# Appendix

**Appendix Table S1. List of polio SIAs along with their geographic coverage and inclusion status in the study, January 2008 to September 2017**

| No. | Polio SIA dates | No. of CGPP districts covered | No. of CGPP blocks/ polio planning units | SIA type | Inclusion/ Exclusion status | SIA No. |
|---|---|---|---|---|---|---|
| 1 | 06 January 2008 | 12 | 56 | NID | Included | 1 |
| 2 | 10 February 2008 | 12 | 56 | NID | Included | 2 |
| 3 | 30 March 2008 | 12 | 56 | SNID | Included | 3 |
| 4 | 27 April 2008 | 12 | 56 | SNID | Included | 4 |
| 5 | 01 June 2008 | 12 | 56 | SNID | Included | 5 |
| 6 | 29 June 2008 | 12 | 56 | SNID | Included | 6 |
| 7 | 27 July 2008 | 05 | 24 | SNID | Excluded | |
| 8 | 03 August 2008 | 04 | 20 | SNID | Excluded | |
| 9 | 26 August 2008 | 05 | 24 | SNID | Excluded | |
| 10 | 14 September 2008 | 12 | 56 | SNID | Included | 7 |
| 11 | 18 October 2008 | 08 | 40 | SNID | Excluded | |
| 12 | 16 November 2008 | 12 | 56 | SNID | Included | 8 |
| 13 | 21 December 2008 | 12 | 56 | NID | Included | 9 |
| 14 | 01 February 2009 | 12 | 56 | NID | Included | 10 |
| 15 | 01 March 2009 | 12 | 56 | SNID | Included | 11 |
| 16 | 05 April 2009 | 09 | 36 | Mop Up | Excluded | |
| 17 | 21 April 2009 | 01 | 06 | SNID | Excluded | |
| 18 | 17 May 2009 | 09 | 46 | SNID | Excluded | |
| 19 | 05 July 2009 | 12 | 56 | SNID | Included | 12 |
| 20 | 26 July 2009 | 04 | 19 | SNID | Excluded | |
| 21 | 09 August 2009 | 12 | 56 | SNID | Included | 13 |
| 22 | 10 September 2009 | 12 | 56 | SNID | Excluded (No booth day activity) | |
| 23 | 04 October 2009 | 10 | 50 | Mop Up | Excluded | |
| 24 | 08 November 2009 | 12 | 56 | SNID | Included | 14 |
| 25 | 06 December 2009 | 10 | 50 | SNID | Excluded | |
| 26 | 10 January 2010 | 12 | 56 | NID | Included | 15 |
| 27 | 07 February 2010 | 12 | 56 | NID | Included | 16 |
| 28 | 21 March 2010 | 10 | 50 | SNID | Excluded | |
| 29 | 25 April 2010 | 10 | 50 | SNID | Excluded | |
| 30 | 23 May 2010 | 12 | 56 | SNID | Included | 17 |
| 31 | 20 June 2010 | 09 | 46 | SNID | Excluded | |
| 32 | 18 July 2010 | 01 | 04 | SNID | Excluded | |
| 33 | 19 September 2010 | 12 | 58 | SNID | Included | 18 |
| 34 | 14 November 2010 | 12 | 58 | SNID | Included | 19 |
| 35 | 23 January 2011 | 12 | 58 | NID | Included | 20 |
| 36 | 27 February 2011 | 12 | 58 | NID | Included | 21 |
| 37 | 27 March 2011 | 12 | 58 | SNID | Included | 22 |
| 38 | 24 April 2011 | 10 | 50 | SNID | Excluded | |
| 39 | 22 May 2011 | 10 | 50 | SNID | Excluded | |
| 40 | 26 June 2011 | 12 | 58 | SNID | Included | 23 |
| 41 | 26 July 2011 | 01 | 10 | Mop Up | Excluded | |
| 42 | 21 August 2011 | 10 | 50 | SNID | Excluded | |

| No. | Polio SIA dates | No. of CGPP districts covered | No. of CGPP blocks/ polio planning units | SIA type | Inclusion/ Exclusion status | SIA No. |
|---|---|---|---|---|---|---|
| 43 | 25 September 2011 | 12 | 58 | SNID | Included | 24 |
| 44 | 13 November 2011 | 08 | 40 | SNID | Excluded | |
| 45 | 15 January 2012 | 10 | 50 | SNID | Excluded | |
| 46 | 5 & 19 February 2012 | 12 | 58 | NID | Included | 25 |
| 47 | 18 March 2012 | 12 | 58 | SNID | Included | 26 |
| 48 | 15 April 2012 | 12 | 58 | NID | Included | 27 |
| 49 | 17 June 2012 | 12 | 58 | SNID | Included | 28 |
| 50 | 09 September 2012 | 12 | 58 | SNID | Included | 29 |
| 51 | 04 November 2012 | 12 | 58 | SNID | Included | 30 |
| 52 | 20 January 2013 | 12 | 58 | NID | Included | 31 |
| 53 | 24 February 2013 | 12 | 58 | NID | Included | 32 |
| 54 | 07 April 2013 | 12 | 58 | SNID | Included | 33 |
| 55 | 16 June 2013 | 12 | 58 | SNID | Included | 34 |
| 56 | 15 September 2013 | 12 | 58 | SNID | Excluded (No booth day activity) | |
| 57 | 24 November 2013 | 12 | 58 | SNID | Included | 35 |
| 58 | 19 January 2014 | 12 | 58 | NID | Included | 36 |
| 59 | 23 February 2014 | 12 | 58 | NID | Included | 37 |
| 60 | 24 April 2014 | 10 | 48 | SNID | Excluded | |
| 61 | 14 September 2014 | 12 | 58 | SNID | Included | 38 |
| 62 | 16 November 2014 | 12 | 58 | SNID | Included | 39 |
| 63 | 18 January 2015 | 12 | 58 | NID | Included | 40 |
| 64 | 22 February 2015 | 12 | 58 | NID | Included | 41 |
| 65 | 26 April 2015 | 12 | 58 | SNID | Included | 42 |
| 66 | 21 June 2015 & 13 September 2015 | 12 | 58 | SNID | Included | 43 |
| 67 | 22 November 2015 | 12 | 58 | SNID | Included | 44 |
| 68 | 13 December 2015 | 04 | 20 | SNID | Excluded | |
| 69 | 17 January 2016 | 12 | 58 | NID | Included | 45 |
| 70 | 21 February 2016 | 12 | 58 | NID | Included | 46 |
| 71 | 16 April 2016 | 11 | 52 | SNID | Excluded (No booth day activity) | |
| 72 | 29 May 2016 | 12 | 58 | SNID | Included | 47 |
| 73 | 25 September 2016 | 12 | 58 | SNID | Included | 48 |
| 74 | 29 January 2017 | 12 | 58 | NID | Included | 49 |
| 75 | 02 April 2017 | 12 | 58 | NID | Included | 50 |
| 76 | 02 July 2017 | 12 | 58 | SNID | Included | 51 |
| 77 | 17 September 2017 | 12 | 58 | SNID | Included | 52 |
| NID = National Immunization Day; SNID = Sub-National Immunization Day | | | | | | |

**Appendix Table S2.    Mean values of indicators (original or reversely coded) used in the computation of Community Engagement Index, January 2008 to September 2017**

| Indicators | CMC area | | Non-CMC area | |
|---|---|---|---|---|
| | Mean | SD | Mean | SD |
| 1. Percentage children vaccinated at SIA booths (original coding) | 77.1 | 9.58 | 47.6 | 11.92 |
| 2. Percentage of households with all vaccinated children (i.e., 'P' houses) at the beginning phase of house-to-house vaccination activity of polio SIAs | 83.9 | 4.05 | 85.8 | 3.33 |
| 3. Percentage of households with all vaccinated children (i.e., 'P' houses) at the end of SIA | 94.6 | 2.36 | 94.0 | 2.23 |
| 4. Rate of non-resistant households (accepters) at the beginning phase of house-to-house vaccination of polio SIAs (per 10,000 households) | 9990.41 | 16.68 | 9995.89 | 6.70 |
| 5. Rate of non-resistant households (accepters) at the end of polio SIAs (per 10,000 households) | 9995.43 | 16.25 | 9998.10 | 4.88 |
| SD = Standard Deviation | | | | |

**Appendix Table S3. Components of five indicators (items considered for computing CEI) derived through principal component analysis**

| Indicators under consideration | Item/ factor loading[1] | Labeling of components derived through PCA | Cronbach's alpha |
|---|---|---|---|
| 1. Percentage children vaccinated at SIA booths | 0.972 | **Component 1 –** CE in booth-based vaccination | --- |
| 2. Percentage of households with all vaccinated children (i.e., 'P' houses) at the beginning phase of house-to-house vaccination activity of polio SIAs | 0.878 | **Component 2 –** CE during a house-to-house vaccination | 0.638 |
| 3. Percentage of households with all vaccinated children (i.e., 'P' houses) at the end of SIA | 0.871 | | |
| 4. Rate of non-resistant households (accepters) at the beginning phase of house-to-house vaccination of polio SIAs (per 10,000 households) | 0.881 | **Component 3 –** Acceptance to polio vaccination | 0.731 |
| 5. Rate of non-resistant households (accepters) at the end of polio SIAs (per 10,000 households) | 0.893 | | |
| The model explains 84.5% of the variance Number of components were determined through Eigenvalues >1 | | | |

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[1] **Item/factor loading** in factor analysis/principal component analysis shows correlation between an item/variable and a component/factor.

**Appendix Table S4.     Mean values of individual indicators and PCA components used for computation of CEI**

| Indicator | Mean values (normalized) | | Components of PCA | Mean values | |
|---|---|---|---|---|---|
| | CMC area | Non-CMC area | | CMC area | Non-CMC area |
| 1. Children vaccinated at SIA booths | 0.771 | 0.476 | **1.** CE in booth-based vaccination | 0.771 | 0.476 |
| 2. Households with all vaccinated children ('P' houses) at the beginning phase of house-to-house vaccination of SIAs | 0.839 | 0.858 | **2.** CE during house-to-house vaccination* | 0.892 | 0.899 |
| 3. Households with all vaccinated children ('P' houses) at the end of SIAs | 0.946 | 0.940 | | | |
| 4. Non-resistant households (accepters) at the beginning phase of house-to-house vaccination of SIAs | 0.99904 | 0.9996 | **3.** Acceptance to polio vaccination* | 0.99929 | 0.9997 |
| 5. Non-resistant houses (accepters) at the end of polio SIA | 0.99954 | 0.9999 | | | |
| * Mean values of sub-dimension indices computed through equal weight method, i.e., allotting equal weights (0.5 to each) to both the sub-dimension indices | | | | | |

**Appendix Table S5. Covariate imbalance across study groups prior to matching**

| Covariate | CMC area (mean) | Non-CMC area (mean) | Difference | t statistic | p-value |
|---|---|---|---|---|---|
| Percent urban population, 2011 | 28.03 | 33.71 | 5.68 | 0.9606 | 0.3389 |
| Female literacy rate, 2011 | 45.28 | 53.90 | 8.62 | 4.4858 | <0.001 |
| Percent Hindu population, 2011 | 38.62 | 62.41 | 23.79 | 7.1088 | <0.001 |
| Percent Muslim population, 2011 | 60.84 | 36.04 | -24.81 | -7.5743 | <0.001 |
| Average household size | 7.48 | 6.08 | -1.40 | -15.6662 | <0.001 |

*Data sources:* CMC (intervention) area = Household surveys of CGPP India (29)
  Non-CMC area = Census of India, 2011 (30,31)

*Note* - Percent Hindu population (with positive correlation with exposure variable) is preferred against the percent Muslims to represent the socio-cultural profile. A preliminary list of covariates for PSM analysis included three covariates: a) female literacy rate and b) percent Hindu Population and c) average household size.
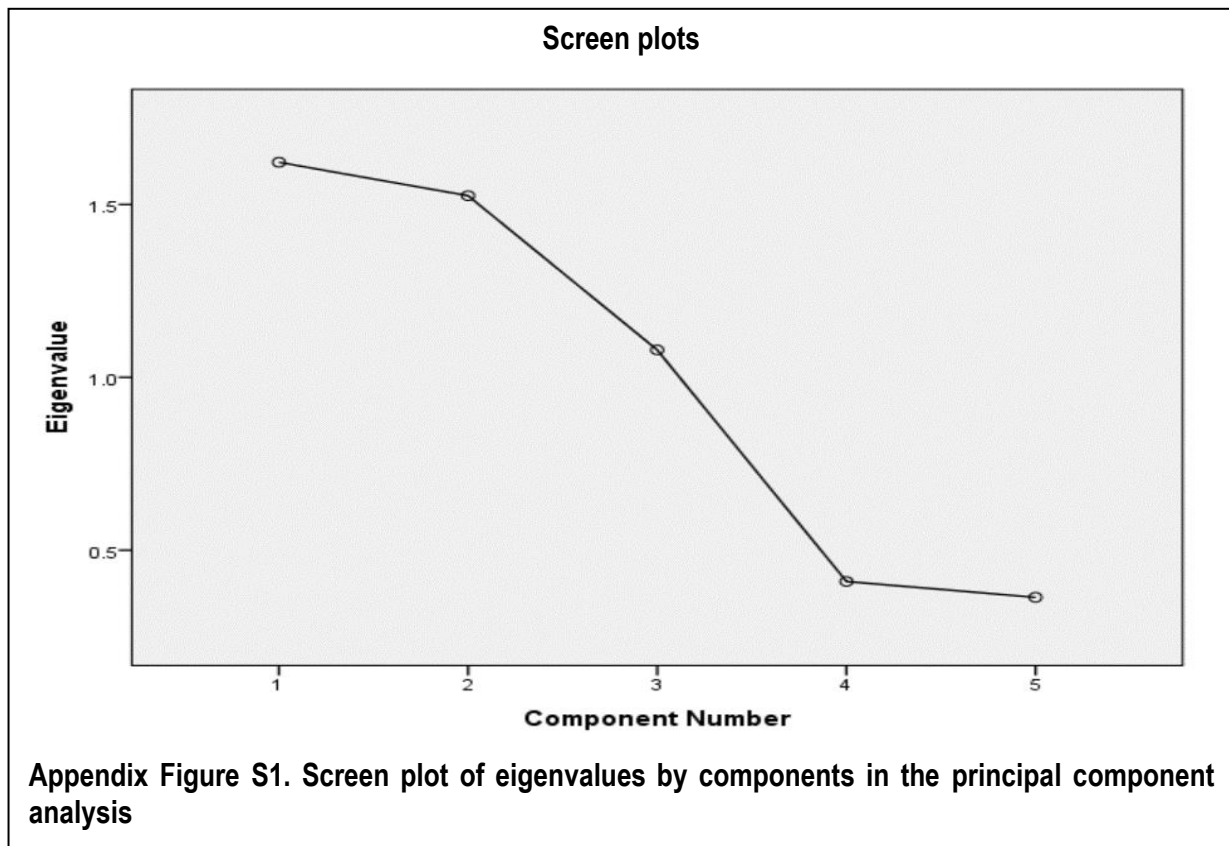
**Appendix Table S6.     Mean values of CEI computed through various computation methods**

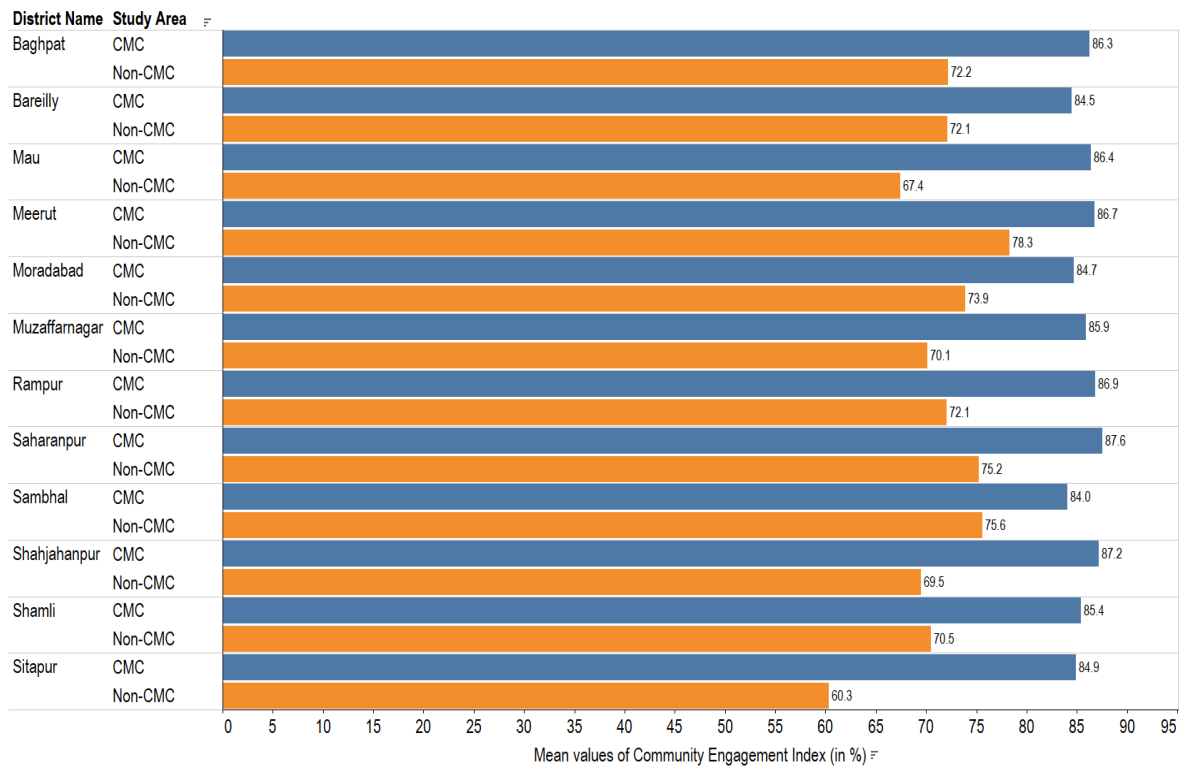| Aggregation method | Mean values of CEI | |
|---|---|---|
| | CMC area | Non-CMC area |
| Equal weights to all three PCA components and aggregation through arithmetic mean | 0.8875 | 0.7918 |
| Equal weights to all three PCA components and aggregation through Geometric mean | 0.8809 | 0.7477 |
| Unequal weights according to the theoretical framework (50-50 weights to two major components) | 0.8583 | 0.7129 |
| Weights according to factor loading of each of the indicators in PCA | 0.8165 | 0.7618 |

**Appendix Table S7.     Difference in the mean of covariates after kernel matching (balancing test statistics of Kernel propensity-score matching model estimating DID treatment effects on community engagement in polio SIAs)**

| Variable | Treated (CMC area) | Control (Non-CMC area) | Difference | p-value |
|---|---|---|---|---|
| Female literacy rate | 45.276 | 45.233 | 0.043 | 0.962 |
| Percent Hindu population | 38.618 | 39.052 | -0.434 | 0.786 |

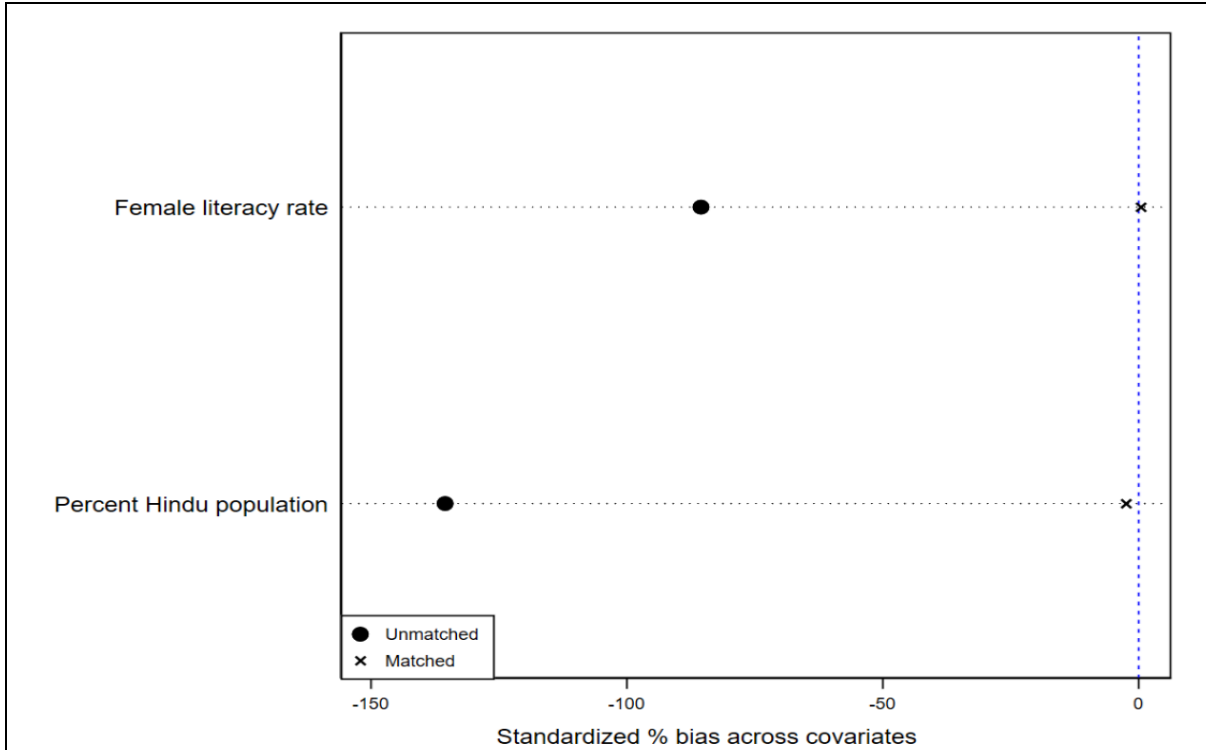**Appendix Figures**



Screen plots

Appendix Figure S1. Screen plot of eigenvalues by components in the principal component analysis

**Level of community engagement in polio SIAs (%) by study district and intervention status**

| District Name | Study Area | Value |
|---|---|---|
| Baghpat | CMC | 86.3 |
| | Non-CMC | 72.2 |
| Bareilly | CMC | 84.5 |
| | Non-CMC | 72.1 |
| Mau | CMC | 86.4 |
| | Non-CMC | 67.4 |
| Meerut | CMC | 86.7 |
| | Non-CMC | 78.3 |
| Moradabad | CMC | 84.7 |
| | Non-CMC | 73.9 |
| Muzaffarnagar | CMC | 85.9 |
| | Non-CMC | 70.1 |
| Rampur | CMC | 86.9 |
| | Non-CMC | 72.1 |
| Saharanpur | CMC | 87.6 |
| | Non-CMC | 75.2 |
| Sambhal | CMC | 84.0 |
| | Non-CMC | 75.6 |
| Shahjahanpur | CMC | 87.2 |
| | Non-CMC | 69.5 |
| Shamli | CMC | 85.4 |
| | Non-CMC | 70.5 |
| Sitapur | CMC | 84.9 |
| | Non-CMC | 60.3 |

Mean values of Community Engagement Index (in %)

**Appendix Figure S2. Mean level of community engagement in polio SIAs by District and Intervention Status**, **January 2008 to September 2017.** Each bar in the graph represents the mean value for Community Engagement Index of polio SIAs. The mean value is calculated at the block level separately for CMC areas and non-CMC areas. The mean values from both the CMC and non-CMC areas are calculated separately for each district. The blue bars and orange bars represent CMC and non-CMC areas, respectively.

**Appendix Figure S3. Diagnostic plots of Kernel PSM based analysis assessing before and after matching imbalance (mean bias) in the covariates of Community Engagement Index.**