Reviewer’s report

Title: Evaluation of coverage and quality of service delivery during national immunization days: a LQAS study in a district of Pakistan's Punjab province

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Reviewer: Jeffrey Partridge

Reviewer’s report:

Overall, the manuscript is well-written and documents once again one issue facing one of the few remaining polio-endemic countries, i.e., despite aggregate figures reporting very high coverage during mass campaigns, when one looks closely at the sub-district level it becomes apparent that coverage and service delivery are not meeting the targets required for poliovirus elimination.

The manuscript also demonstrates the utility of using LQAS methodology to assess mass campaigns; however, there are some issues with the methodology, analysis, and conclusions that I have detailed below.

Major compulsory revisions:

From the Methods section

In general, it is difficult for the reader to confirm that statistically sound methods were adhered to in terms of sample size determination, sample selection, and data analysis.

“Out of 70 primary health centers (PHCs) in District Nankana Sahib, 20 PHCs with their catchment areas were selected randomly as ‘lots’, using EPI Info 6.” Strictly speaking, using LQAS methodology all “lots” should be sampled to estimate coverage in the district—the “study area” doesn’t really represent any defined population in itself, but is a SAMPLE used to make inferences about the district. Seems that you would have to make a correction in the analysis for using a sample of the lots (rather than using information from all of the lots) in order to report an overall coverage figure.

It would be helpful for readers if the methods description were tightened up by explicitly stating the parameters used for:

1. the upper and lower thresholds
2. the alpha and beta
3. the sample size from each lot
4. number of allowable “defects”

Some of this info is available, sometimes parenthetically, but it is necessary to hunt around in order to understand what went into the sampling methods.
How was the sample size determined? Did you really calculate the number of households required from each lot or is 21 the number of individuals that were required from each lot? You state that “d>0”...does this mean that if 1 child from the household was un-immunized then you reject the lot, or you reject if one entire household was missed?? In addition, there seems to be a marriage of LQAS and the standard EPI 30-cluster methodology, so it is hard to tease out why you ended up with the sample that you have. Also, it seems that there will be clustering by households (children within a household are likely to have the same experience)...not sure how you handled this statistically.

Please explain how the raw compliance score was calculated—it seems that this is a reflection of the absolute number of “accepts” but there is only an explanation of about the proportion of “accepts.” Did the compliance score reported take into consideration that there were different denominators for static versus mobile?

A binary answer for some of the qualitative service delivery questions seems prone to subjectivity, e.g., defining an “orderly” session, “correct” filling of forms, etc. Although there is an attempt to define these in the field, they are very much open for interpretation. Perhaps there should be some mention of the limitation of the subjective nature of the data in the limitations paragraph?

From the Results section
Apart from the issue of calculating an overall coverage based upon a sample of lots pointed out above, the rationale for computing an “unadjusted” and adjusted coverage based upon availability of children in the home is not clear. For the “unadjusted” coverage figure, you are assuming that the missing children are un-immunized. What is the basis for this approach? This mixes “percentage interviewed” and “percentage immunized,” which are separate concepts. Missing children are missing and shouldn’t be included in either the denominator or numerator if you didn’t collect history information on them. I would recommend leaving out the “unadjusted” figures from the table and results apart from commenting in the Discussion about whether or not you believe the missing children biased your results.

Minor essential revisions:
From the Background
1. “…virus contained in 18 districts only but polio resurged in 2008 with 118 reported cases…” How many districts in total are there in Pakistan? You are mentioning the number of districts and cases in 2007, but only the number of cases in 2008. Did the number of affected districts also increase in 2008? Of course, another piece of this story is genetic diversity, i.e. I suspect that the number of chains of transmission may have decreased from 2007 to 2008. It is true that 118 is greater than 32, but these absolute numbers may hide evidence that specific genotypes continued to die off, which is a positive move towards eradication that is missed when focusing only on absolute numbers.
2. “Pakistan has achieved all targets set in GPEI strategic plan but virus transmission could not be interrupted. Missing large numbers of children during NIDs…” These two sentences seem contradictory, as achieving high coverage during NIDs was one of the targets. Perhaps it would be more consistent to say: “Pakistan reportedly achieved all targets set in GPEI strategic plan but virus transmission could not be interrupted.” Although it is not part of the thesis of this manuscript, you should also mention that Pakistan didn’t/doesn’t have uniformly high routine immunization coverage either, as this certainly plays into the continuing transmission of polio virus (many countries eliminated poliovirus transmission through routine immunization without campaigns).

From the Discussion section

“Although the study was conducted in a rural district of Pakistan’s Punjab province, the findings may be generalized to other rural areas in Pakistan in particular and South Asia in general, due to similar health system infrastructure, socio-cultural environment and topography.” Are you sure? Do you think that immunization coverage during mass campaigns in rural Pakistan is comparable to campaign coverage in rural Nepal or rural Sri Lanka, for example? This has not been the experience. Also, since the LQAS methodology is “pass/fail” based upon your own parameters and service delivery questions, I am wondering what exactly could be generalized. Coverage and service delivery were poor in Nankana Sahib, therefore, coverage and service delivery are poor in rural Nepal? Perhaps it would be better to make an argument for conducting surveys with LQAS methodology in order to assess performance on a sub-national level than to try to generalize to larger populations. After all, the LQAS methodology is really designed to look at each “lot” rather than to generalize. Also, since only a sample of the “lots” was assessed, I wonder if the study was under powered to even generalize about the district itself (see comment on Methods above).

From ANNEX 1

How are “immunized children” related to “immunized households”? If 4 out of 5 children are immunized in a household, is this household considered “un-immunized”? Perhaps you could explain in a footnote.

As mentioned above, “unadjusted” coverage doesn’t really have a meaning as it mixes “percentage interviewed” with “percentage immunized” so maybe you could remove the unadjusted coverage figures.

The right-most column is not needed, as it only shows a step in the calculation of overall percentage. No need to show how to calculate a weighted average. You can just show the next-to-last column as percentages with an overall weighted percentage at the bottom.

ANNEX 2

The text mentions 11 characteristics that were assessed, but this table has 26 characteristics. It’s not clear how the 11 is related to the 26.
Discretionary revisions:

From the Background

1. “As health programs mature, large-scale or national surveys become less useful; instead, data from small-scale studies is required to evaluate different aspects of a program.” Well, it depends upon what you want to use the data for…national or sub-national (e.g. Punjab province) data is necessary for national/sub-national resource planning, monitoring of national/sub-national coverage trends, modeling national/sub-national disease burden, etc. Your argument seems more focused on fine-tuning program implementation, which is immensely important for programs such as GPEI, but I would argue that “big picture” data is important as well.

From the Conclusions section:

Was the assessment using LQAS methodology useful? Was there any advantage to conducting this assessment over monitoring during the campaigns or the rapid assessments that are regularly conducted after the campaigns?

One problem with the results is that nearly every “lot” failed, i.e., it seems that the whole district is not meeting targets for whatever questions you chose, so it is difficult to make recommendations to the district health authorities. In this scenario, LQAS may not be very useful, but perhaps you don’t know this until after you have conducted it!

Figure 1 (Map of Punjab)

This map is a bit busy and may not be necessary.

ANNEX 3

ANNEX 3 is not needed and can be removed.

**Level of interest:** An article whose findings are important to those with closely related research interests

**Quality of written English:** Acceptable

**Statistical review:** Yes, but I do not feel adequately qualified to assess the statistics.

**Declaration of competing interests:**

I declare that I have no competing interests.