Original Research Article

A study on immunization practices amongst private medical practitioners of Bhopal city in central India

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ABSTRACT

Background: WHO advocates and highly recommend that National Immunization Programmes (NIPs) should increase collaboration and communication with private providers delivering vaccination services to ameliorate the purpose immunizing beneficiaries efficiently.

Methods: It is a cross sectional observational study. It is done to assess immunization practices and other relevant aspects amongst private paediatrics practitioners of Bhopal city.

Results: After doing appropriate statistical analysis, results revealed that most of the cold chain practices, vaccine administration practices, record keeping and reporting mechanisms were not up to the mark (i.e. p values < 0.05 at 95% confidence interval). However, training and level of experience contributed to improve in certain practice outcomes.

Conclusions: Quality of immunization services in private sector could be enhanced by providing training and support to private immunization service providers.

Keywords: Immunisation program, Private practitioners, Vaccination practices, Audit, Bhopal

INTRODUCTION

When immunizing agent is inoculated in the form of a vaccine there is induction of immune response, this process is known as immunization. So, immunization is important part or component of the human right to health and prevention of communicable diseases. In 2012, the World Health Assembly adopted the Global Vaccine Action Plan (GVAP) whose aim was to provide equitable access to vaccines by 2020, the full benefits of immunization to all people, regardless of where they are born, who they are, or where they live can be achieved through shared responsibility of various groups involved in providing healthcare.1

In April 2016, the WHO’s, Strategic Advisory Group of Experts (SAGE) had a focus on implementation of immunization program that results into health system strengthening and universal health coverage which requires internal support and integration between various healthcare sectors.2

For full benefits of immunization, coverage of vaccination has to be increased and more than this potent vaccine should reach the beneficiaries for which cold chain maintenance is a must. The cold chain consists of a series of links that are designed to keep vaccines within WHO recommended temperature ranges from the point of manufacture to the point of administration.3

It is highly recommended to strictly stick to cold chain requirements to maintain potency of vaccine and thus failure to stick to cold chain requirements may reduce vaccine potency and can result in lack of protection.
against VPD (vaccine preventable diseases) and/or increased local reactions after administration of vaccine.\(^4\)

WHO advocates and highly recommend that National Immunization Programmes (NIPs) should increase collaboration and communication with private providers delivering vaccination services regardless of the relative contribution of private providers to the delivery of vaccination. It is recommended by WHO that all practitioners doing vaccination in the private sector should undergo training on immunization, current schedules, new vaccines, storage, cold chain management, vaccine vial monitors, communication, advocacy, multiple injections, adverse events and notifiable disease reporting.\(^5\) Government of India and UNICEF and a study by Mitrovich et al. on the private sectors contribution to immunization service delivery in low, middle, and high-income countries observed that private practitioners provide an estimated 21% of vaccinations in urban centres of India, and are important partners in achieving high vaccination coverage.\(^6,11\)

The aim and challenge of national immunization programmes is to attain the target of high vaccination coverage. Engagement of public sector with the private sector and their collaboration, can increase the vaccination services and can improve the programme and thus increase the coverage, this is only possible if the roles of private sector is clearly defined and the services are collaborative with the existing health system and standards.\(^7\) The Universal immunization program targets around 27 million surviving infants and 30 million pregnant women annually.\(^8\)

Despite significant decline in the incidence of vaccine preventable diseases, India is responsible for 30% of the annual global cohort of unvaccinated children worldwide.\(^9\) Globally the pooled prevalence of missed opportunities for vaccination (MOV) for children, in which a child eligible for vaccination, with no valid contraindication, visits a health service centre and does not receive all recommended vaccines, is estimated at 32% among low- and middle- income countries. The goal set to achieve full immunization of 90% of world children by 2000, has not been achieved, and one of the major contributors is MOV.\(^10\) Reasons were related to service providers, the parents and the immunization system. Most reported reasons related to service providers were immunization cards not reviewed, no administration of vaccine simultaneously and perceived contraindications of concurrent illness. From parent’s side the most common reasons were immunization card not available, forgetfulness in bringing the child to the vaccine provider and concurrent infection. Where as in immunization system, inadequacy of monitoring and supervision of vaccine coverage and collaboration with the private sector are the main weaknesses.

Monitoring and supervision of private provider vaccination delivery and participation in adverse event and disease surveillance activities even in high-income countries where there is adequate government infrastructure and mechanisms to capture this information, reporting is often suboptimal.

Inadequate reporting from the private sector results in loss of information on coverage, vaccine-preventable disease incidence, and adverse events, which can affect planning, prioritization, resource allocation, and timely response to outbreaks and vaccine safety concerns.\(^11\)

A study in India found that 31% of private providers reported vaccine doses to the Government and 69% providers commonly responded that they would not report cases that met surveillance definitions for vaccine preventable notifiable diseases, including measles and polio. The most common reason given was unawareness of any reporting requirement, and not knowing where or how to report.\(^12\) In general, private providers closely followed the IAP- recommended vaccination schedule rather than the UIP schedule.\(^13\)

The challenge of national immunization programmes can only be fulfilled by increasing the vaccination coverage. In order to achieve the national vision of reaching and sustaining routine immunization coverage of 90% for all vaccines by the year 2020, there is a need to involve both the private and public health facilities in providing immunization services. Parents are paying extra amount to private sector as compared to public sector to get maximum benefit of immunization. So, child should receive potent & effective vaccines.

The present study was conducted to know the immunization practices followed by private providers in terms of safety and quality of service delivery, recording and reporting mechanism, cold chain status and injection safety practices, offering a wider selection of newer and updated vaccines as compared to public sector.

**METHODS**

A cross sectional study was conducted in urban area of Bhopal city, from December 2018 to May 2020. Bhopal, the state capital of Madhya Pradesh has a population of 2,390,000. All private medical practitioners, who provided vaccination services and who store vaccines in their set up were included in the study and gave consent to participate in the study. AYUSH doctors, part time doctors and clinics, hospitals outside the city and those who do not store vaccines in their private set up were excluded.

Non probability (convenience) sampling method was used. A comprehensive sampling frame of all private providers of immunization services in Bhopal city was constructed by consulting local branches of paediatrician association (IAP association, Bhopal) and association of general practitioners (IMA, Bhopal). In total, 164 paediatricians were identified. All of them were invited to
participate in the study. Out of these 164 paediatricians, 40 practiced in public system and 20 clinics based paediatrician denied that they provide vaccination through their clinics. Thus total 104 paediatricians were eligible for the present study. Out of these 104 paediatricians, 19 paediatricians refused to participate in the study. Thus finally, 85 paediatricians were involved, giving an overall non-response rate of 18.3%.

Tools and technique

In this study predesigned; pretested questionnaire for interview and structured checklist for on-site observation to assess knowledge, attitudes, and practices of private immunization service providers regarding delivery of immunization services were used. Each assessment includes administration of an in-person structured questionnaire, which captured information on immunization practices related to vaccination administration practices, record-keeping of vaccine and reporting of vaccination coverage, cold chain practices and injection safety practices. Vaccine refrigerators examined for the presence of thermometers and temperature logs and non-vaccines items including food and other medications and the vaccine vial monitor (VVMs) observed and interpretation done based on expired stage examined.

Data collection

Appointment with the participant on phone was taken and those who agreed were asked to sign the consent form. Interview using the questionnaire was taken and physical verification using checklist was done for vaccine storage, vaccine administration and its management at the site.

Statistical analysis

Statistical analysis was done using Excel spread sheets. Analysis was done in the form of percentages, proportions and represented in four tables. Appropriate tests of significance applied. Final data was analysed quantitatively in terms of frequency/ number and percentages. Mean and standard deviation were calculated for continuous data. Categorical data was analysed using per-centage and chi square test and Fishers exact test. A p-value of <0.05 was considered significant (at 95% confidence interval).

Ethical considerations

We obtained ethical approval from ethics committee LN Medical College and Research centre, Bhopal for this study and informed consent to participate in the study was also obtained from all respondents and there was no conflict of interest.

Table 1: Characteristic of private immunization providers all providers (n=85).

| Variables                  | Categories                | n=85 (%) | Mean±SD of quantitative variables. |
|----------------------------|---------------------------|----------|-----------------------------------|
| Age (years)                | 20 - 40 years             | 40 (47%) | 35.4±3.28                         |
|                            | 41 - 60                   | 40 (47%) | 47.38±5.54                        |
|                            | 61 -80                    | 5 (6.0%) | 66.8±7.23                         |
| Sex                        | Male                      | 67 (78.8%) |                                  |
|                            | Female                    | 18 (21.2%) |                                  |
| Religion                   | Hindu                     | 72 (84.7%) |                                  |
|                            | N. Hindu                  | 13 (15.3%) |                                  |
| Qualification              | Diploma in Paediatrics    | 25 (29.4%) |                                  |
|                            | MD in Paediatrics         | 60 (70.6%) |                                  |
| Years of experience        | 0 - 9 year                | 29(34.1%) | 5.76±2.06                         |
|                            | ≥10 years                 | 56(65.9%) | 19.43±8.65                        |
| Training status            | Trained                   | 67 (78.8%) |                                  |
|                            | Not trained               | 18(21.2%) |                                  |
| Type of clinic             | Child                     | 67 (78.8%) |                                  |
|                            | Mother and child          | 10 (11.7%) |                                  |
|                            | General                   | 8 (9.4%) |                                  |
| Name of set up             | Children hospital         | 20 (23.5%) |                                  |
|                            | Nursing home              | 14 (16.5%) |                                  |
|                            | Private paediatric clinic | 42 (49.4%) |                                  |
|                            | Other                     | 9 (10.6%) |                                  |
| Immunization clinic        | Registered                | 70 (82.3%) |                                  |
|                            | Not registered            | 15 (17.6%) |                                  |
| Clinic is audited          | YES                       | 45 (52.9%) |                                  |
|                            | NO                        | 40 (48.1%) |                                  |
Table 2: Immunization practices of private providers by training and years of experience.

| Parameter                                      | Total (n=85) | Level of training |                           |                           | Level of experience | P value |
|------------------------------------------------|--------------|-------------------|---------------------------|---------------------------|---------------------|---------|
|                                                | N (%)        | Trained (N=67) n (%) | Not trained (N=18) n (%) | p- value                 | 0-9y (N=29) n (%) | ≥10y (N=56) n (%) |         |
| Vaccine administration practices               |              |                   |                          |                           |                     |         |
| Vaccination is done                            |              |                   |                          |                           |                     |         |
| Vaccinate Daily                                | 75 (88.24%)  | 62 (92.54%)       | 13 (72.22%)              |                           | 22 (75.86%)        | 53 (94.64%)     |         |
| Vaccinate on weekly basis                      | 1 (1.18%)    | 1 (1.49%)         | 0 (0%)                   | 0.0175                    | 1 (3.45%)          | 0 (0%)          | 0.0108   |
| Vaccinate on parent’s demand                   | 9 (10.58%)   | 4 (5.97%)         | 5 (27.78%)               |                           | 6 (20.69%)         | 3 (5.36%)      |         |
| Use MMR for MCV1                               | 82 (96.47%)  | 64 (95.52%)       | 18 (100%)                |                           | 26 (89.66%)        | 56 (100%)      | 0.0142   |
| Routinely vaccinate infants that are mildly ill | 33 (38.82%)  | 27 (38.80%)       | 6 (33.33%)               | 0.5903                    | 8 (27.59%)         | 25 (42.86%)    | 0.1260   |
| Vary schedule for financial reasons            | 36 (42.35%)  | 29 (43.28%)       | 7 (38.89%)               | 0.7376                    | 11 (37.93%)        | 25 (44.64%)    | 0.5526   |
| Know VVM                                       | 83 (97.65%)  | 65 (97.01%)       | 18 (100%)                |                           | 29 (100%)          | 54 (96.43%)    | 0.3031   |
| Administer 2 or 3 vaccines in the same visit   | 62 (72.94%)  | 49 (73.13%)       | 13 (72.22%)              | 0.9384                    | 18 (62.07%)        | 44 (78.57%)    | 0.9689   |
| Primary reason for not administering 2 or 3 vaccines in the same visit (n=23) | | | | | | |
| Practitioners own judgement                    | 9 (39.13%)   | 7 (38.9%)         | 2 (40%)                  | 0.7291                    | 3 (27.27%)         | 6 (50%)         | 0.5240   |
| Parental concerns                              | 12 (52.17%)  | 9 (50%)           | 3 (60%)                  |                           | 7 (63.64%)         | 5 (41.67%)     |         |
| Other reason                                   | 2 (8.70%)    | 2 (11.11%)        | 0 (0%)                   |                           | 1 (9.09%)          | 1 (8.33%)      |         |
| Vaccination schedule used                      |              |                   |                          |                           |                     |         |
| National                                       | 6 (7.06%)    | 5 (7.46%)         | 1 (5.56%)                | 0.83                      | 5 (17.24%)         | 1 (1.79%)      | 0.0297   |
| IAP                                            | 78 (91.76%)  | 61 (91.04%)       | 17 (94.44%)              |                           | 24 (82.76%)        | 54 (96.42%)    |         |
| Both                                           | 1 (1.18%)    | 1 (1.49%)         | 0 (0%)                   |                           | 0 (0%)             | 1 (1.79%)      |         |
| Cold Chain equipment used                      |              |                   |                          |                           |                     |         |
| Domestic refrigerator                          | 62 (72.94%)  | 48 (71.64%)       | 14 (77.78%)              | 0.8621                    | 23 (79.31%)        | 39 (69.64%)    | 0.0102   |
| ILR                                            | 5 (5.88%)    | 4 (5.97%)         | 1 (5.56%)                |                           | 4 (13.79%)         | 1 (1.79%)      |         |
| Dedicated refrigerator                         | 18 (21.18%)  | 15 (22.39%)       | 3 (16.66%)               |                           | 2 (6.90%)          | 16 (28.57%)    |         |
| Record keeping and reporting                   |              |                   |                          |                           |                     |         |
| Practitioner has a record of vaccination       | 82 (96.47%)  | 66 (98.50%)       | 16 (88.89%)              | 0.04959                    | 28 (96.56%)        | 54 (96.43%)    | 0.9767   |
| If YES, then type of record (n=82)             |              |                   |                          |                           |                     |         |

Continued.
Characteristics of physicians and their practices are described in Table 1. Out of total paediatricians 78.8% were male and 21.2% females. By qualification 29.4% paediatricians were holding Diploma in Child Health (DCH) and 70.6% paediatricians were MD in pediatrics. By level of experience, 34.1% had less than 10 year experience and 65.9% had more than 10 years of experience. In our study 78.8% of those, only 52.9% were done. Immunization practices of private immunization providers by training status and level of experience are described in Table 2 and by audit status in Table 3. Immunization practices were measured on level of training status (trained v/s not trained), level of experience (< 10-year experience v/s ≥10-year experience) and audit status (audited v/s not audited). In immunization practices we assessed vaccination administration practices of private providers. Most practitioners 88.2% were doing vaccination daily.

### RESULTS

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| Parameter                              | Total (n=85) | Level of training | Level of experience |
|----------------------------------------|--------------|-------------------|---------------------|
| Office based register                  | 18 (21.95%)  | 14 (21.21%)       | 9 (32.14%)          |
| Register is used to identify           | 3 (3.66%)    | 3 (4.55%)         | 2 (7.14%)           |
| Home based vaccination card            | 61 (74.39%)  | 49 (74.24%)       | 17 (60.71%)         |
| Reporting doses to government          | 28 (32.94%)  | 26 (38.81)        | 8 (31.03%)          |
| Report a case of rash with fever       | 62 (72.94%)  | 49 (73.13%)       | 23 (79.31%)         |
| Report a case of AFP                   | 82 (96.47%)  | 64 (95.52%)       | 28 (96.55%)         |

### Cold-chain practices

| Vaccine refrigerator has a visible temperature log | 69 (81.18%) | 55 (82.09%) | 14 (77.78%) | 0.6777 | 26 (89.66%) | 43 (76.79%) | 0.1501 |
| Vaccine refrigerator has a Thermometer         | 56 (65.88%) | 51 (76.12%) | 5 (27.78%)  | 0.0001 | 18 (62.07%) | 38 (66.07%) | 0.5935 |
| At least one vaccine with expired VVM (stage 3 or 4) | 13 (15.29%) | 9 (13.43%) | 4 (22.22%)  | 0.3577 | 4 (13.79%)  | 9 (16.07%)  | 0.7820 |
| Functional generator is available             | 64 (75.29%) | 53 (79.10%) | 11 (61.11%) | 0.1160 | 22 (75.86%) | 42 (75%)    | 0.9303 |

### Injection safety practices

| Auto-disable syringes used for immunization   | 68 (80%)    | 51 (76.12%) | 17 (94.44%) | 0.0844 | 26 (89.66%) | 42 (75%)    | 0.1092 |
| Hub cutter used for sharps disposal          | 45 (52.94%) | 35 (52.24%) | 10 (55.56%) | 0.8023 | 17 (58.62%) | 28 (50%)    | 0.4502 |
| Control measures are kept for AEFI           | 84 (98.82%) | 66 (77.65%) | 18 (21.18%) | 0.6021 | 29 (100%)   | 55 (98.21%) | 0.4691 |
Table 3: Immunization practices of private providers overall by audit status.

| Parameter                                      | Total (N =85) | Audit status | p value |
|------------------------------------------------|---------------|--------------|---------|
|                                                | n (%)         | Audited (45) | Not audited (N=40) n (%) |
| Vaccine administration practices               |               |              |         |
| Vaccination is done                            | 75 (88.24%)   | 40 (88.89%)  | 35 (87.5%) 0.5614 |
| Vaccinate daily                                | 1 (1.18%)     | 1 (2.22%)    | 0 (0%)    |
| Vaccinate on parent’s demand                   | 9 (10.58%)    | 4 (8.89%)    | 5 (12.5%) |
| Use MMR for MCV1                               | 82 (96.47%)   | 43 (95.56%)  | 39 (97.5%) 0.6277 |
| Routinely vaccinate infants that are mildly ill | 33 (38.82%)   | 22 (48.89%)  | 11 (25%) 0.04342 |
| Vary schedule for financial reasons            | 36 (42.35%)   | 21 (46.67%)  | 15 (37.5%) 0.3932 |
| Know VVM                                       | 83 (97.65%)   | 43 (95.56%)  | 40 (100%) 0.1772 |
| Administer 2 or 3 vaccines in the same visit   | 62 (72.94%)   | 34 (75.56%)  | 28 (70%) 0.5649 |
| Primary reason for not administering 2 or 3 vaccines in the same visit (n=23) |               |              |         |
| Practitioners own judgement                    | 9 (39.13%)    | 5 (45.45%)   | 4 (33.33%) 0.8180 |
| Parental concerns                              | 12 (52.17%)   | 5 (45.45%)   | 7 (58.33%) |
| Other reason                                   | 2 (8.70%)     | 1 (9.09%)    | 1 (8.33%) |
| Vaccination schedule used                      |               |              |         |
| National                                       | 6 (7.06%)     | 4 (8.89%)    | 2 (5%) 0.8161 |
| IAP                                            | 78 (91.76%)   | 41 (91.11%)  | 37 (92.5%) |
| Both                                           | 1 (1.18%)     | 0 (0%)       | 1 (2.5%)  |
| Cold Chain equipment used                      |               |              |         |
| Domestic refrigerator                           | 62 (72.94%)   | 28 (62.22%)  | 34 (85%) 0.5896 |
| ILR                                             | 5 (5.88%)     | 4 (8.89%)    | 1 (2.5%)  |
| Dedicated refrigerator                          | 18 (21.8%)    | 13 (28.89%)  | 5 (12.5%) |
| Record keeping and reporting                   |               |              |         |
| Practitioner has a record of vaccination       | 82 (96.47%)   | 44 (97.78%)  | 38 (95%) 0.4884 |
| If YES, then type of record (n=82)             |               |              |         |
| Office based register                          | 18 (21.95%)   | 11 (25%)     | 7 (18.42%) 0.6690 |
| Register is used to identify                   | 3 (3.66%)     | 2 (4.54%)    | 1 (2.63%)  |
| Home based vaccination card                    | 61 (74.39%)   | 31 (70.45%)  | 30 (78.95%) |
| Reporting doses to government                  | 28 (32.94%)   | 21 (46.67%)  | 7 (17.5%) 0.0042 |
| Report a case of rash with fever               | 62 (72.94%)   | 33 (73.33%)  | 29 (72.5%) 0.9312 |
| Report a case of AFP                           | 82 (96.47%)   | 43 (95.55%)  | 39 (97.5%) 0.6277 |
| Cold-chain practices                            |               |              |         |
| Vaccine refrigerator has a visible temperature log | 69 (81.18%)  | 41 (91.11%)  | 28 (70%) 0.01294 |
| Vaccine refrigerator has a Thermometer         | 56 (65.880%)  | 36 (77.78%)  | 20 (50%) 0.0035 |
| At least one vaccine with expired VVM (stage 3 or 4) | 13 (15.29%)  | 10 (22.22%)  | 3 (7.5%) 0.0597 |
| Functional generator is available              | 64 (75.29%)   | 38 (84.44%)  | 26 (65%) 0.0380 |
| Injection safety practices                     |               |              |         |
| Auto-disable syringes used for immunization     | 68 (80%)      | 37 (82.22%)  | 31 (77.5%) 0.5869 |
| Hub cutter used for sharps disposal            | 45 (52.94%)   | 26 (57.78%)  | 19 (47.5%) 0.3434 |
| Control measures are kept for AEFI             | 84 (98.82%)   | 44 (97.78%)  | 40 (100%) 0.3429 |

42.3% of practitioners stated that they would vary vaccination schedule “sometimes or often” for financial reasons because of inability to pay by the parents and 57.6% stated that they would never vary vaccine schedule. Of the total, 97.6% private providers knew about VVM. Most of the practitioners (72.9%) administer 2 or 3 vaccines in the same visit, while 27.1% practitioners were not administering 2 or 3 vaccines in same visit. Out of 27.1% practitioners, 39.1% did not administer because of their own judgement and 52.2% because of parental concerns and 8.7% due to other reason.

A common explanation provided was that con-current administration of 2 or 3 vaccine would lead to increased adverse effects and parents will not come for the next time for vaccination. Majority (91.7%) followed the IAP schedule, 7% followed the National Immunisation
Schedule and only one pediatrician followed both. In this study 73% practitioners stored vaccines in domestic refrigerators; 21% practitioners were storing vaccine in dedicated refrigerator, while only 6% were using ILR for storage of vaccine.

Record keeping and reporting practices were not up to mark. In our study 96.5% of practitioners were keeping the record of vaccination. 21.9% private providers were having office based register, 3.7% of practitioners reported using a register to record vaccination doses. 74.4% reported that they would not vaccinate the child if vaccination card provided by practitioner used for due vaccine was not brought by the parents. A majority 67.1% of practitioner stated that they would not report vaccine doses administered to government, the reason being given not knowing how to report and where to report, few of them gave the reason that previously Govt. agents were collecting the report, then they stopped coming to collect it. In the present study, majority of respondents 72.9% knew the importance of reporting a case of rash with fever and 96.5% would report a case of acute flaccid paralysis, but still not reported it. The most common reason given were not knowing where to report.

Cold chain practices were directly observed that was not satisfactory and suggests weakness in cold chain quality. Visible temperature log was present in 81.2% refrigerator; thermometer was more frequently present in 64.7% refrigerators. Functional generator was present in 75.3% private set up.

Injection safety practices were better in private clinics. Majority 80% of the private providers used auto-disable syringes during vaccination and 52.9% used hub cutter for sharp disposal. Most of them 98.8% were keeping control measures for AEFI (Adverse Event Following Immunization).

**DISCUSSION**

This study conducted an on-site assessment of immunization practices among private immunization providers. The response rate of our study was 81.7% which is consistent with prior studies among paediatricians.12,13

**Vaccine administration practices**

Regarding vaccination schedule most of the private providers (91.8%) followed the IAP recommended vaccination schedule rather than the regular Universal Immunization Program (UIP) schedule of India. A varied series of vaccines not included in UIP schedule were offered by private providers (including typhoid, varicella, hepatitis A and human papillomavirus vaccine). Similar findings were obtained by Hagan et al, Santos et al. also reported that the private sector is primarily using vaccines that are not included in the EPI schedule and providers determine the price for vaccines procured outside of the government (e.g. hepatitis A and varicella).12,14

Among the private providers 88.2% were doing vaccination daily, 10.6% on parent’s demand and 1.2% were vaccinating weekly. Practices like not immunizing children who are mildly ill (61.2%), reported among private providers was also found. Misconceptions regarding vaccination in minor illnesses may lead to missed opportunity of vaccination (MOV) and thus contribute to vaccination delay and incomplete vaccinations. In addition, MOV can’t be fully addressed without a key change in the attitude of practitioners towards immunization; without a specific valid contra-indication, every child should be vaccinated with all indicated vaccines to reach and maintain high vaccination coverage.10,30,31

However, in the present study, (97.6%) can interpret VVM (Vaccine Vial Monitor). Similar finding was reported by S Mallik et al.15 In the study, conducted by S. Rao et al. about 80.3% of the doctors were aware about the vaccine vial monitor.26 The vaccine vial monitor registers cumulative heat exposures on vaccine over time. The VVM label provides an indication of the integrity of the cold chain, both in routine storage and, and when vaccines are removed from storage for final distribution to vaccination sessions. This low-cost technology is a critical support to promote good temperature management, and provides reassurance of the potency.29

Since most (72.9%) of the paediatricians were administering 2 or 3 vaccine in the same visit, only (23.1%) reported hesitancy to administer multiple injection at the same visit because of their own judgement (39.1%) rather than parental concerns (52.2%). This finding of multiple injection hesitancy among practitioners may also lead to MOV.12,23 Increased parental hesitancy is associated with parents’ decision to delay or refuse vaccinations for their child, and that this decision is associated with lower vaccination coverage.32 Large number of misconceptions still prevails not only among the health professional but even among general population which often lead to non-completion of vaccination schedule. These are mild cold, cough, diarrhoea, prematurity, breast findings, history of seizures, family history of adverse reactions to vaccine, static neurological diseases.27

**Record keeping and reporting**

In this study we found 96.5% were recordkeeping, out of them 75.6% had home based vaccine card and 20.7% had office-based record. Hagan et al. suggests that MOV could also be reduced through the improved and increase use of office-based records and child-based vaccination registers, instead of relying solely on home-based vaccination cards.12
We found low reporting of vaccination doses. Only 32.9% were reporting vaccination doses and 67.1% did not report. Hagan et al. found that 22% of private providers stated that they reported doses administered to the government; 69% did not report. Patel et al. assessment in the Philippines found that 36% of private hospitals reported vaccination coverage to the government immunization program compared to 96% of government clinics. However, some respondents reported reluctance to report doses to the government out of concern for tax implications due to increased government attention to service volume. In our study we found 74.1% were reporting a case of rash with fever and 96.5% stated that they would report a case of AFP. AEFI (Acute Flaccid Paralysis) (Adverse Event Following Immunization) reported to be similar to findings of Hagan et al. and Patel et al. In India, the government provides limited monitoring and supervision at the field level for private practitioners. Assessment teams who conducted visits to private practitioners providing hepatitis B vaccines noted that reporting of doses administered from the private sector were fragmented and sporadic.

**Cold chain practices**

The findings of this study show that cold chain practices were inadequate and cold chain monitoring was not effective. This shows that in 72.9% of practices, vaccines were stored in domestic refrigerators and only 21.2% in dedicated refrigerator and 5.9% in ILR. This shows that private practitioners do not have good understanding about potential harm if vaccines are kept in none dedicated refrigerator. This study is consistent with study done by Hagan et al., Bell et al. and Lilian Yuan et al. 

In our study 34.1% of the private practices lack thermometer, although 81.2% had visible temperature log in their refrigerator. Hagan et al. found that only 26% paediatricians had thermometer in the vaccine refrigerator. Similar findings have been reported by Lewis et al and Grasso et al, Bell et al have reported that lack of thermometer and failure to maintain temperature ranges in the refrigerator are a major risk factor for failure of potency of vaccines. None of the private sector hospitals maintained a thermometer and required temperature ranges in the freezer. These findings are similar to those reported by Pai et al. from China. This brings out the fact that in developing countries cold chain maintenance practices among the private practitioners/hospitals is not safe and the risk of failure of vaccine potency is high. In our study expired (stage 3-4) VVMs were noted in 15.3% of refrigerator which is consistent with similar findings 16% that was noted by Hagan et al.

The present study did not observe any shortage of back-up generator. Back-up generator services was available in 75.3%. Back-up generator services was available in 20% of the centres in Kolkata city observed by Malik et al. and 17% of the refrigerators had a permanent electrical hook-up in the Grand Valley of Colorado, ensuring against accidental disconnection and compromise of cold chain as reported by Woodyard et al. The Government of India (GOI) protocol recommended that each vaccine storage and distribution facility with electrically operated refrigerator equipment has a power generator to secure a reliable source of electricity.

**Injection safety practices**

Vaccine administration techniques were better in private clinics. Most of the private providers i.e. 80% were using auto-disable syringes for vaccination and half of them 52.9% used hub cutters for sharp disposal. Aseptic precautions were followed at the time of vaccine administration, 98.8% were keeping control measures for AEFI. Injection safety practices were also better in the study done by Hagan et al. and Kumar et al.

**CONCLUSION**

In current scenario of the country, regular periodic audits and ongoing training sessions are drastically required to achieve goals of universal immunisation program coverage in private sector. Although knowledge on immunization practices among private providers was good, it needs improvement in cold storage practices, recordkeeping and reporting practices. Quality of immunization services in private sector can be strengthened by providing training and support to private immunization service providers. As sample size of this study was relatively less, so only few p values have shown significant results for various parameters.

**Recommendations**

Monitoring and supervision of private immunization providers would increase the immunization coverage. Public-private partnership strengthening is needed to improve vaccination and also for newer research in vaccines, that should be shared with public system. Private practitioners should adhere to rules and regular training is recommended for maintenance of cold chain to maintain potency of vaccines. Periodic audits should be done by Government authority for system upgradation with current status of immunization practices and equipment’s. It is obligatory to administrate such operational researches with large sample size at different geographical habitations to do a sensible SWOT (Strength, Weakness, Opportunities and Threats) analysis about the existing lacunae.

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