

**WASTAGE MULTIPLICATION FACTOR OF COVID-19 VACCINES: A DISTRICT-LEVEL STUDY****Mahwish Suhaib<sup>1</sup>, Nitin Dutt Bhardwaj<sup>2</sup>, Anmol Jain<sup>3</sup>, Brig Pradeep Srivastava<sup>4\*</sup>, Saumya Rawat<sup>1</sup> and Seema Khan<sup>1</sup>**<sup>1</sup>MHA Student, <sup>2</sup>Professor (Jr Grade) & Head, <sup>3</sup>Senior Resident, <sup>4</sup>Associate Professor & Corresponding Author  
<sup>123\*</sup>Department of Hospital Administration, KGMU, Lucknow.**\*Corresponding Author: Brig (Dr.) Pradeep Srivastava**<sup>4</sup>Associate Professor & Corresponding Author Department of Hospital Administration, KGMU, Lucknow

Article Received on 19/09/2023

Article Revised on 09/10/2023

Article Accepted on 29/10/2023

**ABSTRACT**

Vaccination is one of the most important ways to prevent or control the outbreak of infectious diseases. Vaccine wastage continues to be a major public health challenge. It is important to minimize this wastage for appropriate vaccine management. Against this backdrop, this study has delved into the COVID-19 vaccines wastage multiplication factor at the district level. It is a descriptive study. The total number of beneficiaries in a year in a district was 54,997,31 for Covishield while for Covaxin it was 10,755,48. Wastage Multiplication Factor was 1.74% for Covishield while it was 18.88% for Covaxin. The study will offer practical guidelines to stakeholders to minimize vaccine wastage and to evaluate and prepare ourselves for the future.

**KEYWORDS:** COVID-19, Vaccine, Wastage Multiplication Factor.**1. INTRODUCTION**

Immunization is a proven tool for controlling & preventing life-threatening infectious diseases & is estimated to prevent 2-3 million deaths every year.<sup>[1]</sup> India runs one of the largest Immunization programs in the world, vaccinating more than 26 million newborns and 29 million pregnant women.<sup>[2]</sup>

SARS-CoV-2, a single-positive strand RNA virus causes COVID-19 disease. In December 2019 the first case of novel coronavirus 2019 (SARS-CoV-2) was reported and soon took over the world indicating the importance of effective vaccination. India witnessed its first case on 27th January 2020. The World Health Organization (WHO) declared COVID-19 a pandemic in March 2020 after which the search for its vaccine began. Vaccination is widely recognized as one of the most effective methods in controlling the spread of epidemics/pandemics like SARS, Ebola, COVID-19 etc.<sup>[3]</sup>

Wastage Multiplication Factor (WMF) is used for the estimation of vaccine and logistics. The WMF is calculated using the permissible wastage percentage. It is important to minimize wastage for appropriate vaccine management in India. According to World Health Organization more than half of all the vaccines produced globally are wasted and recommends the monitoring and reporting of data related to vaccine wastage.<sup>[4]</sup> Vaccine wastage continues to be a major public health challenge.<sup>[5]</sup> In developing countries with large birth

cohorts, vaccine wastage can undermine the coverage of existing vaccines and inhibit the introduction of newer ones due to the escalating costs and logistics.<sup>[6]</sup>

India is a large country with the highest population hence, it is important to have an effective vaccination. To accomplish this, numerous vaccination centres were established in the districts. The main purpose of this study is to know the number of COVID-19 vaccinated beneficiaries and to calculate the Wastage Multiplication Factor for the respective vaccines at the district level.

**2. MATERIALS AND METHODS**

In this study, a descriptive research design was employed to investigate COVID-19 vaccine wastage at the district level in Uttar Pradesh, India. The study focused on beneficiaries of the Covishield and Covaxin vaccines. Data was sourced from District Level Vaccine Store records and the Co-WIN Portal. The variables under consideration included the number of individuals who received 1st, 2nd, and Booster doses of both vaccines across different beneficiary groups such as Healthcare Workers, Frontline Workers, and various age categories. The study adhered to specific inclusion and exclusion criteria, focusing exclusively on COVID-19 vaccines supplied by the State Government. Data collection was undertaken with the requisite permissions from the Chief Medical Office, relying on District Level Vaccine Store records. The collected data underwent thorough analysis, with a focus on descriptive techniques, and was

subsequently presented in clear tabular and graphical formats. A key metric, the Wastage Multiplication Factor (WMF), was calculated for both Covishield and Covaxin. Additionally, the calculated WMF values were compared against the guidelines established by the Ministry of Health Family Welfare (MoHFW).

**3. RESULTS AND DISCUSSION**

The COVID-19 vaccination program in our country rolled out in phases, with priority given to specific

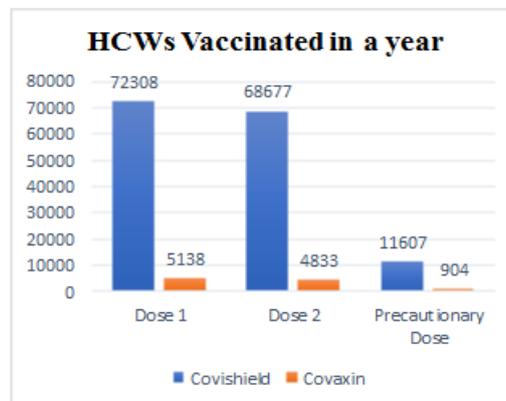
groups such as healthcare workers proceeding to Front Line Workers, citizens more than 60 years of age & between 45-59 years with comorbid conditions, citizens over 45 years of age, and eventually citizens more than 18 years of age. Later on, vaccination for 15-18 years of age was also introduced. Number of people vaccinated with Covishield and Covaxin in a year were recorded as described in Table 1 & 2 and figure 1 to 6.

*Table 1: Number of people vaccinated in each group at District level in a year.*

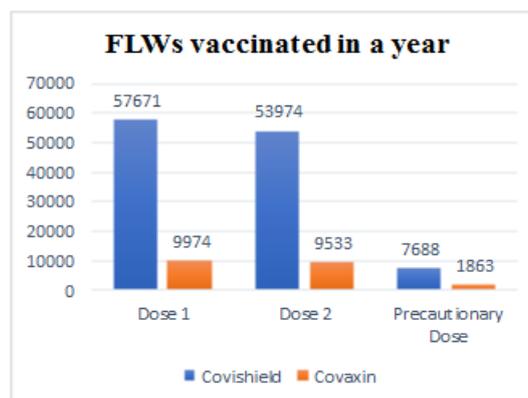
Groups	Number of people vaccinated with 1st dose		Number of people vaccinated with both 1st & 2nd dose		Number of people vaccinated with 1st, 2nd & Booster dose	
	Covishield	Covaxin	Covishield	Covaxin	Covishield	Covaxin
Healthcare Workers (HCWs)	72308	5138	68677	4833	11607	904
Frontline Workers (FLWs)	57671	9974	53974	9533	7688	1863
>60 years of age & between 45-59 years with comorbid conditions	349957	57538	272431	50628	5759	1929
>45 years	655075	99383	498196	87381		
>18 years	2061461	366992	1384927	245548		

*Table 2: Total Doses Administered in a year.*

Dose	Covishield	Covaxin
1st Dose	3196472	672929
2nd Dose	2278205	397923
Booster Dose	25054	4696
Overall	5499731	1075548



*Fig. 1: HCWs vaccinated in a year at District level.*



*Fig. 2: FLWs vaccinated in a year at District level.*

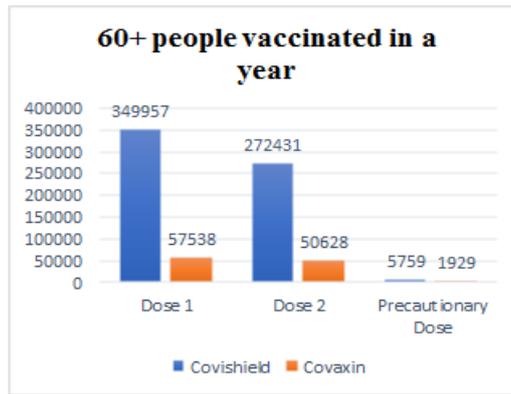


Fig. 3: 60+ people vaccinated in a year at District level.

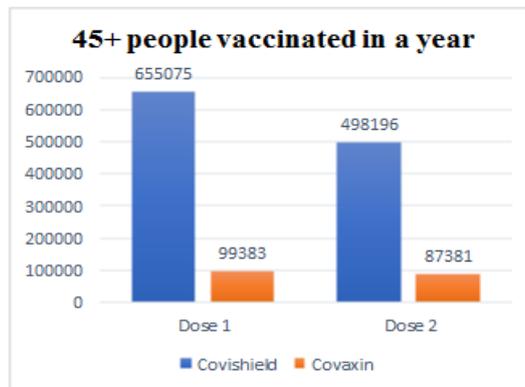


Fig. 4: 45+ people vaccinated in a year at District level.

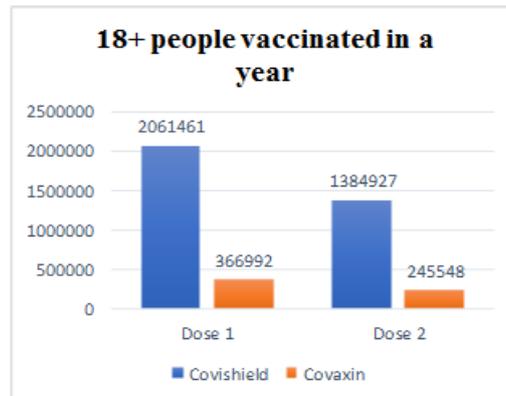


Fig. 5: 18+ people vaccinated in a year at District level.

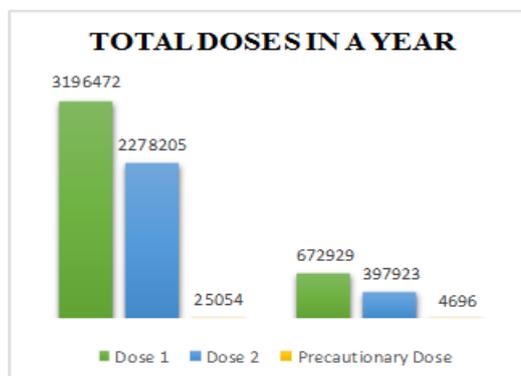


Fig. 6: Total doses in a year at district level.

As per the data collected from Co-WIN portal dosage of Covishield and Covaxin received at District level in a year was 55,97,270 and 13,25,910 respectively while dosage of Covishield and Covaxin administered was

54,997,31 and 10,755,48 respectively, as shown in fig.7. The data regarding vaccine consumption and vaccine coverage in a year was obtained so wastage factor can be calculated using the following formula-

$$\frac{\text{Consumption of vaccine} - \text{Coverage of vaccine} \times 100}{\text{Consumption of vaccine}}$$

• For **Covishield**, WMF at District level,  
 $WMF = \frac{5597270 - 5499731}{5597270} \times 100$   
 = **1.74%** (Fig. 8)

• For **Covaxin**, WMF at District level,  
 $WMF = \frac{1325910 - 1075548}{1325910} \times 100$   
 = **18.88%** (Fig. 9)

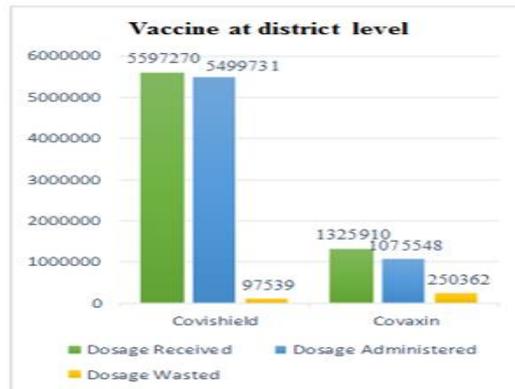


Fig. 7: Vaccine administered at district level.

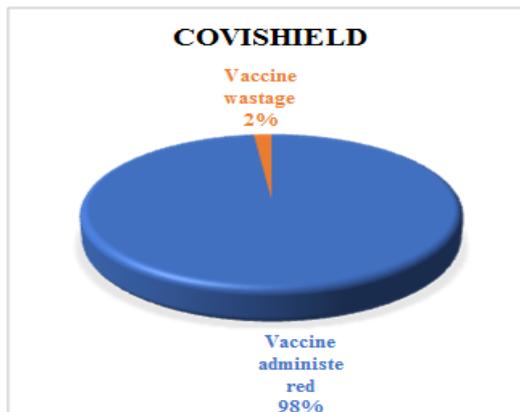


Fig. 8: Wastage Multiplication Factor of Covishield.

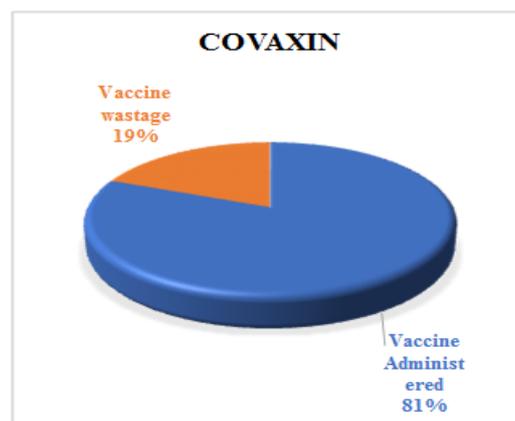


Fig. 9: Wastage Multiplication Factor of Covaxin.

The standard guidelines for COVID-19 vaccines allow a Wastage Multiplication Factor of 1.11, assuming an allowable programmatic wastage of 10%.<sup>[7]</sup> As we can see from the calculated data, WMF for Covishield is within acceptable the limit while it's slightly more (18.88%) for Covaxin. Probable reasons for higher WMF for Covaxin can be stated as:

- Initially, it was supplied as a 20-dose vial (while for Covishield it is a 5 mL vial) hence making it difficult to utilize the entire vial in a specified duration, leading to vaccine wastage. Later on, it also started coming in 10 & 5ml vials.
- When the vaccination started, beneficiaries were required to sign a consent form before Covaxin vaccination which created hesitation among individuals.
- Covaxin was not approved initially by WHO for foreign travel which was one of the potential reasons for a smaller number of recipients hence leading to higher wastage.

#### 4. CONCLUSION

The study focused on assessing the wastage multiplication factor of COVID-19 vaccines at the district level. The following key observations were made:

##### i. Vaccine Dosages and Administration:

- Covishield: Received 55,97,270 doses, Administered 54,99,731 doses
- Covaxin: Received 13,25,910 doses, Administered 10,75,548 doses

##### ii. Wastage Multiplication Factor (WMF) Calculation:

- WMF for Covishield: 1.74%
- WMF for Covaxin: 18.88%

##### iii. Comparison with standard guideline:

- Standard WMF for COVID-19 vaccine, considering a programmatic wastage of 10%, is 1.11.
- Covishield WMF within acceptable limit, Covaxin WMF slightly higher.

The study draws several conclusions based on the analysis of vaccine wastage multiplication factor and related factors:

- i. The immunization is a crucial tool in preventing infectious diseases, and effective vaccination is of paramount importance, especially during pandemics like COVID-19.
- ii. The study identified the significant challenge of vaccine wastage, particularly concerning Covaxin, which exhibited a higher WMF compared to the acceptable limit.
- iii. Covaxin's higher WMF can be attributed to factors such as initial supply challenges, hesitancy due to consent forms, and lack of WHO approval for foreign travel.

#### 5. LIMITATIONS AND FUTURE RESEARCH:

- i. Limited to a specific district and time frame.

- ii. Further research required to explore specific reasons behind Covaxin's higher WMF.
- iii. Comparative studies across different regions and vaccine types could provide additional insights.

**Financial Support and Sponsorship:** Nil.

**Ethical considerations:** The study was conducted in accordance with ethical guidelines.

**Conflict of interest:** None

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