Evaluation plan for Immunization Incentive Roll Out in Sindh Pakistan **October 18, 2021**

(*This document reflects the design at the time the grant was recommended in November 2021. It is subject to change following piloting.*)

There are four main objectives of the evaluation plan: to estimate the impact on vaccination rates of the introduction of incentives in the 7 most disadvantaged districts in Sindh province in Pakistan; to understand the characteristics of those not being reached at all by current immunization services; to pilot additional steps that could further increase the effectiveness of the mCCT program; and to test to ensure there are not negative spillovers on other non-immunization services. The first of these is the primary objective. A rigorous randomized impact evaluation of the program has already been conducted at a smaller scale so the evaluation will seek to add additional information on impact at scale.

Estimating the impact of scaling up small incentives for immunizations in Sindh

To evaluate the causal impact of the ZM program on coverage and timeliness, we will use a randomized stepped wedge design. The seven districts which have been chosen to receive the mCCT program (based on their baseline levels of immunization) will be phased into the program based on a randomized schedule with one district per month entering the program for a period of seven months. The evaluation team will conduct the randomization. Data generated by the ZM electronic database will be the primary source of data to evaluate the impact of the program. A panel estimating equation will be used to identify the impact utilizing ZM data from before the introduction of the program, during the phase in period and post phase in. This will allow estimation of district specific effects, time specific effects, seasonal effects (for example Ramadan effects), treatment effects and the impact of a series of controls for baseline immunization rates and socioeconomic factors. Errors will be clustered at the level of randomization (i.e., the district). Machine learning techniques will be used to optimize the precise specification, including inclusion of control variables. In addition, we will explore the use of Bayesian techniques to combine data from the randomized experiment and the data from districts which were not chosen to be part of the study utilizing the clearly documented cutoff for inclusion in the study (i.e., the 7 districts with the lowest baseline immunization rates). The later strategy is promising because all 30 districts in Sindh collect data on immunization in the same way through the ZM registry). The results of both the standard frequentist stepwise panel estimation and (if it proves feasible) a Bayesian approach will be made public.

The three main outcomes of interest are: number of additional children receiving at least one vaccination as a result of the program; persistence through the vaccination schedule; and timeliness by which children receive their vaccines. The first will be measured by estimating the increase in the number of children registered in the ZM system (children are registered when they are brought in for their first shot). Coverage rates by vaccine or the average number of vaccines received by child speak to the second objective. Note however, that an increase in more marginalized children coming into the system can bring down the average number of vaccines received per child even while the total number of vaccines increases. One way to address this is to estimate the total vaccines delivered by district for each vaccine. The same challenge arises with respect to measuring timeliness: timeliness of those who would have been in the system anyway could increase while new entrants could bring down the average receiving their vaccines in a timely way. Again, estimating the increase in the number of children receiving their vaccinations in a timely way solves this potential bias.

In addition, it will be possible to characterize the rough location of children who are induced to enter the system and receive at least one shot as a result of the introduction of the mCCT program. The ZM electronic register records the clinic at which a child receives their immunization, making it possible to analyze which clinics are seeing the biggest increases in children attending. By merging clinic location with other geographic data such as census or DHS data it may be possible to characterize the sociodemographic and ethnic composition of the catchment areas of clinics seeing the largest increases in children receiving at least one shot and seeing the largest increases in coverage and timeliness. However, this will depend on the ability to get disaggregated geographic locators for socioeconomic data.

Verification calls made as part of the ZM monitoring process will be leveraged to get some socioeconomic data. A total of 3% of visits will be followed by a verification call to caregivers. In 20% of these, caregivers will be asked if they would agree to stay on the line and answer a few more questions in return for airtime. Questions would include education, income proxies, employment status of household head and (if piloting suggests it does not cause concern) home language and citizenship status.

Under this evaluation design there would be an 80% chance of distinguishing the impact of mCCT from zero if the true effect of the program was to reduce the number of children not receiving Penta-3 by 23 percent (equivalent to a 10.9 percentage points effect) and a 95% confidence interval was used. It is likely that power would be somewhat higher once there is additional data that helps explain variation in immunization rates over time in different districts. There would also be more power to detect a composite indicator such as average number of vaccines received per child which could be calculated with child specific data. It is not possible without merging clinic and disaggregated socioeconomic data to calculate power or MDE for the analysis of characteristics of clinics seeing the largest increases in vaccination rates.

Table 1. Minimum detectable effect (MDE) with 7 districts rolled in randomly 1 month apart

Vaccine	1 Month Interval Between Districts	
	Perc. Points	Perc. Unvaccinated
BCG	0.1298	41%
Penta-1	0.1169	37%
Penta-2	0.1140	27%
Penta-3	0.1086	23%
Measles-1	0.1230	23%
Measles-2	0.0893	13%

To check that the ZM data provides a reliable indicator of vaccinations given, a system of verification will be in place. Calls will be made to a random sample of phone numbers of caregivers who report taking their child for a vaccination and receiving an incentive. This phone survey (also discussed in the M&E plan) will be supervised by the evaluation team and will cover 3% of caregiver visits. If it is decided to do a household survey, see below, further validation of the ZM data will be possible.

Understanding the characteristics of those not reached by immunization services through household survey

To understand the characteristics of children not reached by the program a household survey would be undertaken in 2 districts, one rural and one urban. The household survey would not attempt to replicate the estimate of impact discussed above. Instead, 15 UCs in each district would be randomly selected (stratified by coverage rates and overweighted towards low coverage UCs). A mapping of all children under three years of age would be conducted using child listings from Lady Health Workers and house to house sampling. All field survey staff will receive training prior to the survey to ensure consistency of approach and measurements. Below is a high-level outline of the steps involved:

i. **Mapping:** First, district coordinators from the evaluation team will get a listing of Lady Health Worker (LHW) areas for the selected UCs in their districts. Eight LHW areas are randomly selected from each of the 15 UCs. The survey team supervisors will then talk to village leaders and approach Lady Health Workers to map the communities in their catchment area.

ii. **Piloting:** All enumerators will spend up to 10 days piloting survey questions in their allocated areas. In a few pilot areas, this catchment area would be compared to satellite maps of the area to ensure communities are not missed by Lady Health Workers

iii. **Household listing:** Once each selected LHW area is mapped, the survey teams will go house-to-house in these areas to conduct the household listing exercise. Each household will first be asked whether they children under the age of three in their household. If they do, they will be asked a few further short questions. For each LHW area, 10 households with eligible children are then randomly selected to take part in the full household survey.

iv. **Surveying:** Enumerators would then go to the edge of the catchment area and start interviewing selected women on the LHW list. They would be asked about: child age, immunization received, incentives received, whether older children in the family had been immunized, knowledge of the incentive program and of immunizations. Basic socioeconomic indicators would be collected including income proxies (not a full income survey), education, language, and settlement status (i.e., are they refugees or migrants). They would then be asked about other mothers of young children they knew who lived nearby and both these and those on the LHW list would be tracked down. We will pilot bringing mothers together outside health clinics or in a neutral space to do a listing. This will only be possible in rural areas and may not be possible at all. Data from the census will be compared to the lists from the LHW and ZM records. If there are many children on the ZM and LHW list who are not found on the census enumerators will seek to find them in a second round of surveying.

v. **Monitoring:** Following the survey, 5% of the participants in the full household survey will be contacted for backchecks.

The household survey serves two purposes. First it seeks to document and children who are remaining outside the system even after the introduction of mCCT. By collecting socioeconomic data on locations and comparing those to areas that saw a big increase in vaccination with the introduction of mCCT, and by analyzing the characteristics of those who vaccinated their youngest child but did not vaccinate older children it will be possible to give some information about the type of children who got vaccinated as a result of the mCCT program. Second it seeks to understand mechanisms: was the cost and inconvenience of getting a child immunized contribute to low immunization rates and did the mCCT help alleviate that;

or is there deeper-seated hesitancy and misinformation about vaccines in areas with low vaccine take up?

Understanding the characteristics of those brought into the system by mCCTs who would otherwise have received no vaccinations would be assessed through phone surveys added to the validation calls and the linking of ZM data and DHS/census data as described above.

Evaluating additional ways to promote the effectiveness of the mCCT program

Evidence from other studies suggests targeted and informative communication can be a highly cost-effective way of changing health behavior. In India, informing key members of the community about immunization services and CCTs and asking them to encourage caregivers to bring their child for immunization was a highly cost-effective add-on to CCTs. However, the approach was tested in rural India which has a very different social structure particularly compared to urban Pakistan. Given the high cost-effectiveness of the approach, it is worth piloting. In other contexts, addressing misunderstandings about side effects of medical interventions was highly effective at changing behavior.

Four different add-ons to the mCCT will be piloted and tested:

i) **Community influencer:** Caregivers would be asked for the names of people in the community who would be good at getting the message out about the CCT program. LHW would be asked to help track these people to see if they would be willing to act as immunization "Ambassadors". These people would be sent a text explaining the program and asking them to inform caregivers in the community about the program. This strategy would first be piloted in 30 LHW areas, and then fully tested in 120 LHW areas. Verification calls will be made to the influencers and up to 10 individuals per community following the program.

ii) **SMS messages:** Varying the content of SMS messages drawing on lessons from behavioral economics studies. The SMS messages will be sent IRD (or another legitimate/trusted source) encouraging parents to get their children vaccinated -- using reminders, nudges, social proof, and other short texts. This experiment would be randomized at the clinic level across the 7 districts and would be relatively inexpensive to run.

iii) **WhatsApp bot:** The WhatsApp bot is a basic program that answers common questions/ concerns about vaccination (e.g., where is the closet clinic, is it free, how old my child should be, are vaccines safe, etc.). The key challenge is that this requires a certain level of literacy, digital literacy, and WhatsApp use. However, it is relatively low cost to implement and if LHWs are strapped for time or parents are unsure where to go for information this could offer an additional vehicle for reminders, information dissemination, and communication. This strategy would first be piloted through using a sample of existing phone numbers in the ZM system, before rolling out to all parents in the ZM systems across the 7 districts. A social media advert (e.g., through Facebook, TikTok, Instagram etc.) would be used to promote the bot and reach social media users who may not already be in the ZM system. The advert and WhatsApp bot will link a random sample of communities to a series of social media video clips promoting immunization and the program.

iv) **Adverts in the media:** More content filled pieces answering key questions about immunization would be delivered through cable/ local TV channels and radio stations randomized at the lowest possible geographic level.

Outcomes for this part of the evaluation would be vaccination coverage (from ZM), knowledge about the program (from the household survey). The areas where these experiments are conducted would overlap with the areas covered by the household survey.

Checking for negative (or positive) spillovers from the mCCT program

One concern with any program that seeks to promote one activity by individuals and health workers is that it reduces the effort spent on other health activities. This concern is mitigated in the Pakistan context by the fact that vaccinators do not do other activities. The mCCT program may change vaccinator behavior, for example by reducing their outreach activities and being in the main clinic more frequently. By introducing children into the health system there may be positive spillovers of the mCCT program. The likelihood of positive spillovers is reduced in those locations where vaccination clinics are separate from other health care activities (combined clinics are more common in urban areas). The part of the healthcare system most likely to experience spillovers from the program is Lady Health Workers as they work both on vaccination and on other tasks. If the program is successful in bringing more patients into the vaccination centers LHW may spend less time promoting vaccination and more on other health prevention tasks and family planning. We will seek access to data on the activity of LHWs and distribution of preventative goods (including family planning supplies) in an effort to track possible positive spillovers by releasing LHW time to spend on these important activities. A final potential spillover is on the number of immunization campaigns. If immunization rates rise, the need for campaigns may fall. However, campaigns are often launched at the national level and thus may not be impacted. We will track the number of days of immunization campaigns in both treatment and control and non-study districts to assess this potential spillover impact.