, and health workers got sick or were absent due to fear of getting sick, which in turn increased workload for others and reduced morale.[2,3,4] Due to the COVID-19 pandemic, most mass immunization campaigns in low- and middle-income countries have been cancelled or postponed,[5] and in some countries, routine immunization coverage has already dropped by 6-12%.[6] Even short service interruptions increase the risk of outbreaks of vaccine-preventable diseases, and essential health services such as immunization should be maintained whenever these can be conducted safely.[7,8,9] Providing routine immunization services in a safe manner requires the program to be adequately resourced to ensure health worker safety, minimize community transmission, and adapt the way immunization is delivered to the context of COVID-19.

**Modifications in the way vaccines are delivered can change the cost of conducting immunization outreach sessions considerably.** WHO guidance advises countries to explore innovative methods for vaccine delivery to optimize service delivery while minimizing the risks of COVID-19 transmission. It recommends improving infection prevention and control (IPC) measures during vaccination sessions, including training staff on IPC, supplying facilities with IPC equipment, screening at the entrance of the vaccination area, reducing the session size, and reducing waiting time. For outreach and mobile services, it advises countries to work together with communities to identify open sites that allow physical distancing. The way that this is implemented specifically differs across countries. For example, while Guinea,[10] Uganda[11] and Indonesia[12] recommend maintaining or even increasing the frequency of outreach sessions throughout the country whenever feasible, Bangladesh,[13] India[14] and the Philippines[15] recommend that areas under lockdown temporarily suspend outreach activities and only offer immunization services at facilities. To understand how these changes will affect the cost of conducting immunization outreach sessions, this study has modelled the cost implications of a range of potential modifications.

## METHODOLOGY

**This analysis used facility-level primary data from two immunization costing studies that included detailed data on routine and outreach delivery costs.** To estimate the cost of changes in outreach immunization strategies, the study used primary data from two immunization costing studies conducted in 2018 in Indonesia and Tanzania. Both studies collected data at facility and district level on the cost of conducting routine immunization services and outreach sessions. Data on the type of outreach sites, the frequency and size of outreach sessions, the composition of the outreach vaccination teams, any per diems or incentives that staff receive for their participation in outreach sessions, and on the number of doses delivered were extracted from the original two studies and used to model potential changes in the cost of delivering immunization services through outreach.

**Using the originally collected input data, this study estimates the impact of four changes in the way outreach is conducted**: (1) providing health workers with personal protective equipment (PPE) and increased IPC measures during outreach sessions, (2) increasing the size of the outreach teams to ensure physical distancing and screening during the sessions, (3) changing the frequency and size of outreach sessions, and (4) increasing the number of children covered through outreach as the result of potential reductions in facility-based coverage. The analysis used the original study's weights to calculate new delivery cost estimates under each scenario, as well as the combined effect of (1), (2) and (4). Results show US dollar and percentage changes in the cost per dose delivered, as well as monthly and initial investment costs per facility. Results were also disaggregated by geographic area. All results were

converted to 2020 US dollars using World Bank official exchange rates[16] and IMF inflation rates (average consumer price)[17].[i]

## DATA

**The Indonesia study originally estimated the cost of delivering vaccines at facilities, outreach posts and schools in high coverage areas[18].** The study used a government perspective to estimate the costs incurred from providing immunization services at district/city, sub-district and village levels between January and December 2016. The sample included 2 provinces, 2 districts/cities, 24 health facilities, 48 outreach health posts (Posyandu) and 48 elementary schools. Ten of the facilities delivered doses only through outreach and school-based strategies, and two thirds of all doses were delivered at the outreach health posts. The study used volume weights based on the total number of doses delivered by each facility to calculate the cost per dose. The delivery cost per dose was highest when delivered at facilities, followed by outreach posts, and lowest when delivered at schools. Data from all facilities included in the sample were used as the basis for this analysis. Table 1 shows the immunization schedule of Indonesia at the time of the study.

*Table 1 – Indonesia's routine immunization schedule at the time of the study (2016)*

| Antigen | Age at delivery |
|---|---|
| Hepatitis B (HepB) | Birth dose |
| BCG, OPV 1 | 1 month |
| DPT-HepB-Hib 1, OPV 2 | 2 months |
| DPT-HepB-Hib 2, OPV 3 | 3 months |
| DPT-HepB-Hib 3, OPV 4 | 4 months |
| Measles 1 | 9 months |
| DPT-HepB-Hib 3, Measles 2 | 18 months |
| DT, Measles 3 | 1st grade |
| Td | 2nd and 3rd grade |

**The Tanzania study originally estimated the cost of delivering immunization using fixed facility, outreach and mobile clinic delivery strategies.[19]** The study employed a government/provider perspective to estimate the costs incurred at the facility, district, region and national levels between July 2016 and June 2017. The sample included 4 regions, 12 districts and 54 facilities, although 3 facilities were dropped during data cleaning. Of the 51 health facilities included in the analysis, 26 conducted outreach immunization. In the original study, costs were estimated using inverse probability of sampling weights and the calibration technique, and were presented disaggregated by administrative level, geographic area, and delivery strategy, and by main cost activities and line items. This analysis utilized the facility-level data from the original study and recalculated unit costs using volume weights. Table 2 shows the immunization schedule of Tanzania at the time of the study.

[i] For Tanzania, the 2020 exchange rate was not available and the latest available exchange rate (2018) was used instead

*Table 2 – Tanzania's routine immunization schedule at the time of the study (2016-2017), up to 18 months of age*

| Antigen | Age at delivery |
|---|---|
| OPV0 | At birth up to 14 days |
| BCG | At birth or first contact |
| OPV1, DTP-HepB-Hib 1, PCV13 1, Rota 1 | 6 weeks |
| OPV2, DTP-HepB-Hib 2, PCV13 2, Rota 2 | 10 weeks |
| OPV3, DTP-HepB-Hib 3, PCV13 3 | 14 weeks |
| Measles/Rubella 1 | 9 months |
| Measles/Rubella 2 | 18 months |

**The price data used for all supplies and commodities not already included in the original studies were based mainly on WHO and UNICEF guidance, and thus assumed to be the same across the two studies.** The unit prices for PPE supplies, soap, and hand sanitizer used in this analysis are those used in the WHO COVID-19 Essential Supplies Forecasting Tool (ESFT).[20] Prices for hand washing stations are based on a WASH study conducted in Kenya[21], converted to USD 2020 values. These prices are in line with the latest UNICEF price ranges for low cost and low to medium cost hand washing stations.[22] All prices are exclusive of shipment costs. The price used for the thermometer comes from the UNICEF Supply Catalogue.[23] Annex A includes a list of all the price assumptions used in this analysis.

## SCENARIOS & ASSUMPTIONS

**This analysis considered four scenarios to illustrate the impact of global guidance and a range of country experience changes on the cost of conducting outreach immunization sessions.** The scenarios and the cost assumptions used for these are based on guidance and protocols from WHO on delivering immunization[1,7,9] and other essential health services in the context of COVID-19,[8] other guidance on IPC measures related to COVID-19,[24,25,26,27,28,29] as well as policies on conducting routine and outreach immunization services during COVID-19 from Bangladesh, Guinea, India, Indonesia, Philippines and Uganda. The scenarios follow the same principles as used in related analyses on the cost of conducting immunization campaigns[30] and a forthcoming analysis on the cost of facility-based routine delivery in the context of COVID-19, conducted by ThinkWell and Harvard T.H. Chan School of Public Health respectively, with support from the Bill & Melinda Gates Foundation. Note that the scenarios are not intended to reflect Tanzania's and Indonesia's actual country guidelines on implementing outreach immunization services during this time, but rather illustrate the impact of global guidance and a range of experiences.

**All scenarios are aimed to estimate the cost of keeping overall routine immunization coverage equal, and thus assume that the total number of children reached remains constant.** The first two sets of scenarios assume that outreach sessions will be conducted at the usual frequency and with the usual sessions sizes, but with additional measures in place to reduce the risk of COVID-19 transmission, while the second two sets of scenarios estimate the cost of changes in the size and frequency of outreach sessions:

1. Outreach is conducted as usual, but with PPE and hand hygiene measures in place.
2. Outreach is conducted as usual, but with additional health workers to ensure that physical distancing is observed during the session and to screen the waiting area for COVID-19 exposure risk and symptoms.

3. Changing the frequency of outreach: a reduction in the frequency to reduce the number of community touchpoints with more children covered per session, or an increase in the frequency in order to reduce the session size to fewer children, while keeping the overall number of children reached through outreach monthly constant.
4. Modeling the implications of a reduction in facility-based vaccination demand and the cost of making up for that through larger or additional outreach sessions.

### 1. Personal protective equipment (PPE) & infection prevention and control (IPC) measures

**The first set of scenarios assumes that outreach sessions will continue as usual, but with PPE and hand hygiene measures in place (Table 3).** The low intensity scenario represents WHO guidance for areas without widespread community transmission of COVID-19. In such areas, WHO indicates that the use of medical masks is not required, and that gloves would only be needed if the skin is damaged. For oral vaccines, self-administration of the vaccine by the beneficiary or the care giver under the supervision of the vaccinator is recommended as a potential way of avoiding direct contact between the health worker and the beneficiary. If in those cases sufficient distance can be maintained, WHO and the Global Polio Eradication Initiative (GPEI)[31] indicate that the use of PPE is also not required.

**The high intensity scenario also includes the use of gloves and goggles.** In areas with widespread community transmission of COVID-19 or in areas where transmission is not well known or surveillance systems are weak, WHO recommends considering the extended use of medical/surgical masks during vaccination shifts. The COVID-19 Risk Communication Package For Healthcare Facilities[32] also recommends masks even for triaging staff at facilities, and several countries (e.g. Bangladesh,[33] India,[34] Kenya[35]) require both vaccinators and other team members to wear masks during immunization sessions. Therefore, the medium and high intensity scenarios include masks for all outreach team members. The assumption is that team members would change their mask twice per day, as guidance indicates to replace masks as soon as they become damp.

**The high intensity scenario also includes the use of gloves, as per some countries' guidance (e.g. DRC, India, Kenya), as well as goggles (e.g. face shields are used during immunization sessions in Indonesia[12]).** The high intensity scenario assigns a set of reusable goggles to each health workers that participates in outreach sessions. It assumes that the goggles have a useful life of a year, and therefore they would not need to be replaced during the pandemic. In both studies, some facilities were assumed to have several vaccine teams working simultaneously due to the high number of outreach visits per month. In both countries, outreach sessions took at least one day, so if more than 24 sessions (considering Indonesia's six-day workweek) or 20 sessions (considering Tanzania's five-day workweek) were held during a given month, it was assumed that more than one team operated at the same time.

**To account for the cost of added infection prevention and control (IPC) materials, all scenarios include hand sanitizer and hand washing stations at the entrance and exits of outreach 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 between after administering each vaccine. In DRC, during the measles outbreak response campaign in Kinshasa in April 2020 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.[36] The low and medium intensity scenarios include two simple handwashing stations to accommodate both the entry and exit points of each fixed outreach site. The high intensity scenario includes a more advanced handwashing station consisting of a tap and a basin.

*Table 3 – Scenario 1: infection prevention and control*

| Scenario 1: Infection prevention and control[ii] | | | |
|---|---|---|---|
| | Low intensity | Medium intensity | High intensity |
| PPE | – No PPE | – 1 mask for all outreach team staff per half day session (2 masks for a full day session)<br>– 1 biohazard waste bag per session/team | – 1 mask for all outreach team staff per half day session<br>– 1 pair of gloves per beneficiary for vaccinators, 2 pairs per day for other outreach team staff<br>– 1 set of reusable goggles for vaccinators per year<br>– 1 biohazard waste bag per session/team |
| IPC | – Simple hand washing stations (2 x 60 L buckets) per site, 2 units of soap per session<br>– 12 ml of hand sanitizer per beneficiary[iii] | – Simple hand washing stations (2 x 60 L buckets) per site, 2 units of soap per session<br>– 12 ml of hand sanitizer per beneficiary[iii] | – Advanced hand washing stations for each vaccination post (2 x buckets, stands and basins) and 2 units of soap per session<br>– 12 ml of hand sanitizer per beneficiary[iii] |

**In both studies, the number of beneficiaries covered during outreach sessions was not always collected, and where more than one antigen was delivered during a session, assumptions were made to calculate the amount of hand sanitizer used and the number of gloves needed in the high intensity scenario.** At any given facility, if the number of doses delivered in outreach was not available by antigen, the share delivered in outreach was assumed to equal the overall share of doses delivered in outreach. Following the schedule of each country, we assumed that vaccines that are meant to be co-delivered—e.g. pentavalent, PCV and polio—would all be given at the same time to the same beneficiary. Therefore, the highest number between these three antigens plus every measles-rubella (MR) dose was considered the total number of beneficiaries during a given outreach session. This method will most likely have led to an underestimation of the number of beneficiaries reached through outreach sessions, and therefore a possible underestimation in the number of gloves and amount of hand sanitizer required.[iv]

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

[iii] We assumed that a 3ml pump would be used by every child and every accompanying caregiver, and that each health worker would use the sanitizer before and after each vaccination

[iv] To minimize the underestimation of beneficiaries, in the Tanzania analysis Penta vaccines were considered as the benchmark to estimate the number of beneficiaries receiving Penta, OPV, PCV (and Rotavirus, when applicable) vaccines together. Every additional dose of OPV, PCV and Rotavirus vaccines was considered to be an additional beneficiary.

## 2. Physical distancing & screening

**Vaccination teams may require additional support during outreach sessions to maintain physical distancing, screen recipients, and ensure adequate hand washing practices are observed.** WHO recommends to secure an outdoor large space where persons can be separated by at least 1 meter. Additionally, health workers should screen recipients and companions at the entrance to the vaccination site to prevent the spread of COVID-19, and a referral system should be in place for suspected COVID-19 cases. In the low intensity scenario, it is assumed that each vaccination team will require one additional crowd controller to ensure that physical distancing is observed at outreach sites and to screen the queue for potential COVID-19 cases. The high intensity scenario assumes two additional staff per team would be required. This is in line with what was done in DRC during the measles campaign in Kinshasa in April 2020, where in addition to the regular five vaccination team members (two vaccinators, a person responsible for tallying, a crowd controller and a social mobilizer), two staff were added and dedicated to screening and monitoring the handwashing station. The scenarios assume the addition of one or two crowd controllers irrespective of the original number of crowd controllers in the outreach teams.

**The additional staff are assumed to be existing facility staff; incentives/per diems but no additional salaries are included.** The analysis assumes that such additional staff would require a level of training comparable to that of community health workers (CHWs), and that they would be paid per diems equal to what community health workers would receive based on the original study data. Where data on the community health worker per diems were not available, an average of all per diems in other facilities was used. Most facilities included in the Indonesia study did not pay any per diems for outreach activities, and the five facilities which pay per diems are all within the same district (Kabupaten Pulang Pisau). Therefore, for Indonesia, the low intensity scenario does not include any additional cost due to the addition of staff, the medium intensity scenario adds per diem for the additional staff only if they already paid their staff per diems for outreach, and in the high intensity scenario, all additional staff in Kabupaten Pulang Pisau were assumed to receive per diems for outreach activities.

*Table 4 – Scenario 2: screening & crowd control during outreach sessions*

| **Scenario 2: Screening & crowd control during outreach sessions** | | | |
|---|---|---|---|
| | Low intensity | Medium intensity | High intensity |
| Additional staff | – One additional triager/crowd controller per session to ensure physical distancing is observed<br>– No PPE (as per low scenario 1) | – One additional triager/crowd controller per session to ensure physical distancing is observed<br>– PPE: masks (as per medium scenario 1) | – One triager and one crowd controller per vaccination team to ensure physical distancing is observed<br>– PPE: masks & gloves (as per high scenario 1) |
| Screening | – Screening questionnaire, no thermometer | – Screening questionnaire, no thermometer | – One infrared thermometer per vaccination team or per fixed site post |

**The high intensity scenario also includes the provision of infrared thermometers for COVID-19 screening.** WHO indicates that screening should include an assessment of the exposure risk and COVID-19 symptoms. However, some countries recommend temperature checks at immunization sessions (e.g. Guinea, Kenya and Indonesia). During the measles campaign in Kinshasa in April 2020, and the polio, measles and cholera campaigns held in Kivu in 2019 during the Ebola outbreak, fixed sites were allocated

Thermoflash thermometers. In Tanzania, if two outreach sessions were held at the same time, these were assumed to take place at different locations and this assumption increased the number of hand washing stations required.

### 3. Changes in the frequency and size of outreach immunization sessions

**To reduce the COVID-19 transmission risk, countries may reduce outreach sessions sizes and increase their frequency or opt to limit the number of touchpoints between health workers and the community and reduce the frequency of outreach sessions while increasing the number of children covered in each session.** Several countries have suspended or reduced the number of outreach sessions to reduce the risk of transmission of COVID-19, and the low intensity scenario estimates the difference in cost if the same number of children would be reached through fewer sessions. As one way of avoiding crowds at campaigns, WHO has advised countries to plan for smaller session sizes and extending the duration of the campaign.[37] WHO also lists additional outreach and/or mobile sessions or the conduct of periodic intensification of routine immunization services (PIRIs) as a strategy to conduct catch-up immunization activities after a temporary suspension or reduction. The medium and high intensity scenarios estimate the cost of conducting outreach more frequently, with smaller sessions sizes, thus reaching the same total number of children.

*Table 5 – Scenario 3: changes in the frequency of outreach sessions*

| **Scenario 3: Changes in the frequency of outreach sessions** | | | |
|---|---|---|---|
| | Low intensity | Medium intensity | High intensity |
| Session frequency | – Half the number of sessions | – Double the frequency of sessions | – Four time the number of sessions |
| Session size | – Twice the number of doses delivered per session | – Half the number of doses per session | – Delivering a quarter of the number of doses per session |

**If the population size in a given area was very small or if a health facility's regular sessions size was already quite large, an assumption was made that the sessions size could not be doubled (low intensity scenario)**. The analysis assumes that facilities could increase the number of doses delivered in one session up until a certain threshold. The maximum outreach session size that can be achieved by a facility is generally a factor of the population density around the facility and the total number of doses delivered. The threshold represents a proxy for the maximum session size and not an indication the data's central tendency. For Tanzania, the 75$^{th}$ percentile of number of doses delivered in outreach as per the original study, stratified by geographic location and facility size, was considered to be the most adequate proxy. In Indonesia, the population size in two out of the four districts in the sample was small, and in these two districts outreach sessions were assumed to not be able to double in size. In third district, sessions were assumed to be able to increase due to the low average output of 10 doses per session (range 9-12). In the fourth district, the facilities had a substantially higher and more variable output, and the maximum session size was set at the 75$^{th}$ percentile of the district, just as was done for Tanzania.

### 4. Increased outreach volumes to compensate for a reduction in facility-based routine coverage

**In several low- and middle-income countries, there are already indications that routine immunization coverage is suffering from the lockdown measures and community fear of transmission of COVID-19.** In DRC, coverage of routine immunization attendance dropped by 6-10% in April 2020, in Côte d'Ivoire MR coverage was 12% lower than last year during the same period, Laos' first quarter MCV coverage was 7% lower than last year in the same quarter, and Kenya noted a 10% drop in the coverage of pentavalent

third dose in April 2020.[6] Coverage may fall further over the months to come. During the Ebola epidemic, coverage fell by 23%, 30% and 50% in Sierra Leone, Guinea and Liberia, respectively.[2] With communities being reluctant to visit health facilities out of fear of getting sick, additional outreach activities may be organized in communities to compensate for the reduction in facility-based immunization coverage. This scenario assesses the change in cost associated with that at different levels of intensity. In Indonesia, many facilities deliver doses only at outreach posts, and only 14 out of the 24 facilities in the sample also delivered doses at the facility itself, so the other 10 were excluded from the analysis for this scenario. However, as the study also included a school-based delivery strategy implemented at all 24 facilities, the cost implications of a drop in school-based coverage was assessed as well.

*Table 6 – Scenario 4: increased outreach to compensate for a reduction in facility-based coverage*

| **4. Increased outreach to compensate for a reduction in facility-based coverage** | | | |
|---|---|---|---|
| | Low | Medium | High |
| 4A. Drop in facility-based coverage | – Additional outreach to compensate for a drop in facility-based delivery by 10% | – Additional outreach to compensate for a drop in facility-based delivery by 25% | – Additional outreach to compensate for a drop in facility-based delivery by 50% |
| 4B. Drop in school-based coverage (Indonesia only) | – Additional outreach to compensate for a drop in school-based delivery by 50% | | – Additional outreach to compensate for a drop in school-based delivery by 100% |

## RESULTS

### Baseline

**Table 7 describes the delivery cost of the 'status quo' outreach strategy, and there are several notable differences in the delivery strategies between the two countries.** The table below shows the outreach strategy characteristics and delivery cost estimates as per the original study data, converted to 2020 US dollars. There are several notable differences between the delivery strategies, and thus the delivery cost associated with outreach immunization activities in Tanzania and Indonesia. In Tanzania, the proportion of doses delivered in outreach varied from a median of 9% in rural areas, 10% in urban areas to 15% in nomadic regions. On the other hand, in Indonesia, many facilities deliver all of their doses through fixed outreach posts (referred to as *posyandu*), resulting in a much higher median in rural (70%) and urban areas (55%). Indonesia also conducts outreach much more frequently than Tanzania, with smaller session sizes, yet larger teams. While Tanzania pays health workers per diem for immunization outreach activities, in Indonesia, very few facilities reported that this was the case.

*Table 7 - Baseline outreach costs in Tanzania and Indonesia and median for selected sample data (costs in 2020 USD)*

| | Tanzania | | | | Indonesia | | |
|---|---|---|---|---|---|---|---|
| | **Overall** | **Urban** | **Rural** | **Nomad** | **Overall** | **Urban** | **Rural** |
| Baseline cost per dose delivered in outreach[v] | **$ 5.17** | $ 2.32 | $ 8.87 | $ 5.90 | **$ 1.41** | $ 1.10 | $ 2.37 |
| Number of facilities in the sample | **26** | 5 | 13 | 8 | **24** | 14 | 10 |
| Median total n. of doses delivered per facility per year | **7,654** | 7,883 | 3,491 | 5,181 | **7,403** | 10,133 | 4,569 |
| Median % of doses delivered in outreach | **14%** | 10% | 9% | 15% | **67%** | 55% | 70% |
| Median n. sessions per month | **2.1** | 2.0 | 2.0 | 1.5 | **24** | 23 | 24 |
| Median n. outreach doses per session/day | **34.0** | 40.6 | 8.9 | 28.2 | **11** | 11 | 10 |
| Median number of staff per session | **2.0** | 2.0 | 2.0 | 1.0 | **2** | 2 | 2 |
| Median number of CHW per session | **0.0** | 1.0 | 2.0 | 0.0 | **2** | 1 | 2 |
| Median outreach per diem per person/day | **$ 7.86** | $ 10.48 | $ 7.86 | $ 9.17 | **$ 0.00** | $ 0.00 | $ 0.00 |
| Median transport cost per session | **$ 2.00** | $ 2.00 | $ 2.00 | $ 1.50 | **$ 2.82** | $ 2.82 | $ 3.22 |

### 1. Personal protective equipment (PPE) & infection prevention and control (IPC) measures

**Because Indonesia delivers a high share of immunization doses through small but frequent outreach sessions, masks for health workers are the biggest cost driver, while in Tanzania, where the overall share of doses delivered through outreach is lower, initial investments in goggles would form the biggest cost driver.** When adding hand sanitizer and hand washing stations to outreach sites, the delivery cost per dose delivered in outreach would increase by 11% (Tanzania) to 14% (Indonesia). If in addition health workers also wear masks during the sessions, the cost increase would be 18% in Tanzania, and because Indonesia's outreach vaccination teams are generally larger, the increase in cost per dose is much greater at 38%. The volatility in the prices of masks observed since the start of the pandemic may further affect these results. If health workers would also wear goggles and gloves when immunizing children, and would change their gloves after every child that has been immunized, the cost increase would be much more significant. Especially in Tanzania, the increase is high (from 18% to 61%), because the start-up investment for goggles is spread out over fewer outreach doses. Several of the PPE and IPC costs are one-off investments. Hand washing stations and goggles are assumed to last for the entire duration of the COVID-19 pandemic. To illustrate the cost impact of the initial investments compared to longer term recurrent costs, **Error! Reference source not found.** 8 presents a breakdown of start-up and monthly recurrent costs for a six month period.

[v] Although the original study reported calibrated estimates, for this analysis, volume weighted averages were used.

*Figure 1 - Incremental cost per dose due to implementation of PPE and IPC measures (in 2020 USD and as % change from baseline)*

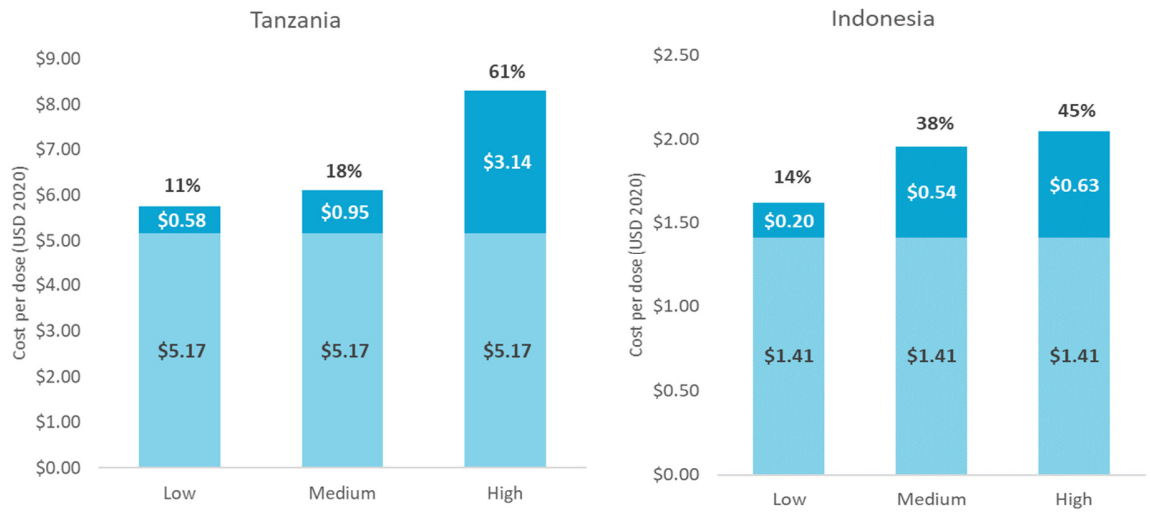



*Table 8 - Start-up and recurrent cost for PPE and IPC measures for an average health facility, in 2020 USD*

| | | Tanzania | | | Indonesia | | |
|---|---|---|---|---|---|---|---|
| **Intensity** | **Cost component** | **Start-up cost** | **Recurrent cost per month** | **6-month total** | **Start-up cost** | **Recurrent cost per month** | **6-month total** |
| **Low** | No PPE | $0 | $0 | $0 | $0 | $0 | $0 |
| | IPC (hand washing stations, hand sanitizer) | $12 | $12 | $87 | $24 | $100 | $625 |
| | **Total** | **$12** | **$12** | **$87** | **$24** | **$100** | **$625** |
| **Medium** | PPE (masks) | $0 | $13 | $76 | $0 | $141 | $846 |
| | IPC (hand washing stations, hand sanitizer) | $12 | $12 | $87 | $24 | $100 | $625 |
| | **Total** | **$12** | **$25** | **$163** | **$24** | **$241** | **$1,472** |
| **High** | PPE (masks, gloves, goggles) | $7 | $14 | $90 | $11 | $173 | $1,047 |
| | IPC (hand washing stations, hand sanitizer) | $79 | $12 | $154 | $150 | $100 | $752 |
| | **Total** | **$86** | **$26** | **$244** | **$161** | **$273** | **$1,799** |

## 2. Physical distancing & screening

**While adding an additional team member for outreach sessions is not a major cost driver, providing facilities with thermometers as well as two additional team members for outreach immunization activities can increase the cost of per dose considerably (42% increase in Tanzania), unless outreach volumes are very high (increase of 19% in Indonesia).** Adding additional staff to outreach sessions is not a major cost driver. This analysis assumes these staff are existing facility staff, and so no additional salary costs were included. In the case of Indonesia, most health workers do not receive per diems for outreach activities specifically, therefore in the low scenario there are no additional costs. In Tanzania, where health workers do regularly receive per diems for outreach activities, the impact of the per diem for an additional team member is still relatively limited (9%). For Tanzania, the increase in the medium scenario is only due to the addition of masks for the additional team members, while in the high scenario, gloves were added. In Indonesia, in addition to the PPE for the additional staff, the medium scenario includes per diems for additional staff for those facilities where health workers usually receive per diems for outreach immunization, and in the high intensity scenario, per diems for additional team members were included for all facilities in Kabupaten Pulang Pisau, the only district which pays per diem for outreach activities.

*Figure 2 - Incremental cost per dose due to physical distancing and screening (in 2020 USD and as % change from baseline)*

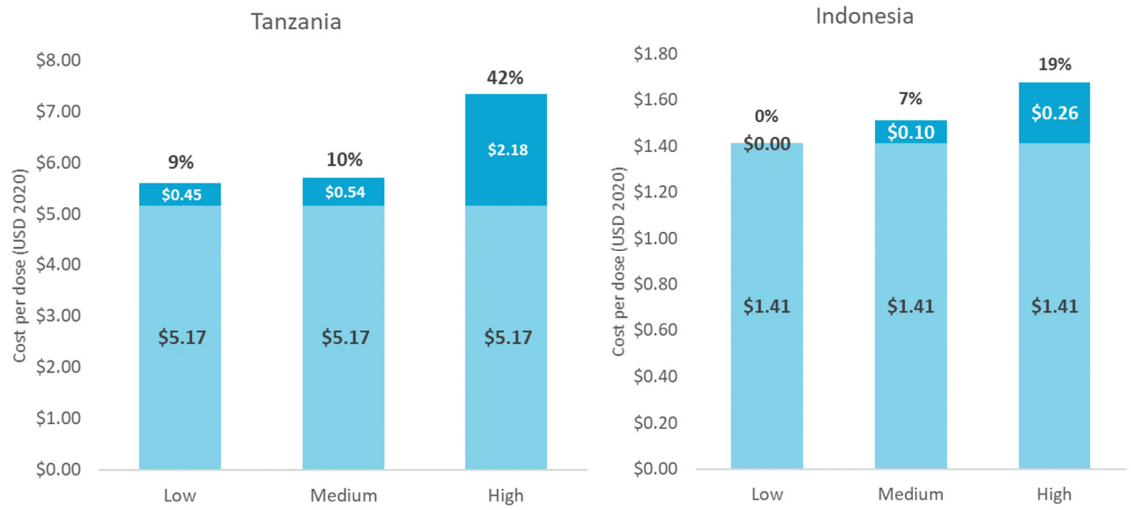



*Table 9 - Start-up and recurrent cost for physical distancing and screening measures for an average health facility, in 2020 USD*

| | | Tanzania | | | Indonesia | | |
|---|---|---|---|---|---|---|---|
| **Intensity** | **Cost component** | **Start-up cost** | **Recurrent cost per month** | **6-month total** | **Start-up cost** | **Recurrent cost per month** | **6-month total** |
| **Low** | Crowd controller (per diem, no PPE) | $0 | $18 | $108 | $0 | $0 | $0 |
| | Infrared thermometer | $0 | $0 | $0 | $0 | $0 | $0 |
| | **Total** | **$0** | **$18** | **$108** | **$0** | **$0** | **$0** |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Medium** | Crowd controller (per diem, masks) | $0 | $21 | $127 | $0 | $41 | $248 |
| | Infrared thermometer | $0 | $0 | $0 | $0 | $0 | $0 |
| | **Total** | **$0** | **$21** | **$127** | **$0** | **$41** | **$248** |
| **High** | Crowd controller (per diem, masks and gloves) | $0 | $43 | $256 | $0 | $104 | $625 |
| | Infrared thermometer | $37 | $0 | $37 | $70 | $0 | $70 |
| | **Total** | **$37** | **$43** | **$293** | **$70** | **$104** | **$695** |

## 3. Changes in the frequency and size of outreach immunization sessions

**The savings from conducting outreach half as often are limited (-16% in Tanzania, -2% in Indonesia), while increasing the frequency of outreach with smaller session sizes would result in a very large cost increase (40-119% in Tanzania, 18-65% in Indonesia).** Conducting outreach less often to reach the same number of children would require doubling the session size. In same cases, session sizes were already large, and a doubling was not considered feasible. For any facility, if a doubling of the number of children covered in session surpassed the 75% percentile, the frequency of outreach at the facility was kept as per the baseline. In Indonesia, some districts also had such a small population spread out over a large area, that covering double the number of children was not considered feasible. However, doubling (medium intensity) or quadrupling (high intensity) the frequency of outreach, and reducing the session size accordingly is always possible, and the cost increase associated with that would be very large.

*Figure 3 - Incremental cost per dose due to changes in frequency and size of outreach sessions (in 2020 USD and as % change from baseline)*

*Table 10 – Average start-up and recurrent cost for changes in frequency and size of outreach sessions for one health facility in 2020 USD*

| | | Tanzania | | Indonesia | |
|---|---|---|---|---|---|
| **Intensity** | **Cost component** | **Recurrent cost per month** | **6-month total** | **Recurrent cost per month** | **6-month total** |
| **Low** | Transport | -$2 | -$9 | -$16 | -$96 |
| | Per diem | -$26 | -$153 | $0 | $0 |
| | **Total** | **-$27** | **-$162** | **-$16** | **-$96** |
| **Medium** | Transport | $7 | $42 | $85 | $85 |
| | Per diem | $73 | $438 | $5 | $29 |
| | **Total** | **$80** | **$480** | **$90** | **$542** |
| **High** | Transport | $21 | $125 | $256 | $1,538 |
| | Per diem | $219 | $1,314 | $55 | $328 |
| | **Total** | **$240** | **$1,439** | **$311** | **$1,866** |

### 4. Increased outreach volumes to compensate for a reduction in facility-based routine coverage

**An increase in the number of children covered through outreach to compensate for a 10-50% drop in coverage at facilities could increase the cost of outreach per dose by 10-11% (Tanzania).** This scenario looked at the additional costs associated with larger or additional outreach sessions required to compensate for a drop in the number of children immunized at facilities. In Tanzania, the effect could be 10% in the case of a 10-25% drop or 11% if facility-based coverage would drop to 50%. In Indonesia, many facilities do not deliver immunization services from anywhere but outreach posts and schools, and even those that do, currently deliver very few doses per session in outreach. Therefore, a percentage reduction in facility-based coverage had little to no effect on the cost and volume of outreach delivery. As data was also available on school-based delivery in Indonesia, the analysis also assessed the cost impact of a drop in school-based volume by 50-100%. Even if school-based delivery would be cancelled altogether, the impact on the cost of conducting outreach would be small, as many of the staff at these facilities did not pay per diems for outreach, and the increase in transports for extra sessions was largely offset by the increase in denominator (larger number of doses delivered in outreach).

*Figure 4 - Incremental cost per dose due to increased outreach volumes (in 2020 USD and as % change from baseline)*

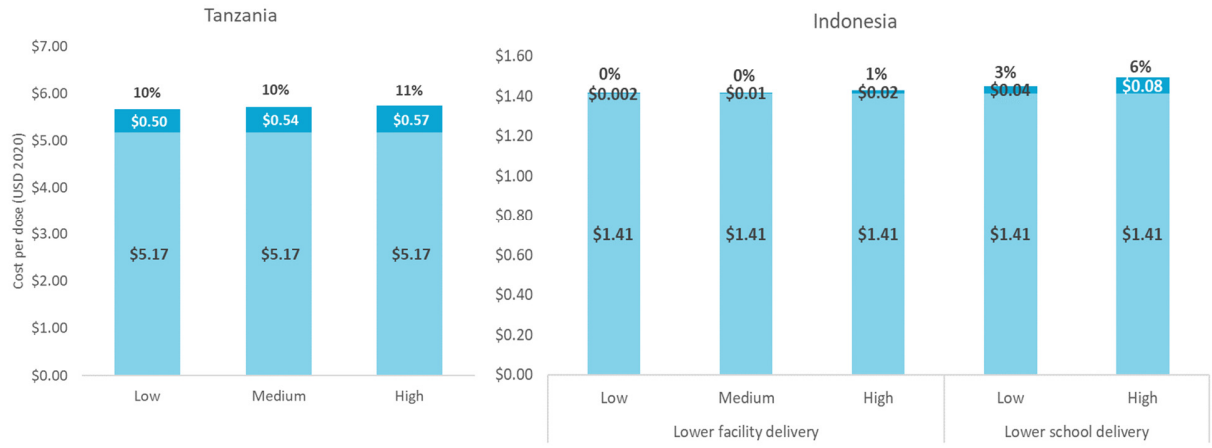



*Table 11 - Start-up and recurrent cost for increased outreach volumes for one health facility, in 2020 USD*

| | | Tanzania | | Indonesia | | | |
|---|---|---|---|---|---|---|---|
| | | Compensating for drop in doses delivered at facilities | | Compensating for drop in doses delivered at facilities | | Compensating for a reduction in school-based delivery | |
| **Intensity** | **Component** | **Recurrent cost per month** | **6-month total** | **Recurrent cost per month** | **6-month total** | **Recurrent cost per month** | **6-month total** |
| **Low** | Transport | $6 | $33 | $1 | $6 | $13 | $79 |
| | Per diem | $134 | $802 | $0 | $0 | $1 | $6 |
| | **Total** | **$139** | **$836** | **$1** | **$6** | **$14** | **$84** |
| **Medium** | Transport | $14 | $84 | $2 | $15 | - | - |
| | Per diem | $334 | $2,006 | $0 | $0 | - | - |
| | **Total** | **$348** | **$2,090** | **$2** | **$15** | **-** | **-** |
| **High** | Transport | $28 | $167 | $5 | $29 | $26 | $157 |
| | Per diem | $669 | $4,012 | $3 | $17 | $8 | $49 |
| | **Total** | **$697** | **$4,179** | **$8** | **$47** | **$34** | **$206** |

### Total cost of PPE & IPC (1), physical distancing & screening (2) and compensating for drops in facility-based coverage (4)

**When combining the addition of PPE and IPC measures at outreach sites, added staff and thermometers for physical distancing and screening, and the impact of a reduction in facility- and/or school-based delivery together, the outreach delivery cost per dose could increase by 34-129% in Tanzania or 20-88% in Indonesia.** In both countries, offering hand washing stations and hand sanitizer during outreach sessions, and providing PPE for health workers has the largest impact on the cost of delivering outreach. This is followed by the effect of increasing the size of outreach teams to support with

crowd control and screening and equipping them with thermometers. The impact in Indonesia is lower as the 'status quo' volume delivered through outreach was higher.

*Figure 5 - Cumulative incremental cost per dose by intervention, in 2020 USD (and overall % increase from baseline)*

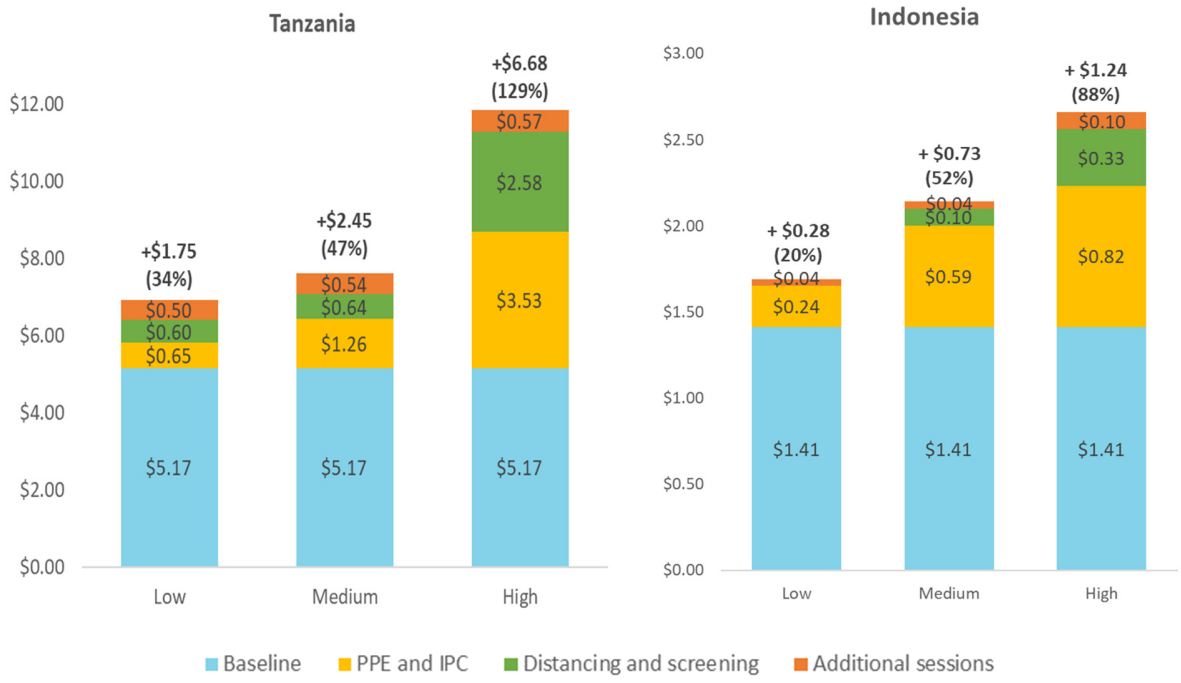



*Table 12 - Start-up and recurrent cost for PPE and IPC measures, physical distancing and screening, and compensating for a drop in facility-based (and school-based) delivery by component, for an average health facility in Indonesia, in 2020 USD*

| | | Tanzania | | | Indonesia | | |
|---|---|---|---|---|---|---|---|
| **Intensity** | **Cost component** | **Start-up cost** | **Recurrent cost per month** | **6-month total** | **Start-up cost** | **Recurrent cost per month** | **6-month total** |
| **Low** | PPE and IPC | $12 | $23 | $148 | $27 | $119 | $740 |
| | Physical distancing | $0 | $41 | $249 | $0 | $0 | $0 |
| | Extra sessions | $0 | $96 | $577 | $0 | $15 | $90 |
| | **Total** | **$12** | **$160** | **$974** | **$27** | **$134** | **$830** |
| **Medium** | PPE and IPC | $12 | $115 | $704 | $27 | $266 | $1,623 |
| | Physical distancing | $0 | $88 | $530 | $0 | $43 | $257 |
| | Extra sessions | $0 | $240 | $1,442 | $0 | $16 | $99 |
| | **Total** | **$12** | **$444** | **$2,676** | **$27** | **$325** | **$1,979** |
| **High** | PPE and IPC | $107 | $163 | $1,083 | $195 | $377 | $2,459 |
| | Physical distancing | $67 | $414 | $2,549 | $84 | $135 | $893 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Extra sessions | $0 | $481 | $2,883 | $0 | $42 | $253 |
| | **Total** | **$174** | **$1,057** | **$6,515** | **$279** | **$520** | **$3,399** |

### Disaggregated results by geographic area, facility volume and delivery strategy mix

**Although absolute cost per dose increases were highest for areas that started with high delivery costs (rural areas), the percentage increase in cost was higher for areas that had low baseline delivery costs (urban).** For both the Tanzania and Indonesia data, the absolute increase in the cost per dose of precautionary measures and changes in the way outreach is delivered was highest in areas for which the baseline costs (delivery as per pre-COVID-19 guidelines) were highest. However, the percentage increase was highest for areas where the initial baseline cost was lowest (urban areas). In Tanzania, in rural areas, the cumulative cost of the scenarios could increase the cost of delivering immunization in outreach per dose by 119% in the high intensity scenario, while in urban areas, the increase in delivery cost per dose is almost double at 186%. For Indonesia, the difference is smaller, but the increase is still higher in urban areas that started from lower baseline costs. Annex B and C also show disaggregated results by delivery volume and proportion of strategies used. Generally, the cost increase per dose was highest for facilities that normally deliver few doses in outreach, compared to those that already delivered a large share of their immunization doses through outreach. Furthermore, the increase in cost per dose was highest for facilities whose annual dose output using all delivery strategies was around the average for the facilities in that country.

*Figure 6 - Cumulative incremental cost per dose by intervention and geographic area in Tanzania, in 2020 USD (and overall % increase from baseline)*

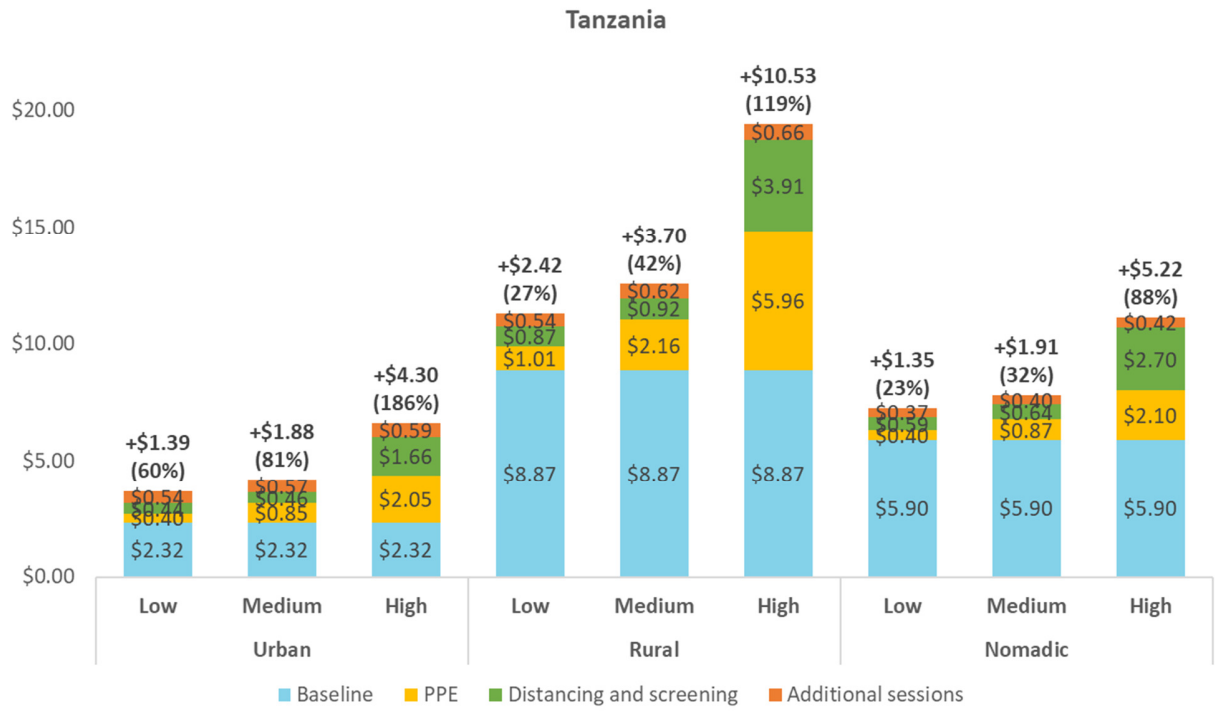
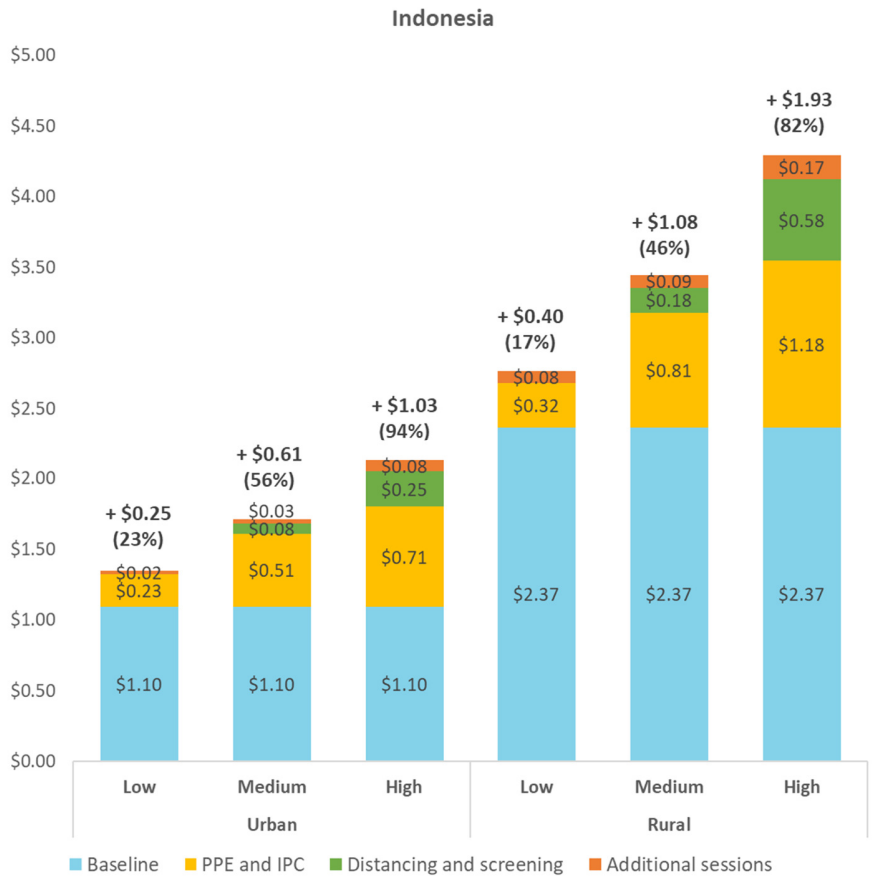


*Figure 7 - Cumulative incremental cost per dose by intervention and geographic area in Indonesia, in 2020 USD (and overall % increase from baseline)*




## LIMITATIONS

**There are several important limitations of this analysis that should be noted.** Due to the limited availability of detailed primary data available on the cost of conducting outreach immunization activities compared with the delivery of immunization at facilities, this analysis included only two countries. Both countries have different specificities with regards to their outreach strategies, and the results are illustrative. Country-specific guidance and policies should be reviewed before translating these results to other country contexts. Prices for COVID-19 response materials are also changing rapidly, which will affect the accuracy of the results of this analysis over time. Furthermore, several assumptions had to be made on the feasible size of an outreach sessions and the number children that can be reached during a given session, which have not been validated with the individual facilities or districts in the original sample. Naturally, any errors and limitations that applied to the original data collected also apply to the scenarios costed in this analysis. Last, the analysis does not take into account that many of the additional costs included in the scenarios could be shared across programs, and would not have to be borne by the immunization program only. Co-delivery of immunization with other health services could result in efficiencies that have not been taken into account. A forthcoming study from ICAN on the Sierra Leone campaign during which MR, polio, Vitamin A supplements and deworming tablets were administered, will offer lessons on potential efficiencies associated with co-delivery.

## CONCLUSION

**Through the examples of Tanzania and Indonesia, this analysis is meant to illustrate the impact that several delivery strategy changes in response to COVID-19 could have on the cost of delivering outreach immunization services in low- and middle-income countries.** It shows that PPE for health workers and IPC facilities during outreach sessions would have a considerable impact on the cost of delivering outreach. However, most of these costs would have also been incurred if those doses would have been delivered through facility-based immunization, and countries should consider the results of this analysis next to cost analyses for facility-based routine service delivery (such as the one conducted by the Harvard T.H. Chan School of Public Health, also available on *www.immmunizationeconomics.org*). Compensating for a reduction in attendance at facility-based immunization sessions through additional outreach showed a more moderate impact on the cost per dose delivered through outreach. This data can be helpful for countries to determine their optimal mix of delivery strategies during and in the aftermath of COVID-19 community transmission scenarios. However, countries should keep in mind their specific context, as the current delivery strategy mix, facilities' total vaccination volumes as well as outreach sites and team composition all determine the precise cost implications.

## ANNEX A – PRICE ASSUMPTIONS

### Table 13 - Unit costs of PPE and screening supplies (USD 2020)

| Item | Unit cost (USD 2020) | Source |
|---|---|---|
| 1 mask | $ 0.70 | WHO forecasting spreadsheet |
| 1 set of gloves | $ 0.06 | WHO forecasting spreadsheet |
| 1 pair of goggles | $ 2.80 | WHO forecasting spreadsheet |
| 1 biohazard bag | $ 0.15 | WHO forecasting spreadsheet |
| 1 unit of soap (1 l.) | $ 0.90 | WHO forecasting spreadsheet |
| 1 60-liter bucket | $ 6.23 | Freedman et al. |
| 1 stand | $ 31.15 | Freedman et al. |
| 1 basin | $ 2.27 | Freedman et al. |
| Infrared thermometer | $ 36.88 | UNICEF supply catalogue |
| Hand sanitizer (1 l.) | $ 8.30 | WHO forecasting spreadsheet |

## ANNEX B – TANZANIA RESULTS TABLES

**Table 14 - Baseline cost per dose and description of the sample data, by geographic area, total facility output and proportion of doses delivered in outreach in Tanzania (all costs are in 2020 USD)**

| | Baseline cost per dose | N. facilities | Median annual number of doses | Median % of doses delivered through outreach | Median n. outreach doses per session/day | Median n. sessions per month | Median n. staff per outreach session | Median n. CHW per outreach session | Median outreach per diem per person | Median transport cost per session |
|---|---|---|---|---|---|---|---|---|---|---|
| **Overall** | $5.17 | 26 | 7,654 | 14% | 34.0 | 2.1 | 2 | 0 | $7.9 | $2.0 |
| **By geographic area** | | | | | | | | | | |
| **Urban** | $2.32 | 5 | 7,883 | 10% | 40.6 | 2.0 | 2 | 1 | $10.5 | $2.0 |
| **Rural** | $8.87 | 13 | 3,491 | 9% | 8.9 | 2.0 | 2 | 2 | $7.9 | $2.0 |
| **Nomad** | $5.90 | 8 | 5,181 | 15% | 28.2 | 1.5 | 1 | 0 | $9.2 | $1.5 |
| **By facility: annual total number of doses delivered** | | | | | | | | | | |
| **Up to 2500** | $1.84 | 6 | 2,032 | 7% | 7.7 | 1.4 | 2 | 0 | $7.9 | $1.3 |
| **2501 to 5000** | $2.08 | 7 | 3,491 | 15% | 10.5 | 2.6 | 1 | 2 | $7.9 | $2.0 |
| **5001 to 10,000** | $1.96 | 8 | 6,216 | 10% | 43.1 | 2.1 | 1.5 | 0 | $10.5 | $2.0 |
| **10,000+** | $11.21 | 5 | 14,747 | 1% | 26.3 | 2.2 | 2 | 2 | $7.9 | $2.0 |
| **By facility: proportion of doses delivered through outreach** | | | | | | | | | | |
| **Up to 6%** | $14.15 | 10 | 5,385 | 5% | 8.8 | 1.9 | 2 | 2 | $7.9 | $2.0 |
| **6% to 15%** | $1.34 | 5 | 5,506 | 10% | 34.3 | 1.5 | 2 | 0 | $7.9 | $1.0 |
| **15% to 30%** | $1.28 | 8 | 3,549 | 20% | 30.6 | 2.4 | 1.5 | 0 | $7.9 | $2.5 |
| **30%+** | $0.32 | 3 | 7,213 | 39% | 116.2 | 2.7 | 1 | 2 | $10.5 | $2.0 |

**Table 15 - Incremental cost per dose by scenario, geographic area, annual facility output, and by proportion of outreach doses delivered in Tanzania, in 2020 USD and as % increase from baseline**

| | Baseline | (1) PPE and IPC measures | | | (2) Distancing and screening | | | (3) Fewer (larger) or more frequent (larger) sessions | | | (4) Compensating for a drop in facility-based demand | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Low | Medium | High | Low | Medium | High | Low | Medium | High | Low | Medium | High |
| **Overall** | **$5.17** | $0.58 (11%) | $0.95 (18%) | $3.14 (61%) | $0.45 (9%) | $0.54 (10%) | $2.18 (42%) | -$0.85 (-16%) | $2.05 (40%) | $6.16 (119%) | $0.50 (10%) | $0.54 (10%) | $0.57 (11%) |
| **By geographic area** | | | | | | | | | | | | | |
| **Urban** | **$2.32** | $0.35 (15%) | $0.60 (26%) | $1.78 (77%) | $0.31 (13%) | $0.36 (15%) | $1.28 (55%) | -$0.92 (-40%) | $1.92 (83%) | $5.75 (248%) | $0.54 (24%) | $0.57 (25%) | $0.59 (25%) |
| **Rural** | **$8.87** | $0.95 (11%) | $1.69 (19%) | $5.35 (60%) | $0.74 (8%) | $0.92 (10%) | $3.70 (42%) | -$1.33 (-15%) | $3.44 (39%) | $10.32 (116%) | $0.54 (6%) | $0.62 (7%) | $0.66 (7%) |
| **Nomadic** | **$5.90** | $0.58 (10%) | $0.69 (12%) | $2.95 (50%) | $0.34 (6%) | $0.41 (7%) | $2.00 (34%) | -$0.15 (-3%) | $0.68 (11%) | $2.03 (34%) | $0.37 (6%) | $0.40 (7%) | $0.42 (7%) |
| **By facility: annual total number of doses delivered** | | | | | | | | | | | | | |
| **Up to 2500** | **$1.84** | $0.27 (15%) | $0.43 (23%) | $1.61 (87%) | $0.18 (10%) | $0.23 (12%) | $1.05 (57%) | -$0.44 (-24%) | $0.93 (51%) | $2.80 (152%) | $0.07 (4%) | $0.08 (5%) | $0.09 (5%) |
| **2501 to 5000** | **$2.08** | $0.29 (14%) | $0.47 (23%) | $1.50 (72%) | $0.27 (13%) | $0.33 (16%) | $1.19 (57%) | -$0.15 (-7%) | $0.98 (47%) | $2.93 (141%) | $0.36 (17%) | $0.41 (20%) | $0.45 (22%) |
| **5001 to 10,000** | **$1.96** | $0.33 (17%) | $0.44 (23%) | $1.58 (81%) | $0.16 (8%) | $0.20 (10%) | $1.00 (51%) | -$0.18 (-9%) | $0.59 (30%) | $1.76 (90%) | $0.21 (11%) | $0.24 (12%) | $0.26 (13%) |
| **10,000+** | **$11.21** | $0.98 (9%) | $1.64 (15%) | $5.39 (48%) | $0.78 (7%) | $0.93 (8%) | $3.76 (34%) | -$1.63 (-15%) | $3.54 (32%) | $10.62 (95%) | $0.81 (7%) | $0.85 (8%) | $0.87 (8%) |
| **By facility: proportion of doses delivered through outreach** | | | | | | | | | | | | | |
| **Up to 6%** | **$14.15** | $1.42 (10%) | $2.35 (17%) | $8.05 (57%) | $1.08 (8%) | $1.30 (9%) | $5.51 (39%) | -$2.32 (-16%) | $5.14 (36%) | $15.42 (109%) | $1.34 (9%) | $1.40 (10%) | $1.43 (10%) |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **6% to 15%** | **$1.34** | $0.18 (14%) | $0.27 (20%) | $0.95 (71%) | $0.12 (9%) | $0.15 (11%) | $0.64 (48%) | -$0.06 (-5%) | $0.42 (32%) | $1.27 (95%) | $0.04 (3%) | $0.06 (4%) | $0.07 (5%) |
| **15% to 30%** | **$1.28** | $0.21 (17%) | $0.28 (22%) | $0.87 (68%) | $0.16 (12%) | $0.19 (15%) | $0.70 (55%) | -$0.03 (-2%) | $0.36 (28%) | $1.07 (83%) | $0.05 (4%) | $0.10 (8%) | $0.13 (10%) |
| **30%+** | **$0.32** | $0.06 (20%) | $0.09 (27%) | $0.21 (65%) | $0.04 (11%) | $0.04 (13%) | $0.14 (44%) | $0.00 (0%) | $0.12 (37%) | $0.35 (112%) | $0.01 (4%) | $0.03 (8%) | $0.04 (12%) |

**Table 16 - Cumulative cost per dose of implementing PPE and IPC (1), distancing and screening measures (2), and of increasing outreach sessions to compensate for a drop in facility-based delivery (4) by geographic area, annual doses delivered and proportion of doses delivered in outreach in Tanzania, in 2020 USD and as % increase from baseline**

| | Baseline | Low | Medium | High |
|---|---|---|---|---|
| **Overall** | **$5.17** | $1.75 (34%) | $2.45 (47%) | $6.68 (129%) |
| **By geographic area** | | | | |
| **Urban** | **$2.32** | $1.39 (60%) | $1.88 (81%) | $4.30 (186%) |
| **Rural** | **$8.87** | $2.42 (27%) | $3.70 (42%) | $10.53 (119%) |
| **Nomadic** | **$5.90** | $1.59 (27%) | $2.01 (34%) | $6.39 (108%) |
| **By facility: annual total number of doses delivered** | | | | |
| **Up to 2500** | **$1.84** | $0.54 (30%) | $0.80 (43%) | $2.85 (155%) |
| **2501 to 5000** | **$2.08** | $1.03 (50%) | $1.50 (72%) | $3.67 (177%) |
| **5001 to 10,000** | **$1.96** | $0.77 (39%) | $1.05 (54%) | $3.18 (163%) |
| **10,000+** | **$11.21** | $2.87 (26%) | $4.00 (36%) | $11.28 (101%) |
| **By facility: proportion of doses delivered through outreach** | | | | |
| **Up to 6%** | **$14.15** | $4.30 (30%) | $6.00 (42%) | $16.87 (119%) |
| **6% to 15%** | **$1.34** | $0.36 (27%) | $0.53 (40%) | $1.79 (133%) |
| **15% to 30%** | **$1.28** | $0.45 (35%) | $0.65 (51%) | $1.89 (148%) |
| **30%+** | **$0.32** | $0.11 (36%) | $0.17 (54%) | $0.43 (137%) |

**Table 17 - Start-up and recurrent cost by component and geographic area, for an average health facility in Tanzania, in 2020 USD**

| Intensity | Cost component | Urban | | | Rural | | | Nomadic | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Start-up cost | Recurrent cost per month | 6-month total | Start-up cost | Recurrent cost per month | 6-month total | Start-up cost | Recurrent cost per month | 6-month total |
| Low | PPE and IPC | $12 | $28 | $179 | $12 | $19 | $127 | $12 | $17 | $113 |
| | Physical distancing | $0 | $50 | $298 | $0 | $27 | $160 | $0 | $43 | $256 |
| | Extra sessions | $0 | $156 | $936 | $0 | $38 | $230 | $0 | $42 | $249 |
| | **Total** | **$12** | **$233** | **$1,412** | **$12** | **$84** | **$518** | **$12** | **$101** | **$618** |
| Medium | PPE and IPC | $12 | $164 | $995 | $12 | $80 | $490 | $12 | $60 | $371 |
| | Physical distancing | $0 | $105 | $628 | $0 | $48 | $290 | $0 | $102 | $610 |
| | Extra sessions | $0 | $390 | $2,340 | $0 | $96 | $576 | $0 | $104 | $623 |
| | **Total** | **$12** | **$658** | **$3,963** | **$12** | **$224** | **$1,356** | **$12** | **$265** | **$1,604** |
| High | PPE and IPC | $112 | $229 | $1,483 | $87 | $161 | $1,052 | $122 | $96 | $698 |
| | Physical distancing | $71 | $530 | $3,249 | $37 | $208 | $1,284 | $94 | $416 | $2,593 |
| | Extra sessions | $0 | $780 | $4,679 | $0 | $192 | $1,152 | $0 | $208 | $1,246 |
| | **Total** | **$183** | **$1,538** | **$9,412** | **$124** | **$561** | **$3,488** | **$216** | **$720** | **$4,536** |

**Table 18 - Start-up and recurrent cost by component and health facility annual output, for an average health facility in Tanzania, in 2020 USD**

| Intensity | Cost component | Up to 2,500 doses | | | 2,501 to 5,000 doses | | | 5,001 to 10,000 doses | | | 10,000+ doses | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Start-up cost | Recurrent cost per month | 6-month total | Start-up cost | Recurrent cost per month | 6-month total | Start-up cost | Recurrent cost per month | 6-month total | Start-up cost | Recurrent cost per month | 6-month total |
| Low | PPE and IPC | $2 | $1 | $11 | $6 | $6 | $43 | $10 | $13 | $87 | $19 | $43 | $277 |
| | Physical distancing | $0 | $2 | $12 | $0 | $16 | $93 | $0 | $19 | $113 | $0 | $83 | $496 |
| | Extra sessions | $0 | $1 | $9 | $0 | $16 | $94 | $0 | $15 | $92 | $0 | $203 | $1,221 |
| | **Total** | **$2** | **$5** | **$32** | **$6** | **$37** | **$231** | **$10** | **$47** | **$292** | **$19** | **$329** | **$1,994** |
| Medium | PPE and IPC | $2 | $6 | $36 | $6 | $28 | $173 | $10 | $34 | $213 | $19 | $238 | $1,448 |
| | Physical distancing | $0 | $4 | $22 | $0 | $27 | $161 | $0 | $31 | $187 | $0 | $193 | $1,159 |
| | Extra sessions | $0 | $4 | $21 | $0 | $39 | $235 | $0 | $38 | $230 | $0 | $509 | $3,052 |
| | **Total** | **$2** | **$13** | **$79** | **$6** | **$94** | **$569** | **$10** | **$103** | **$630** | **$19** | **$940** | **$5,659** |
| High | PPE and IPC | $16 | $6 | $54 | $39 | $35 | $247 | $68 | $46 | $345 | $198 | $434 | $2,801 |
| | Physical distancing | $7 | $11 | $76 | $17 | $98 | $607 | $30 | $113 | $707 | $147 | $932 | $5,737 |
| | Extra sessions | $0 | $7 | $43 | $0 | $78 | $470 | $0 | $77 | $460 | $0 | $1,017 | $6,104 |
| | **Total** | **$24** | **$25** | **$172** | **$56** | **$211** | **$1,324** | **$98** | **$236** | **$1,512** | **$345** | **$2,383** | **$14,642** |

**Table 19 - Start-up and recurrent cost by component and proportion of outreach doses delivered, for an average health facility in Tanzania, in 2020 USD**

| Intensity | Cost component | Up to 6% of total doses | | | 6% to 15% of total doses | | | 15% to 30% of total doses | | | 30%+ of total doses | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Start-up cost | Recurrent cost per month | 6-month total | Start-up cost | Recurrent cost per month | 6-month total | Start-up cost | Recurrent cost per month | 6-month total | Start-up cost | Recurrent cost per month | 6-month total |
| Low | PPE and IPC | $20 | $36 | $239 | $5 | $3 | $25 | $8 | $12 | $81 | $5 | $11 | $73 |
| | Physical distancing | $0 | $86 | $518 | $0 | $7 | $43 | $0 | $17 | $100 | $0 | $9 | $53 |
| | Extra sessions | $0 | $222 | $1,330 | $0 | $3 | $20 | $0 | $7 | $42 | $0 | $4 | $24 |
| | **Total** | **$20** | **$345** | **$2,088** | **$5** | **$14** | **$88** | **$8** | **$36** | **$223** | **$5** | **$24** | **$149** |
| Medium | PPE and IPC | $20 | $244 | $1,487 | $5 | $7 | $44 | $8 | $24 | $152 | $5 | $23 | $141 |
| | Physical distancing | $0 | $208 | $1,245 | $0 | $11 | $65 | $0 | $25 | $147 | $0 | $12 | $71 |
| | Extra sessions | $0 | $554 | $3,325 | $0 | $8 | $49 | $0 | $18 | $105 | $0 | $10 | $59 |
| | **Total** | **$20** | **$1,006** | **$6,057** | **$5** | **$26** | **$158** | **$8** | **$66** | **$405** | **$5** | **$44** | **$271** |
| High | PPE and IPC | $204 | $359 | $2,361 | $31 | $39 | $264 | $53 | $65 | $445 | $33 | $26 | $192 |
| | Physical distancing | $151 | $1,010 | $6,209 | $14 | $35 | $224 | $23 | $73 | $462 | $14 | $36 | $231 |
| | Extra sessions | $0 | $1,108 | $6,649 | $0 | $16 | $99 | $0 | $35 | $210 | $0 | $20 | $119 |
| | **Total** | **$355** | **$2,477** | **$15,219** | **$45** | **$90** | **$586** | **$76** | **$174** | **$1,118** | **$46** | **$83** | **$542** |

## ANNEX C – INDONESIA RESULTS TABLES

**Table 20 - Baseline cost per dose and description of the sample data, by geographic area, total facility output and proportion of doses delivered in outreach in Indonesia (all costs are in 2020 USD)**

| | Baseline cost per dose | Number of facilities | Median number of doses delivered per month | Median % of doses delivered through outreach | Median n. outreach doses per session/day | Median n. sessions per month | Median n. staff per outreach session | Median n. CHW per outreach session | Median outreach per diem per person | Median transport cost per session |
|---|---|---|---|---|---|---|---|---|---|---|
| **Overall** | $5.17 | 24 | 617 | 67% | 11 | 24 | 2 | 2 | $0.00 | $2.82 |
| **By geographic area** | | | | | | | | | | |
| **Urban** | $1.10 | 14 | 844 | 55% | 11 | 23 | 2 | 1 | $0.00 | $2.82 |
| **Rural** | $2.37 | 10 | 381 | 70% | 10 | 24 | 2 | 2 | $0.00 | $3.22 |
| **By facility: annual total number of doses delivered** | | | | | | | | | | |
| **<5000** | $3.11 | 10 | 307 | 70% | 11 | 15 | 2 | 2 | $0.40 | $8.05 |
| **5000-10,000** | $1.54 | 6 | 627 | 63% | 9 | 48 | 2 | 2 | $0.00 | $2.42 |
| **10000+** | $0.87 | 8 | 1242 | 55% | 21 | 32 | 2 | 0 | $0.00 | $2.82 |
| **By facility: proportion of doses delivered through outreach** | | | | | | | | | | |
| **35-65%** | $1.12 | 11 | 680 | 55% | 10 | 38 | 2 | 2 | $0.00 | $2.42 |
| **65-80%** | $1.82 | 13 | 369 | 71% | 12 | 17 | 2 | 0 | $0.00 | $4.03 |

**Table 21 - Incremental cost per dose by scenario, geographic area, annual facility output, and by proportion of outreach doses delivered in Indonesia, in 2020 USD and as % increase from baseline**

| | Baseline | (1) PPE and IPC measures | | | (2) Distancing and screening | | | (3) Fewer (larger) or more frequent (larger) sessions | | | (4A) Compensating for a drop in facility-based demand | | | (4B) Compensating for a drop in school-based delivery | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Low | Medium | High | Low | Medium | High | Low | Medium | High | Low | Medium | High | Low | High |
| **Overall** | **$1.41** | $0.20 (14%) | $0.54 (38%) | $0.63 (45%) | $0.00 (0%) | $0.10 (7%) | $0.26 (19%) | -$0.02 (-2%) | $0.25 (18%) | $0.92 (65%) | $0.002 (0%) | $0.01 (0%) | $0.02 (1%) | $0.04 (3%) | $0.08 (6%) |
| **By geographic area** | | | | | | | | | | | | | | | |
| **Urban** | **$1.10** | $0.18 (17%) | $0.47 (43%) | $0.56 (51%) | $0.00 (0%) | $0.07 (7%) | $0.21 (19%) | -$0.03 (-3%) | $0.17 (16%) | $0.73 (67%) | $0.003 (0%) | $0.01 (1%) | $0.02 (2%) | $0.02 (2%) | $0.06 (5%) |
| **Rural** | **$2.37** | $0.26 (11%) | $0.74 (31%) | $0.85 (36%) | $0.00 (0%) | $0.17 (7%) | $0.43 (18%) | $0.00 (0%) | $0.48 (20%) | $1.49 (63%) | $0.004 (0%) | $0.01 (0%) | $0.02 (1%) | $0.08 (3%) | $0.15 (6%) |
| **By facility: proportion of doses delivered through outreach** | | | | | | | | | | | | | | | |
| **35-65%** | **$1.12** | $0.20 (18%) | $0.59 (53%) | $0.69 (61%) | $0.00 (0%) | $0.09 (8%) | $0.24 (22%) | -$0.03 (-2%) | $0.17 (15%) | $0.68 (61%) | $0.003 (0%) | $0.01 (1%) | $0.02 (2%) | $0.02 (2%) | $0.06 (5%) |
| **65-80%** | **$1.82** | $0.21 (11%) | $0.47 (26%) | $0.55 (30%) | $0.00 (0%) | $0.11 (6%) | $0.29 (16%) | -$0.02 (-1%) | $0.36 (20%) | $1.27 (69%) | $0.002 (0%) | $0.005 (0%) | $0.01 (0%) | $0.05 (3%) | $0.11 (6%) |
| **By facility: annual total number of doses delivered** | | | | | | | | | | | | | | | |
| **<5000** | **$3.11** | $0.23 (20%) | $0.95 (85%) | $1.07 (96%) | $0.00 (0%) | $0.20 (18%) | $0.58 (52%) | $0.00 (0%) | $0.72 (64%) | $3.14 (281%) | $0.01 (1%) | $0.02 (2%) | $0.09 (8%) | $0.12 (11%) | $0.32 (28%) |
| **5000-10000** | **$1.54** | $0.30 (20%) | $0.78 (50%) | $0.90 (58%) | $0.00 (0%) | $0.12 (8%) | $0.32 (21%) | -$0.02 (-1%) | $0.30 (20%) | $0.91 (59%) | $0.005 (0%) | $0.01 (1%) | $0.02 (1%) | $0.05 (3%) | $0.09 (6%) |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **10000+** | **$0.87** | $0.16 (9%) | $0.33 (18%) | $0.39 (22%) | $0.00 (0%) | $0.06 (3%) | $0.15 (8%) | -$0.03 (-2%) | $0.09 (5%) | $0.28 (15%) | $0.001 (0%) | $0.002 (0%) | $0.01 (0%) | $0.01 (0%) | $0.01 (1%) |

**Table 22 - Cumulative cost per dose of implementing PPE and IPC (1), distancing and screening measures (2), and of increasing outreach sessions to compensate for a drop in facility-based delivery (4) by geographic area, annual doses delivered and proportion of doses delivered in outreach in Indonesia, in 2020 USD and as % increase from baseline**

| | Baseline | Low | Medium | High |
|---|---|---|---|---|
| **Overall** | **$1.41** | $0.28 (20%) | $0.73 (52%) | $1.24 (88%) |
| **By geographic area** | | | | |
| **Urban** | **$1.10** | $0.25 (23%) | $0.61 (56%) | $1.03 (94%) |
| **Rural** | **$2.37** | $0.40 (17%) | $1.08 (46%) | $1.93 (82%) |
| **By facility: proportion of doses delivered through outreach** | | | | |
| **<5000** | **$3.11** | $0.40 (13%) | $1.38 (44%) | $2.70 (87%) |
| **5000-10000** | **$1.54** | $0.41 (27%) | $1.04 (68%) | $1.75 (114%) |
| **10000+** | **$0.87** | $0.19 (22%) | $0.42 (49%) | $0.65 (75%) |
| **By facility: proportion of doses delivered through outreach** | | | | |
| **35-65%** | **$1.12** | $0.26 (23%) | $0.76 (68%) | $1.27 (114%) |
| **65-80%** | **$1.82** | $0.29 (16%) | $0.68 (37%) | $1.19 (65%) |

**Table 23 - Start-up and recurrent cost by component and geographic area, for an average health facility in Indonesia, in 2020 USD**

| Intensity | Cost component | Urban | | | Rural | | |
|---|---|---|---|---|---|---|---|
| | | Start-up cost | Recurrent cost per month | 6-month total | Start-up cost | Recurrent cost per month | 6-month total |
| Low | PPE and IPC | $25 | $118 | $736 | $31 | $118 | $741 |
| | Physical distancing | $0 | $0 | $0 | $0 | $0 | $0 |
| | Extra sessions | $0 | $10 | $58 | $0 | $31 | $185 |
| | **Total** | **$25** | **$128** | **$794** | **$31** | **$149** | **$926** |
| Medium | PPE and IPC | $25 | $260 | $1,583 | $31 | $281 | $1,718 |
| | Physical distancing | $0 | $38 | $225 | $0 | $58 | $349 |
| | Extra sessions | $0 | $11 | $67 | $0 | $33 | $197 |
| | **Total** | **$25** | **$308** | **$1,874** | **$31** | **$372** | **$2,264** |
| High | PPE and IPC | $180 | $357 | $2,320 | $269 | $427 | 2,832 |
| | Physical distancing | $77 | $113 | $757 | $118 | $201 | $1,322 |
| | Extra sessions | $0 | $33 | $198 | $0 | $68 | $406 |
| | **Total** | **$257** | **$503** | **$3,275** | **$387** | **$695** | **$4,559** |

**Table 24 - Start-up and recurrent cost by component and health facility annual output, for an average health facility in Indonesia, in 2020 USD**

| Intensity | Cost component | Up to 5,000 | | | 5,001 to 10,000 doses | | | 10,000+ doses | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Start-up cost | Recurrent cost per month | 6-month total | Start-up cost | Recurrent cost per month | 6-month total | Start-up cost | Recurrent cost per month | 6-month total |
| Low | PPE and IPC | $19 | $58 | $368 | $38 | $146 | $911 | $24 | $125 | $776 |
| | Physical distancing | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | Extra sessions | $0 | $31 | $187 | $0 | $31 | $187 | $0 | $6 | $34 |
| | **Total** | **$19** | **$89** | **$555** | **$38** | **$177** | **$1,098** | **$24** | **$131** | **$811** |
| Medium | PPE and IPC | $19 | $224 | $1,360 | $38 | $342 | $2,088 | $24 | $242 | $1,477 |
| | Physical distancing | $0 | $45 | $268 | $0 | $49 | $297 | $0 | $39 | $237 |
| | Extra sessions | $0 | $34 | $204 | $0 | $29 | $174 | $0 | $7 | $40 |
| | **Total** | **$19** | **$302** | **$1,832** | **$38** | **$420** | **$2,559** | **$24** | **$288** | **$1,754** |
| High | PPE and IPC | $133 | $353 | $2,253 | $336 | $506 | $3,371 | $166 | $329 | $2,143 |
| | Physical distancing | $57 | $178 | $1,124 | $142 | $170 | $1,163 | $72 | $109 | $726 |
| | Extra sessions | $0 | $116 | $696 | $0 | $58 | $349 | $0 | $15 | $91 |
| | **Total** | **$190** | **$647** | **$4,073** | **$478** | **$734** | **$4,883** | **$239** | **$453** | **$2,959** |

**Table 25 - Start-up and recurrent cost by component and proportion of outreach doses delivered, for an average health facility in Indonesia, in 2020 USD**

| Intensity | Cost component | 35-65% of total doses | | | 65-80% of total doses | | |
|---|---|---|---|---|---|---|---|
| | | Start-up cost | Recurrent cost per month | 6-month total | Start-up cost | Recurrent cost per month | 6-month total |
| Low | PPE and IPC | $24 | $111 | $688 | $16 | $59 | $370 |
| | Physical distancing | $0 | $0 | $0 | $0 | $0 | $0 |
| | Extra sessions | $0 | $7 | $43 | $0 | $19 | $114 |
| | **Total** | **$24** | **$118** | **$731** | **$16** | **$78** | **$484** |
| Medium | PPE and IPC | $24 | $264 | $1,606 | $16 | $92 | $566 |
| | Physical distancing | $0 | $37 | $222 | $0 | $32 | $194 |
| | Extra sessions | $0 | $9 | $52 | $0 | $20 | $117 |
| | **Total** | **$24** | **$309** | **$1,880** | **$16** | **$144** | **$877** |
| High | PPE and IPC | $176 | $306 | $2,011 | $107 | $132 | $901 |
| | Physical distancing | $75 | $108 | $721 | $48 | $106 | $685 |
| | Extra sessions | $0 | $29 | $175 | $0 | $39 | $233 |
| | **Total** | **$250** | **$443** | **$2,907** | **$154** | **$278** | **$1,819** |

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