Review of Vaccine Wastage at rural Primary Health Care Facilities in three districts of Uttar Pradesh.

Introduction

India’s Universal Immunization Program targeting approximately 27 million infants and 30 million pregnant women have made a significant impact on the burden of diseases and directly contributed to reduction in child mortality in the country. All the vaccines included in national immunization schedule (i.e. BCG, DPT, OPV, Measles and Hepatitis B for infants and TT for pregnant women) offered to the beneficiaries through primary health care system are free of cost, with significant financial implication on overall national health budget.

Cost of vaccines constitutes the largest proportion of immunization budget, followed by costs of cold chain infrastructure for maintaining quality of vaccines and service delivery. In immunization program, the number of vaccine doses used is always higher than the number of beneficiaries actually immunized. This excess number of vaccine doses which remain unutilized contributes to vaccine wastage at service delivery level.

Reasons for vaccine wastage may be classified into two broad groups: (1) wastage in opened vials - due to practice of discarding remaining doses in opened vials at the end of immunization session, and (2) wastage in unopened vials due to problems with cold chain (VVM at discard point, frozen DPT, TT or Hepatitis B vaccine vials), breakage during transportation and handling or expired vaccine batches.

Effective vaccine utilization is an integral component of vaccine security, and vaccine wastage is one of the key factors to be considered with regards to vaccine forecasting and need estimation.

Review of literature:

The Ministry of Health and Family Welfare (MOHFW), Government of India has recommended that wastage rate of all vaccines should not be higher than 25% (i.e. wastage multiplication factor of 1.33). The indicative vaccine wastage rates that could be used for estimation of vaccines as per World Health Organization is 50% (10-20 dose vials) and 10% (2-6 dose vials) for lyophilized vaccines and 25% (10-20 dose vials) and 10% (2-6 dose vials) for liquid vaccines.

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2. Vaccine Wastage Assessment, UNICEF, April 2010
Some studies done to assess wastage of individual vaccines are as follows:

- Mukherjee et al while assessing vaccine wastage during Pulse Polio Immunization Program in India found that at the point of administration wastage of Oral Polio Vaccine (OPV) was 14.5% with wastage factor of 1.175.

- Palanivel et al conducted a study on vaccine wastage in primary care setting in urban India and found that wastage rate was highest for BCG (70.9%), followed by TT (62.8%), DT (57.3%), OPV (48.1%), Measles (39.9%), DPT (38.6%) and MMR (37.5%).

- Another study conducted in Bangladesh by Guichard et al revealed that average vaccine wastage rates were highest for BCG (84.9%, range 55-93%), followed by measles vaccine (69.7%, range 28-86%), DPT (44.4%, range 16-77%) and TT (35.5%, range 10-73%).

- An assessment of vaccine wastage in India, conducted in 2009 revealed that wastage rate depended on formulation, presentation and was inversely proportional to session size.

Very few field level assessments have been done for providing a realistic picture to policy makers and program managers about the vaccine wastage in rural primary health care service delivery setting vis a vis recommended rates by WHO and MOHFW. The present document highlights the findings of review of government records and reports done at rural service delivery level by USAID funded Maternal and Child Health Integrated Program (MCHIP) in three focus districts of Uttar Pradesh.

**Methodology**

The objective of present review was to assess the actual vaccine wastage rate of vaccines included in national immunization schedule at rural primary health care facilities, through retrospective analysis of administrative records and reports; and recommend measures that can be incorporated to build efficient mechanisms to reduce vaccine wastage and streamline vaccine management practices. The information collected has also been organized in a manner to analyze trend of vaccine wastage against coverage of different vaccines. This review is not intended to be statistically representative, and looks into both program-related and process-related aspects underlying wastage of vaccines.

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8 National Vaccine Policy , Ministry of Health and Family Welfare, Government of India, April 2011, page 24

9 MCHIP is providing technical assistance for strengthening quality and service delivery of immunization program in three focus districts of state of Uttar Pradesh, viz. Banda, Gonda and Varanasi.
All the rural primary health care facilities in the three districts of Uttar Pradesh (total 32 rural health facilities) were visited on monthly basis between April 2011 and March 2012 (one complete reporting year) for collection of relevant data from different administrative records and reports including vaccine stock book, vaccine distribution logbook and monthly coverage reports. The reporting month was taken as per the administrative guidelines i.e. 21st of current month to 20th of subsequent month, and was not same as the calendar month.

Information about receipt, distribution and consumption of four primary infant vaccines included in national immunization schedule (i.e. BCG, DPT, OPV and Measles) was collected, and entered in form of database in MS Excel worksheet.

**Calculation of wastage rates:** During the review vaccine wastage rates were calculated according to the guidelines of World Health Organization, where initially vaccine usage rates are calculated, and then wastage rates are measured using following formulae:

\[
\text{Vaccine usage rate (\%)} = \frac{\text{Number of doses administered}}{\text{Number of doses consumed}} \times 100
\]

\[
\text{Vaccine wastage (\%)} = 100 - \text{Vaccine usage (\%)}
\]

Number of doses “consumed” includes doses used for immunization and those discarded at the end of session (i.e. opened vials), and also all doses discarded or lost for any reason including expiry, VVM at discard point, cold chain failure, freezing and missing inventory (i.e. unopened vials)

**Results**

Higher vaccine wastage rates were revealed in all three districts compared to that recommended by MOHFW and WHO (Table 1). Highest wastage was observed for BCG vaccine (52.4%), followed by Measles (45.7%), OPV (45.2%) and DPT (26.8%). The range of vaccine wastage was also found highly variable for different vaccines. Certain characteristic observations made from the analysis indicative of programmatic reasons are as follows:

- The combined data for DPT usage for the three districts show minimum wastage of 8.6% during certain month and as high as 42% during another month. This is indicative of mobilization factor at the immunization session sites. As per the guidelines vaccine vial has to be opened even if one beneficiary approaches for vaccination. Therefore in case of poor

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10 Monitoring vaccine wastage at country level - guidelines for programme managers, Vaccines and Biologicals, WHO, 2003
mobilization or when the location or time of session is not appropriate for the community the turnout of beneficiaries would be less leading to higher wastage.

Table 1: district and vaccine wise usage and wastage rates

<table>
<thead>
<tr>
<th>District</th>
<th>Vaccine</th>
<th>Doses administered (number)</th>
<th>Vaccine doses consumed (number)</th>
<th>Vaccine usage rate (%)</th>
<th>Vaccine wastage rate (%)</th>
<th>Range of vaccine wastage during different months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Banda</td>
<td>BCG (A)</td>
<td>33713</td>
<td>104868</td>
<td>32.1%</td>
<td>67.9%</td>
<td>59.7% - 77.0%</td>
</tr>
<tr>
<td></td>
<td>DPT (B)</td>
<td>133137</td>
<td>201829</td>
<td>66.0%</td>
<td>34.0%</td>
<td>5.3% - 50.0%</td>
</tr>
<tr>
<td></td>
<td>OPV (C)</td>
<td>137533</td>
<td>274037</td>
<td>50.2%</td>
<td>49.8%</td>
<td>11.9% - 71.3%</td>
</tr>
<tr>
<td></td>
<td>Measles (D)</td>
<td>34384</td>
<td>63594</td>
<td>54.1%</td>
<td>45.9%</td>
<td>1.4% - 63.5%</td>
</tr>
<tr>
<td>Gonda</td>
<td>BCG</td>
<td>79134</td>
<td>187354</td>
<td>42.2%</td>
<td>57.8%</td>
<td>36.2% - 73.2%</td>
</tr>
<tr>
<td></td>
<td>DPT</td>
<td>296306</td>
<td>367186</td>
<td>80.7%</td>
<td>19.3%</td>
<td>(-)0.4% - 40.1%</td>
</tr>
<tr>
<td></td>
<td>OPV</td>
<td>282820</td>
<td>442555</td>
<td>63.9%</td>
<td>36.1%</td>
<td>20.9% - 51.0%</td>
</tr>
<tr>
<td></td>
<td>Measles</td>
<td>79513</td>
<td>132493</td>
<td>60.0%</td>
<td>40.0%</td>
<td>30.8% - 49.4%</td>
</tr>
<tr>
<td>Varanasi</td>
<td>BCG</td>
<td>53189</td>
<td>165650</td>
<td>32.1%</td>
<td>67.9%</td>
<td>54.6% - 81.1%</td>
</tr>
<tr>
<td></td>
<td>DPT</td>
<td>197895</td>
<td>287940</td>
<td>68.7%</td>
<td>31.3%</td>
<td>9.9% - 47.8%</td>
</tr>
<tr>
<td></td>
<td>OPV</td>
<td>195537</td>
<td>407765</td>
<td>48.0%</td>
<td>52.0%</td>
<td>23.2% - 78.5%</td>
</tr>
<tr>
<td></td>
<td>Measles</td>
<td>50501</td>
<td>106560</td>
<td>47.4%</td>
<td>52.6%</td>
<td>44.0% - 61.2%</td>
</tr>
<tr>
<td>Total</td>
<td>BCG</td>
<td>163727</td>
<td>343921</td>
<td>47.6%</td>
<td>52.4%</td>
<td>44.0% - 61.6%</td>
</tr>
<tr>
<td></td>
<td>DPT</td>
<td>627338</td>
<td>856955</td>
<td>73.2%</td>
<td>26.8%</td>
<td>8.6% - 42.0%</td>
</tr>
<tr>
<td></td>
<td>OPV</td>
<td>615890</td>
<td>1124357</td>
<td>54.8%</td>
<td>45.2%</td>
<td>27.3% - 60.3%</td>
</tr>
<tr>
<td></td>
<td>Measles</td>
<td>164398</td>
<td>302647</td>
<td>54.3%</td>
<td>45.7%</td>
<td>30.7% - 53.4%</td>
</tr>
</tbody>
</table>

(A) BCG: Lyophilized vaccine with 10 doses per vial; single dose injectable
(B) DPT: Liquid vaccine with 10 doses per vial; 5 doses (3 primary doses and 2 booster doses) injectable
(C) OPV: Liquid vaccine with 20 doses per vial; 5 doses (zero, 3 primary doses and one booster dose) orally
(D) Measles: Lyophilized vaccine with 5 doses per vial; single dose injectable

- BCG and Measles are lyophilized vaccines which have to be constituted by adding diluent provided along with them. These vaccines as per the national guidelines have to be discarded after four hours of reconstitution. So in case if adequate number of beneficiaries does not approach the session site many doses will have to be discarded. This is one important reason for higher wastage rate of these vaccines. Even the minimum wastage rate for these vaccines (as per the range) is very high as compared to recommended wastage rate.
• OPV vaccine is supplied in 20 dose vial and any opened vial has to be discarded at end of session even if there are remaining doses in the vial. Therefore when the wastage rate of OPV is compared to that of DPT (which comes in 10 dose vials and all its primary doses and one booster dose are to be given along with OPV vaccine) it is evident that if number of doses in OPV vial is equal to that of DPT, significant reduction can be brought into its wastage.

• There are instances when wastage rate is very less and in some case even negative. This indicates towards the correctness of recorded and reported data. Higher wastage can also result from poor planning of immunization sessions in terms of injection load. Properly planned sessions at appropriate time and locations can bring more beneficiaries leading to reduction in wastage rates.

**Recommendations:**

Some level of vaccine wastage is unavoidable and looking into wastage rates seen in isolation may not lead to reasonable conclusions on the wastage rates as being high, low or rather being justified. For countries like India where a large proportion of the population is reached through outreach immunizations sessions it is important to monitor vaccine wastage rates with immunization coverage rates at all service delivery points for ensuring timely corrective actions in terms of estimation and forecasting of vaccine needs. Irrational estimation without looking into the coverage and consumption may lead to frequent shortages and over stocking of different vaccines.

Data quality audit should be conducted at health facilities at periodic intervals to ensure data quality and accuracy in the government administrative immunization reporting systems. Setting up of district level immunization cell for collecting coverage and vaccine utilization data may help to closely monitor and support in program implementation at different levels. Similarly monitoring of data at national and state levels also need strengthening.

Gap in documentation and correct recording reporting practices indicates towards regular capacity building of staff members for effective data management. For instance in this review the data on unavoidable and avoidable vaccine wastage was not available at any level, which otherwise could have indicated towards specific system or program related aspects, further facilitating local planning and/or national and state policy.

In India like setting with large number of service delivery points there is demanding need to establish technology based solution like internet based reporting and vaccine logistics management system,
which will not only facilitate analysis of reports but also ensure timely availability of vaccines and other critical logistics.

Taking a broader agenda, vaccine wastage monitoring should not only be seen with perspective to strengthen vaccine logistics management, rather it may also help in diagnosis of other existing but hidden problems in program management, microplanning, cold chain management, validity of reporting etc.

**Conclusion:**

To build upon the existing evidence on vaccine wastage, the present review is a small reiteration of the problem prescribing rather simplistic solutions to a complex problem. The focus during this review was to determine vaccine wastage rates through administrative immunization reports, and how proper recording and reporting practices may strengthen overall program management.

During the last decade there have been conscious efforts at the policy level which acknowledge the weak systems of vaccine and logistics management. India’s comprehensive Multi Year Strategic Plan (2005-2010) strategizes to strengthen coordination activities to reduce vaccine wastage and implement open vial policy with the objective to ensure an efficient vaccine and logistics management system\(^\text{11}\).

Vaccine wastage is an expected component of any immunization program. In India since a large proportion of service delivery is through outreach, a high vaccine wastage rate is acceptable if the immunization coverage is high. However, this should be balanced with optimal wastage, safety concerns, and timely use of vaccines. Vaccine wastage can be minimized by determining avoidable causes of loss of vaccine and taking timely corrective action.