

Challenges, optimization, and best practices in COVID-19 Vaccination: Experiences from a tertiary care urban vaccination centre of Himachal Pradesh

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ABSTRACT

The COVID-19 vaccination rollout in Himachal Pradesh faced significant operational hurdles. This study evaluates strategic responses at an urban COVID Vaccination Centre (CVC) to maximize vaccine utilization and delivery. As eligibility expanded to adults aged 18+, adaptive strategies were implemented to achieve zero dose wastage despite restrictive session constraints and online-only booking complexities. Key interventions included a "Zero Tolerance to Dose Wastage" policy, on-site beneficiary confirmation, and extended hours. By utilizing low dead space syringes, the centre extracted 11–12 doses per 10-dose vial, surpassing standard expectations. A systematic protocol for refilling leftover slots ensured maximum vial utilization. Between May and June 2021, 1,221 individuals were vaccinated—exceeding the 1,100 published slots—by accommodating 168 additional beneficiaries through dedicated outreach. The centre enhanced equity by providing digital booking support for underserved populations and achieved a peak throughput of 371 vaccinations in six hours. Ultimately, 41,500 doses were administered across 595 sessions, saving ₹528,750 through optimization. This framework, anchored by the principle "One Dose Equivalent to One Life," provides a replicable model for sustainable public health impacts during crises amidst the ensuing pandemic.

KEYWORDS

COVID-19 vaccination, Vaccine utilization, Best practices, challenges

INTRODUCTION

The Government of India (GoI) and Himachal Pradesh (HP) launched a COVID-19 vaccination drive on 16th January 2021 with 1st prioritized inoculation of the healthcare workers primarily. The vaccines administered were under the trade names of 'Covishield' and 'Covaxin'. From 1st March 2021 onwards, the GoI rolled out vaccination for citizens who had attained the age of either 60 or 45 years with co-morbidities on or before 1st January 2022. (1) Subsequently, those above the age of 45 were also included, and from 1st May 2021 onwards, it was extended to the age of 18 yrs. A projected population of 7.3 million inhabits HP as per Census 2011 projections on 1st March 2021.(2) An estimated 5.5 million people were required to be inoculated as target, for dose saturation of 1st dose in the state of HP. The registration for 18 to 45 years was rolled out on the Co-Win app on 28th April 2021. This section of the population responded enthusiastically, and a record of 13 million-plus registrations were done in a single day across the country. This phase was regulated under Liberalized Pricing and Accelerated National COVID-19 Vaccination Strategy(3) Vaccine for people above 45 years was centrally provided, and for the 18 to 45 categories, HP followed the central directive of procuring vaccines directly through open market channels. In HP, the vaccination for (18+) was rolled out, effectively on 17th May

2021, along with subsequent sessions planned on two days of the week with fixed publishing timings (1,2).The urban Covid Vaccination Centres (CVCs) like us were directed to have exclusive online sessions only, with online slot booking restricted to 100 slots per session. The roll out of the various phases of the vaccination campaign put forth numerous challenges. The authors here attempt to disseminate the experiences and best practices adopted, sustained for referencing of any foreseeable challenges in the future.



Key components of Framework of Best Practices: Source - A Systematic Literature Review

Rationale: A best practice is defined as "An intervention that has shown evidence of effectiveness in a particular setting and is likely to be replicable to other situations"(3) The

essence of a best practice is based on key eight identified evaluation criteria as depicted below. There were various such practices were adopted at our tertiary care medical college COVID-19 Vaccination centre during the period of pandemic as listed below based on these criteria highlighted as published in the systematic literature review :

MATERIAL & METHODS

Figure 1. Depicts the time line and actual dates of launch of various phases of the vaccination drive by the Government of India and State government of HP. There were distinct phases of beneficiary load at our vaccination centre, corresponding to the inclusion of eligible beneficiaries as per government policy directives. The key differentiation was the state of HP launched an exclusive drive for eighteen years above beneficiaries serving at the various points as front line workers across various sections.

Novelty: With the advent of the rolling out of vaccination patterns as per directives, we encountered various challenges repeatedly. The challenge surfaced during roll out of the drive for 45 and years above was uniquely different from roll out in above eighteen years category. Every challenge put forth by the vaccination team leads to the creation of best practices about the contextual situation of the vaccination phases. Some of the key challenges, solutions and good practices are listed in figure 2.

RESULTS

Strategies adopted for Execution and Implementation of Best practices:

a. (i)-Zero Tolerance To 'Any' Dose Wastage: For categories HCW+FLW+60+45 yrs & above, there was on-spot registration, and it was practised that every vial of the day would be opened only if there were "Confirmed 10/11 beneficiaries" at the site. In case 1 or 2 doses were still left at the end of the session, we practised individualized efforts to look out for any eligible beneficiary in the hospital settings and ensured 'Zero Tolerance to Dose Wastage' with extended hours of sessions daily. The session were often extended up to 5 pm or more to achieve the daily objective of not wasting even a single dose. However, the real challenge resurfaced over (18+ category) with "All exclusive online session only" without any spot registration facility at the site. The vaccines procured for categories 18 to 45 were from the state quota only, and people were impatient for the quickest vaccination. In each session of (18+), online slots were published for booking through district authorities only. The session was primarily fixed for 100 slot only with strict restriction of onsite spot registration at the centre by backend district control centre.

(ii)-Fixed Slot 18+ sessions. 'One dose equivalent to One life' principle and Strategic Plan:

The real challenge foreseen hypothetically was, assuming 100 online slots are being booked and all individuals reporting for vaccination, one person could still be left out as 'unvaccinated' despite the extra effort to extract 11 doses per vial. Assuming such a situation (Table 1), the beneficiary (confirmed online booked slot) could forcibly demand the opening of the next vial, thereby wasting the left-out doses. As we could not publish/book the slots on the spot, it was decided that we would utilize every dose and, at the same time, not refuse vaccination benefits to anyone. The authors were aware of the fact that overfill for a 10-dose vial can be from about 16% to 24% (or 0.58 to 0.62mL fill-volume for a 0.5mL dose), and it was possible to withdraw 11 or 12 doses of 0.5 mL from a 10-dose vial when a low dead space syringe

is used (1). Low-dead space syringes were used to administer vaccine and we could extract all doses. Various Standard Operating procedures (SOPs) were laid out to be followed as a protocol by all. We used to estimate the left-out doses left after scheduled vaccination as per online booked slots. We proceed to contact every beneficiary for their confirmation through mobile and request district authorities to republish the left-out slots till exhaustion of last dose. Table 1 depicts the actual implementation of the plan session-wise at the centre based on 11 doses per vial.

b. Advanced - AEFI Management Centre at CVC: All sessions were conducted with fully equipped advanced management centre managed by designated anaesthesia/medicine resident to address any AEFI if reported. Reassurance of AEFI management played the key role in vaccination of about 100+ @High Risk individuals from far off (~150 km) places.

c. Mandatory IEC post vaccination: All the beneficiaries who were administered the doses of COVID -19 vaccine were mandatorily observed for any expected adverse event at least for 30 minutes as recommended by government of India guidelines at the initiation of the vaccination. Our centre not only plasticised this in principle for every beneficiary and simultaneously were provided with relevant IEC of any adverse event post vaccination by dedicated team of health educators.

d. Sharp at 9 am. The scheduled recommended time for vaccination session start was 9.30 am onwards. At our centre, the session started at 9 am sharp on daily basis during peak periods (April- August 2020 first dose campaign. The 9:00 AM starts enabled early vaccination for daily wagers, ensuring job security via empowered staff and on-site registration.

e. Walk the Extra mile - 'Online Slot Booking by support staff at the centre.

During the unprecedented rush of 18+ sessions, online slot booking was a massive challenge for unsavvy digital persons. Only a limited number of slots would open at a fixed time for session and would fill within minutes. Our centre became a renowned site for the general public for facilitating online slot booking by team. National and local media reported the extra efforts of the team.

f. Shortest possible- 'Waiting time' – 'Maximum Vaccination' at the centre. Despite all the efforts for zero tolerance to dose wastage and other efforts, our centre ensured the shortest possible 'Waiting time' with maximum vaccination. On 14th August, our centre vaccinated 371 individuals within 6 hours of scheduled session timings, attending one beneficiary each per minute, inclusive of online registration, verification and vaccination.

g. Exhaustive IEC and Special efforts for Vaccination drive for 2nd Dose. During the 1st and 2nd dose drives dedicated campaign for community participation. There were special efforts devised and practised for community mobilisation during vaccination drive, including 'selfie stand ' along with, "I am fully vaccinated" signature wall during 2nd and booster dose campaign.

DISCUSSION

Impact: At our Centre, till the culmination of the Vaccination drive of both the phases, in total 41,580 doses were administered during the 595 sessions. We utilized 3923 vials, out of that, extra doses utilized were 2350. We vaccinated 168 individuals additionally during an exclusive online slot only 18+ drive. The vaccination drive of the phase of 18+ was funded on its own by the respective state governments & SII had reduced the price of the Covishield for the states to ₹300 per dose from ₹400. We saved 5,28,750 INR at our centre

notionally during the entire vaccination drive. Hence, we were able to save the exchequer along with our objective of maximum vaccination of beneficiaries equitably, under the mission of 'One Dose equivalent to One life'.

It is noteworthy, to mention that in the state of HP, for the vaccination of 18 years and above only one available vaccine, 'COVISHIELD' was approved by the nodal agency National Health Mission, HP despite being the availability of other vaccine which was indigenously developed by the name of 'COVAXIN'. This decision turned out to be an administrative master stroke, as any addition of two different vaccines into the roll out of the vaccination drive might have led to multiple operational challenges, of supplies, logistics and above all, multiple inconveniences of the beneficiaries for participation at the micro level of vaccine delivery.

CONCLUSION

The 'One Dose equivalent to One life' motto was key driver for the motivation of the team members and played a significant role in achieving the objective. The two phases of the vaccination drive lasted almost a year. The long duration of the vaccination drive in a hilly state, put forth novel challenges and issues every time for smooth success of the campaign. Each challenge was addressed amicably with compatible local solution as per resource availability and later on practiced as an adopted best practice for community participation and alleviation of the relevant practical problems of the vaccination beneficiaries, that too amidst peak of COVID-19 pandemic morbidity and mortality.

With collective effort & a pre-planned strategy for all sessions, we achieved the goal of 'Zero wastage and maximum vaccination to the resource capacities' at the centre despite multiple operational challenges, as a best practice. All the interventions introduced as local viable solution was adopted as best practice which was both sustainable and replicable. Sustainability and Replicability being the vital key ingredient of a best practice as highlighted in the, 'Key components of Framework of Best Practices: Source - A Systematic Literature Review'.

RECOMMENDATION

We recommend a sustainable and replicable best practice model that views every dose as a critical resource, specifically for resource constraint country like India. This practice should be encouraged in critical times of the pandemic, when production of the vaccines is a major concern. By combining technical tools like specialized syringes with human-centric supports like digital assistance, real time behavioural responses, health systems can achieve maximum vaccination relative to resource capacity while maintaining community trust and participation.

LIMITATION OF THE STUDY

As this commentary pertains to one of the experiences of single centre at tertiary care level, the generalizability is limited. Additionally, the documentation of practices being best leads to subjective bias also by the authors about the situation.

RELEVANCE OF THE STUDY

It is a collective attempt by the authors to disseminate the various interventions adopted to enhance the participation of community for larger cause of the humanity during pandemic, by being human centric and behavioural in responses to the needs of beneficiaries and responding to it on real time basis by offering viable solutions.

AUTHORS CONTRIBUTION

All authors have contributed equally.

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Nil

CONFLICT OF INTEREST

There are no conflicts of interest.

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DECLARATION OF GENERATIVE AI AND AI ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

Grammarly was used to cross check for any grammatical improvement. All references are self-researched and cited, no generative AI tool was used.

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