Building Evidence for Coverage of Fully Vaccinated Children of 12–23 Months of Age across Districts of North India, 2015

Ashok Kumar Bhardwaj, Dinesh Kumar, Sushant Sharma, Anmol Gupta, Vishav Chander, Abhilash Sood
Department of Community Medicine, Dr. Rajendra Prasad Government Medical College, Kangra, Department of Community Medicine, Indira Gandhi Medical College, Shimla, Himachal Pradesh, India

Abstract

Context: Unprecedented low coverage (63%) of fully vaccinated (FV) children in the recent round of national survey district level household (HH) and facility survey 4 (DLHS-4) propelled health system of Himachal Pradesh for an independent rapid assessment of FV coverage. Aim: The aim of the study was to assess the FV coverage among 12–23-month old children in the state. Settings and Design: A community-based survey with an interviewer-administered questionnaire was carried out in all 12 districts of Himachal Pradesh from September 2015 to January 2016. Subject and Methods: WHO 30 × 7 cluster technique was used. Statistical Analysis Used: Chi-square and unpaired Student’s t-test along with 95% confidence intervals. Results: A total of 2492 children across 35,551 HHs (2.4% of state share) were surveyed with FV coverage of 98.1% (95% confidence interval [CI]: 97.5–98.6) and 86% (95% CI: 84.6–87.3) based on history and card, respectively. Conclusions: The reported FV coverage in the current study was observed too high in the state as reported in earlier round of the national surveys (except DLHS-4).

Keywords: Coverage, fully vaccinated, rapid survey

Introduction

Himachal Pradesh remained one of the better performing states in India supported by its health indicators which are timely assessed during national surveys. Fully vaccinated (FV) children coverage in 12–23 months considered to be a priority indicator for monitoring coverage vaccination services. Government funded National Family Health Survey (NFHS) and District Level Household and Facility Survey (DLHS) routinely cover it as a child health indicator. Himachal Pradesh, in recent DLHS (4th round) survey unexpectedly reported FV coverage as 63%, which considered to be very low compared to its earlier rounds where it was 82.3% (3rd round) and 79.3% (2nd round). Although state has better coverage in routinely conducted NFHS as 83.4% and 74.2% in its 2nd and 3rd round, respectively.1,2 The low coverage in DLHS-4 instilled introspection in the form of desired rapid independent assessment with the execution of standard technique across all the districts of Himachal Pradesh by practicing public health professionals in the state academia.

Subject and Methods

Based on reported immunization coverage of 75% (as per NFHS-3) in the state, a sample of 217 children for each district was calculated with 5% level of significance, 10% precision, and a design effect of three. National census in year 2011 observed 6,864,602 (rural: 89.9%) population along with 1,483,280 (rural: 88.5%) households (HHs) in the state. From each district, thirty clusters from the sampling frame of all its villages and municipal wards were selected with probability proportion to size method. The rural and urban stratification was not done for every district as about 90% of state population resides in the rural area. Each cluster was then divided into four rough geographical areas and about two children (12–23 months of age) were enrolled from each area. In each cluster area, first HH was selected randomly by the bottle spin method and then adjoining HHs were visited till the required sample size of 2 per geographical area and ultimately 7 per cluster was met. Adjacent village was selected in a case of low recruitment, so 210 children (30 × 7) per

Address for correspondence: Dr. Dinesh Kumar,
Department of Community Medicine, Dr. Rajendra Prasad Government Medical College, Kangra, Himachal Pradesh, India.
E-mail: dinesh9809@gmail.com

This is an open access article distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as the author is credited and the new creations are licensed under the identical terms.

For reprints contact: reprints@medknow.com

How to cite this article: Bhardwaj AK, Kumar D, Sharma S, Gupta A, Chander V, Sood A. Building evidence for coverage of fully vaccinated children of 12–23 months of age across Districts of North India, 2015. Indian J Community Med 2017;42:197-9.

Received: 08-05-16, Accepted: 14-07-17
district and a total of 2520 (210 × 12) children were estimated for data collection. In a cluster, mothers of children were inquired for the administration of Bacillus Calmette-Guérin (BCG)/oral polio vaccine at birth (OPV-0), diphtheria pertussis tetanus (DPT)/OPV-1/2/3, and measles vaccine. FV status was assessed based on history given by mother and presence of vaccination card. Weighted FV coverage was calculated only for the state where cluster weight was assigned to each district by inverse multiplication law of probability; first was an independent probability for selection of cluster and then probability of selection of HH from selected cluster.

The survey was carried out by professionals of Dr. Rajendra Prasad Government Medical College and Indira Gandhi Medical College of Himachal Pradesh. After informed consent, data were collected using the WHO recommended interview schedule by medical interns from September 2015 to January 2016. Data entry and analysis were done in Microsoft Excel (2003–2007) software of windows. Chi-square test was used for assessing statistical group level difference, where indicated. The permission was obtained from the Institute Ethics Committee before beginning the survey.

### Results

A total of 2492 children were surveyed across all districts in the state as only 182 children (against 210) could be surveyed in one (Lahaul and Spiti) district. A total of 35,551 (2.4% of state) HHs were surveyed to recruit eligible number of children. Of all surveyed children, the mother was asked for vaccination (history) and also for vaccination card. It was observed that FV coverage based on history was observed to be 98.1% (weighted: 98.3%) and 86% (weighted: 83.5%) based on the card. This difference is due to the fact that most of the mothers did not possess the vaccination card at the time of interview. FV coverage based on history was significantly high that the presence of vaccination card (which is more valid) [Table 1]. Only in one district (Lahaul and Spiti) about 50% of respondents were unable to produce vaccination card due to a reason that majority of HHs have left the card in their homes in adjoining Kullu district due to migration to Kullu in the season of heavy snowfall (4 months) during winter season. Therefore, card-based FV coverage was reported lowest (49.9%) in this district and considered as an outlier and was not compared with rest of districts for the purpose of interpretation.

Gender differential was not observed for FV coverage as statistically insignificant difference was observed for male (98% [95 CI: 97.2–98.7]) and female (98.2% [95 CI: 97.4–99.9]) children. Almost all (97.7%; 95 CI: 97.1–98.3) children reported to be FV before 1 year of their age, and this pattern was observed across all districts. Government facilities such as hospitals and health center observed to be major source of vaccination thought their contribution observed to be decreased from BCG/OPV-0 (78.6%) to DPT/OPV-3 (68.4%). If we remove BCG/OPV-0, then coverage was almost similar a plateau. Contribution of government facilities observed with a relatively high rate of decline in four districts of the state [Table 2]. Age-appropriate vaccination (AAV), i.e., received a dose as per recommended schedule at birth for BCG/OPV-0 and 6, 10, 14 weeks and 9 months after birth for DPT/OPV-1, 2, and 3 and measles, respectively, was observed to be low in the state. It was found to be 84.9% for both BCG/OPV-0 and DPTOPV-1, and 84.8%, 83.9%, and 82.7%, for DPT/OPV-2, 3 and measles, respectively. All mothers of surveyed children were also observed for the administration of tetanus toxoid (TT) vaccine during their recent pregnancy. The TT coverage was observed to be high (98.7%) in the state, ranging from 96.2%–100% across all districts. Most of the deliveries (85.1%) were reported to be conducted by the skilled birth attendants (SBAs) such as doctors and nurses.

### Discussion

Vaccination as a most cost-effective public health strategy expects to avert deaths: 18,000 from diphtheria, 320,000 from tetanus toxoid (TT) vaccine during their recent pregnancy. The TT coverage was observed to be high (98.7%) in the state, ranging from 96.2%–100% across all districts. Most of the deliveries (85.1%) were reported to be conducted by the skilled birth attendants (SBAs) such as doctors and nurses.

#### Table 1: History and card-based coverage for fully vaccinated children of 12-23 months surveyed in all 12 districts of Himachal Pradesh, 2015, India

| District            | History (%) | Card (%) |
|---------------------|-------------|----------|
| Bilaspur*           | 98.1        | 93.8     |
| Chamba*             | 95.7        | 81.4     |
| Hamirpur*           | 99.5        | 84.3     |
| Kangra              | 97.6        | 97.6     |
| Kinnaur*            | 99.5        | 89.5     |
| Kullu               | 99.0        | 93.8     |
| Lahaul and Spiti*   | 98.4        | 48.9     |
| Mandi*              | 99.5        | 90.0     |
| Shimla*             | 99.5        | 93.8     |
| Sirmaur*            | 93.8        | 72.9     |
| Solan*              | 95.7        | 89.0     |
| Una*                | 98.6        | 91.4     |
| All*                | 98.1        | 86.0     |

*P<0.01. FV: Fully vaccinated

#### Table 2: Contribution of government facilities for different vaccines for 12-23 months children surveyed in all 12 districts of Himachal Pradesh, 2015, India

| District        | BCG | DPT-1 | DPT-2 | DPT-3 | Measles |
|-----------------|-----|-------|-------|-------|---------|
| Bilaspur        | 94.8| 80.0  | 81.0  | 81.0  | 80.5    |
| Chamba          | 78.1| 78.1  | 77.1  | 78.1  | 76.7    |
| Hamirpur        | 84.8| 81.9  | 82.4  | 82.4  | 81.4    |
| Kangra          | 85.2| 81.9  | 81.9  | 81.9  | 81.9    |
| Kinnaur         | 69.5| 51.9  | 52.4  | 53.8  | 53.3    |
| Kullu           | 88.1| 80.5  | 81.0  | 81.0  | 81.4    |
| Lahaul and Spiti| 49.5| 47.8  | 47.8  | 47.3  | 47.8    |
| Mandi           | 73.8| 56.2  | 57.1  | 57.6  | 60.5    |
| Shimla          | 72.9| 52.4  | 52.4  | 52.4  | 53.8    |
| Sirmaur         | 68.6| 49.5  | 50.5  | 51.0  | 51.0    |
| Solan           | 61.4| 57.1  | 58.6  | 58.6  | 58.6    |
| Una             | 91.4| 91.9  | 91.9  | 91.0  | 91.0    |
| All             | 76.8| 67.7  | 68.1  | 68.2  | 68.4    |

BCG: Bacillus Calmette-Guérin, DPT: Diphtheria pertussis tetanus
pertussis, 403,000 from tetanus, 17,000 from poliomyelitis, and 351,000 from Measles in South Asia.\cite{22} Since 1978 in India, Expanded Program on Immunization leaped into Universal Immunization Program as a promising strategy for child health with a 60% decline in under five mortality from 1990 to 2015.\cite{13,14,15} Governments observed difficulties to achieve sustainable financing in terms of GDP although financial outlay has increased in absolute number with targeted efforts.\cite{3,4,8}

Target based performance assessment based on routine health management information system (HMIS) for year 2014–2015 observed high coverage levels of BCG, DPT-3, OPV-3, and measles in India and studied state.\cite{22} These service statistics reflect correctly guided effort at country and almost best at the state level. Relying on these figures could be misleading as these figures are reported by the health system itself and could be, mostly observed to be, biased, such as reporting bias - possibly due to likely administrative explanations, lack of understanding, or lack of validation.\cite{9,10} The routine HMIS caters information for almost every unit (individual) of the population and could not only be biased but also lack quality and inadequate to inform policy.\cite{11}

Recent NFHS-3 informed better FV coverage (74.2%) in the country, whereas, in studied state, it was consistently better reported as 83.4% in NFHS-2, 79.3% in DLHS-2, and 82.3% in DLHS-3, which has positioned the state as a better-performing state along with other health indicators.\cite{2,3} Furthermore, coverage evaluation survey observed a high FV coverage among children.\cite{12} It was fine until an alarm was raised by DLHS-4 where the FV coverage among 12–23-month child observed to be 63%; 62% in rural and 72.7% in urban area. This has fueled rapid assessment in the state to generate supportive evidence for its better position as observed in earlier rounds of surveys. This survey in the state and across all the districts observed with a very high coverage for FV among children, TT among women along with high prevalence for SBAs-assisted deliveries based on scientifically valid WHO 30 cluster technique. Although AAV adjunct to FV coverage observed as a significant concern as was pointed out in other studies as well.\cite{11,13,14}

The current survey observed with additional advantages as it has surveyed 2.5% of state HHs which is quite high as compare to NFHS-3 and DLHS-4 where about 0.2% and 0.9% state HHs were surveyed, respectively. In NFHS-3 and 4 data were collected for all births in preceding 5 years of the survey whereas, in DLHS-4, it was collected for the past two surviving children born in the preceding 5–6 years.\cite{15} The current study observed that in HH, only one child of 12–23 months age indicating a child born 2 years preceding the survey and currently in its 2nd year of life.

The current study did not stratify for rural and urban area whereas effort was to have a representative sample, so district was the strata and sample was selected for each district with villages and wards in its sampling frame, as majority (90%) of state population resides in rural area and incidentally about 5% of HH were recruited from the urban area in the current study. The quality of data collection procedure was ensured as the data were collected by the trained medical undergraduates and postgraduates under the onsite supervision of faculty member of public health discipline. In best of the knowledge, this statewide survey is the stand-alone effort executed by the public health fraternity which promised to provide the valid data. Whereas other coverage surveys are often outsourced and collected by the trained field workers recruited for the survey.

**Conclusion**

State level effort, in the form of rapid survey, generates an evidence for high level FV coverage among children. It is in concurrence with the earlier rounds of national level survey.

**Financial support and sponsorship**

This study was financially supported by National Health Mission, Himachal Pradesh.

**Conflicts of interest**

There are no conflicts of interest.

**References**

1. Government of India, Ministry of Health and Family Welfare. National Family Health Survey (NFHS-3). Vol. 1. Mumbai: International Institute for Population Sciences (IIPS) and Macro International; 2007.

2. Government of India, Ministry of Health and Family Welfare. District Level Household and Facility Survey (DLHS-4). Mumbai: International Institute for Population Sciences (IIPS) and Macro International; 2013.

3. Brenzel L, Wolfson LJ, Fox-Rushby J, Miller M, Halsey NA. Vaccine preventable diseases. In: Jamison DT, Breman JG, Measham AR, Alleyne G, Claeson M, Evans DB, et al., editors. Disease Control Priorities in Developing Countries. 2nd ed. New York, USA: Oxford University Press; 2006. p. 596-9.

4. Ministry of Health and Family Welfare. National Health Mission: Routine Immunization. Available from: http://www.nrhm.gov.in/nrhm-components/rmnhc-a/immunization/background.html. [Last accessed on 2016 Apr 03].

5. Pejaver RK. Millennium Development Goals: Regional perspectives – India. Arch Dis Child 2015;100 Suppl 1:S59-60.

6. The World Bank. Data. Available from: http://www.worldbank.org/indicator/SH.DYN.MORT. [Last accessed on 2016 Apr 03].

7. Stevance AP, Mengel J, Young D, Glaser G, Symon C. Review of the Sustainable Development Goals: The Science Perspective. Paris: International Council for Science (ICSU), International Social Science Council (ISSC); ISBN: 978-0-930357-97-9. 2015.

8. Government of India. National Health Portal. Available from: http://www.nhp.gov.in/immunization-indradhanush_pg. [Last accessed on 2016 Apr 03].

9. Kumar D, Bansal AK, Mankotia S, Tripathy SP, Bhardwaj AK. Spatio-temporal analysis of secondary data for usefulness and utility of health management information system. J Community Health 2016:4:20-34.

10. AbouZahr C, Boerma T. Health information systems: The foundations of quality health data. Bull World Health Organ 2010;88:97-103.

11. Govindaraj G, Gronowicz G, Schindler D, Royston P. Impact of childhood vaccination coverage on mortality in urban and rural areas of India: A population based analysis. BMC Public Health 2016;4:20-34.

12. United Nations Children’s Fund (UNICEF) 2010. Coverage Evaluation Survey. New Delhi. Available from: http://www.unicef.org/india/health. html. [Last accessed on 2016 Apr 05].

13. Rammohan A, Awosofe N, District level variations in childhood immunizations in India: The role of socio-economic factors and health infrastructure. Soc Sci Med 2015;145:163-72.

14. Prinja S, Gupta M, Singh A, Kumar R. Effectiveness of planning and management interventions for improving age-appropriate immunization in rural India. Bull World Health Organ 2010;88:97-103.

15. Dandona R, Pandey A, Dandona L. A review of national health surveys in India. Bull World Health Organ 2016;94:286-96A.