Responses to Questions on Haryana Immunization Incentive Project

1) What is the $/DALY (or $ per death averted) for this program? *We have the cost per additional, fully-immunized child, but we don't know which vaccines the children received and what impact these doses would have on child mortality. For example, our impression is that if the program's primary impact is on DPT, the cost per DALY or death averted would be high relative to other programs we've supported; if it had a large impact on measles, it would likely be competitive.*

The $ per death averted estimates are very sensitive based on the assumptions. We estimate that the cost death averted will be $790/death averted and present our assumptions below. We have not estimated the cost per DALY because the data on the effect of vaccines on morbidity India throughout a person's life-cycle is even rarer compared to the data on mortality

<u>Haryana estimate assumptions</u>

1. The figure of $790/death averted is based on the additional cost of the Government of Haryana to run the program (the cost of the incentives and their transport to the immunization sessions) by the number of deaths averted.
2. The budget for incentives including their transportation to the immunization sessions is $430,000.
3. The incentives program will reach ~62,000 kids with the incentives based on the most recent census and estimated growth in cohort sizes.
4. The incentives will lead to an estimated 7740 additional children to get the DPT shot and 7400 additional children to get the measles vaccination. This number comes from the expected effect of the program with a baseline immunization rates as in the District Level Household Survey (DLHS 2011/2012).
    - We have evidence from previous J-PAL studies that DLHS has overestimated vaccination rates. If the actual immunization rates are lower than the DLHS figures, then the number of additional children benefited will be higher. We will have more precise estimates of the baseline immunization rates after the baseline survey which will be conducted in May/June.
5. The vaccines are known to be quite effective. DPT3 is 95% effective against Diphtheria, 89% against Pertusis and 90% against tetanus. Measles shot is about 90% effective against measles.
6. Data on mortality rate in absence of vaccination is extremely scarce in general for developing countries and even more so in case of India.
    - For example, measles case fatality rate (CFR) estimates ranges from under 1% to above 30% in studies done in India with a median case fatality rate of about 3.5%.
    - Even worse is the incidence of disease amongst the un-vaccinated. Many studies mention a universal incidence rate for measles among the un-vaccinated. But combining this with the CFR gives infant (0-4) mortality rate of above 1.75% solely from Measles, which seems high [under 5 mortality rate for India is around 5.3%].

- Data on incidence and death numbers seem to be too low due to obvious reporting issues. For example, Millennium Death Study estimates that over 92,000 infants die with measles whereas official WHO death series hardly reach over 40k. The bias in reporting of incidences can be expected to be much larger.

7. With the difficulties, the range of estimates we get for the estimates of $ per deaths averted vary widely.
    - The CFR and Incidence rates we used for Diphtheria was (0.1, 0.00015), for Pertussis was (0.037, 0.8), for Tetanus was (0.6, 0.03825) and for Measles was (0.035, 1). These numbers are consistent with the number from Jamison et al book "Disease Control Priority in Developing Countries" Chapter 20. (This is the study cited on the GiveWell website.)
8. With these assumptions, the program averts 590 deaths within the next 5 years with $ per death averted of $730/death averted
    - The estimates is only for effects for children under 5. It is quite likely that vaccines continue to protect from diseases into childhood and adulthood.
    - The number presented above is marginal. We believe that this number is more relevant for program like ours that build on top of an existing system and does not involve change in vaccinations, etc.
9. The estimate presented above is calculated using the 'normal' assumptions used in the literature. It relies on a series of assumptions outlined above and the estimates can be sensitive to these assumptions. In particular, the incidence and CFR of the disease could be quite different in the current study context. Few studies exist that calculate the disease incidence and case fatality ratio in case of India. Estimates vary widely in the studies that do. The following table shows the range of estimates based on various assumptions on CFR and Incidence rates. Column 1 uses the assumptions outlined above. Column 2 computes the incidence rates based on the number of incidences of diseases in the WHO vaccine preventable disease monitoring systems. These official incidence numbers are likely to be much lower than actual incidences as not all incidences are reported and reported incidences may not always be recorded (due to the weak record-keeping mechanism in India). Even with these numbers the $ per death averted is $2,540. Column (3) and (4) reproduce Column (1) with the range of CFR found in epidemiological studies conducted in India. The range, as can be seen, is quite large. The CFR used in Column (1) is the median of the CFRs of the several epidemiological studies conducted in India. This seems to be the norm in the literature and we have done the same.

	(1)		(2)		(3)		(4)	
	CFR	Incidence	CFR	Incidence	CFR	Incidence	CFR	Incidence
Diptheria	0.1	0.00015	0.1	0.000103	0.1	0.00015	0.1	0.00015
Pertusis	0.037	0.8	0.037	0.001072	0.037	0.8	0.04	0.8
Tetanus	0.6	0.03825	0.6	0.03825	0.6	0.03825	0.6	0.03825
Measles	0.035	1	0.035	0.065571	0.01	1	0.3	1
$ per death averted	**$ 729**		**$ 2,542**		**$ 1,031**		**$ 177**	