# Is pre vaccination the reason for less morbidity and mortality for COVID-19 in India: An epidemiological study

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## Abstract

As we all know the current rapid of the covid-19 in the most of the world has become a pandemic situation. Many research studies have been by various countries to develop vaccines against the coronavirusSARS-CoV-2. Currently about six vaccine candidates have passed early testing and have entered the clinical trials across the globe, along with more than80 other candidates reported to be in preclinical stages. These state that many different approaches are being moved forward at the same time. However, the destinations not yet completed and so no vaccines are currently licensed for any of the other corona viruses affecting humans. If we go in the past few decades, various vaccines were given to geriatrics as well as paediatrics. So if we look the same in other countries the use of the vaccines is very less or instead some countries have no authentic grant to sell or use the vaccines. Here in this present study we are trying to propose that by the early use of the vaccines also reduced the number of reported COVID-19 cases in a country. So is the combination of these vaccines a reason for the reduced morbidity and mortality and can it be a boon to fight against the disaster of COVID-19 in future.
**Keywords:** COVID-19, Vaccines, morbility, mortality, preclinical and clinical testing.

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## 1. Introduction

A group of cases subjecting to pneumonia caused due to a β-coronavirus, occurred in Wuhan, China. Later it was named as the 2019- novel coronavirus (2019-nCoV) on 12 January 2020 by World Health Organization (WHO). The Chinese scientists rapidly isolated a SARS-CoV-2 from a patient within a short time on 7 January 2020 and came out to genome sequencing of the SARS-CoV-2 [1]. As of 29 March 2020, a total of 81,439 cases of COVID-19 have been confirmed in mainland China including 3,300 deaths [2].

Studies estimated the basic reproduction number (R0) of SARS-CoV-2 to be around 2.2 [3], or even more (range from 1.4 to 6.5) [4], and familial clusters of pneumonia [5] outbreaks add to evidence of the epidemic COVID-19 steadily growing by human-to-human transmission.

Coronavirus disease 2019 (COVID-19) is a respiratory illness that can spread from person to person. The virus that causes COVID-19 is a novel coronavirus that was first identified during an investigation into an outbreak in Wuhan, China. [6]

However, if we compare the case ratio and the death ratio there is a difference when compared India with other. For example Italy has more social interactions and COVID-19 mortality is still high. In contrast, Japan had some of the earlier cases, but the mortality is low despite not having adopted some the more restrictive social isolation measurements. These differences are due to the medicinal standards implemented by the countries

worldwide. Moving further, if we look at the use of the vaccines by the countries it can be straight forward understood that the very few countries have used the vaccine. Developed countries could including Spain, France, and Switzerland, have discontinued their universal vaccine policies due to comparatively low risk for developing infections as well as the proven variable effectiveness in preventing it.

Also countries such as the United States, Italy, and the Netherlands, have yet to adopt universal vaccine policies for similar reasons. Several vaccines including the BCG vaccination have been shown to produce positive "heterologous" or non-specific immune effects leading to improved response against other non-mycobacterial pathogens. By the given our current analysing current epidemiological data, this investigation aims to identify a possible correlation between the existence of universal vaccines policies and the morbidity and mortality associated to COVID-19 infections all over the world.[7]

## 2. Method

Data collection and it's study with reference to the different vaccines given to the  Infants, Children and Pregnant Women according to the age  and by observing the particular conditions of the patient's in India was done from the National Immunization Schedule (NIS). Later the additional data of COVID-19 cases and death per country was also obtained from https://google.org/crisisresponse/covid19.

In an account we classified countries according to their GNI per capita in 2018 using the (https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups).

Countries were divided in three categories: low income (L) with an annual income of 1,025 dollars or less, lower middle income with an income between 1,026 and 3,995 dollars, and middle high and high income countries, which included countries with annual incomes over 3,996 dollars.[7]

### Table 1: Different vaccines given under the Particular age limit

| Age | Vaccines given |
|---|---|
| Birth | Bacillus Calmette Guerin (BCG), Oral Polio Vaccine (OPV)-0 dose, Hepatitis B birth dose |
| 6 Weeks | OPV-1, Pentavalent-1, Rotavirus Vaccine (RVV)-1***, Fractional dose of Inactivated Polio Vaccine (fIPV)-1, Pneumococcal Conjugate Vaccine (PCV) - 1*** |
| 10 weeks | OPV-2, Pentavalent-2, RVV-2*** |
| 14 weeks | OPV-3, Pentavalent-3, fIPV-2, RVV-3***, PCV-2*** |
| 9-12 months | Measles & Rubella (MR)-1, JE-1* , PCV-Booster*** |
| 16-24 months | MR-2, JE-2*, Diphtheria, Pertussis & Tetanus (DPT)-Booster-1, OPV –Booster |
| 5-6 years | DPT-Booster-2 |
| 10 years | Tetanus Toxoid (TT)/Tetanus & adult Diphtheria (Td) |
| 16 years | TT/Td |
| Pregnant Mother | TT/Td1, 2 or TT/Td Booster** |

1. * JE in 231 endemic districts
2. ** One dose if previously vaccinated within 3 years
3. ***Rotavirus vaccine and PCV in selected states/districts as per details below:
Rotavirus: Andhra Pradesh, Assam, Haryana, Himachal Pradesh, Jharkhand, Madhya
Pradesh, Odisha, Rajasthan, Tamil Nadu, Tripura & Uttar Pradesh.
PCV: Bihar, Himachal Pradesh, Madhya Pradesh, Uttar Pradesh (12 districts) & Rajasthan (9 districts).

### Table 2: National Immunization Schedule (NIS) for Infants, Children and Pregnant Women (Vaccine-wise)

| Vaccine | To to give | Dose | Route | Site |
|---|---|---|---|---|
| **For Women** | | | | |
| Tetanus Toxoid (TT)/Tetanus & adult Diphtheria (Td)-1 | Early in pregnancy | 0.5 ml | Intra-muscular | Upper Arm |
| TT/Td-2 | 4 weeks after TT-1 | 0.5 ml | Intra-muscular | Upper Arm |
| TT/Td- Booster | If received 2 TT doses in a pregnancy within the last 3 years* | 0.5 ml | Intra-muscular | Upper Arm |
| **For Infants** | | | | |
| Bacillus Calmette Guerin (BCG) | At birth or as early as possible till one year of age | 0.1ml (0.05ml until 1 month) | Intra-dermal | Left Upper Arm |
| Hepatitis B - Birth dose | At birth or as early as possible within 24 hours | 0.5 ml | Intra-muscular | Antero-lateral side of mid-thigh |
| Oral Polio Vaccine (OPV)-0 | At birth or as early as possible within the first 15 days | 2 drops | Oral | Oral |
| OPV 1, 2 & 3 | At 6 weeks, 10 weeks & 14 weeks (OPV can be given till 5 years of age) | 2 drops | Oral | Oral |

| Pentavalent 1, 2 & 3 | At 6 weeks, 10 weeks & 14 weeks (can be given till one year of age) | 0.5 ml | Intra-muscular | Antero-lateral side of mid-thigh |
|---|---|---|---|---|
| Pneumococcal Conjugate Vaccine(PCV)^ | Two primary doses at 6 and 14 weeks followed by Booster dose at 9-12 months. | 0.5 ml | Intra-muscular | Antero-lateral side of mid-thigh |
| Rotavirus (RVV)^ | At 6 weeks, 10 weeks & 14 weeks (can be given till one year of age) | 3 | Oral | Oral |
| Inactivated Polio Vaccine (IPV) | Two fractional dose at 6 and 14 weeks of age | 0.1 ml ID | Intra dermal two fractional dose | Intra-dermal: Right upper arm |
| Measles Rubella ^(MR) 1st dose | 9 completed months-12 months. (Measles can be given till 5 years of age) | 0.5 ml | Sub-cutaneous | Right upper Arm |
| Japanese Encephalitis (JE) - 1** | 9 completed months-12 months. | 0.5 ml | Sub-cutaneous | Left upper Arm |
| Vitamin A (1st dose) | At 9 completed months with measles-Rubella | 1 ml (1 lakh IU) | Oral | Oral |
| For Children | | | | |
| Diphtheria, Pertussis& | 16-24 months | 0.5 ml | Intra-muscular | Antero-lateral side of mid- |
| Vaccine | When to give | Dose | Route | Site |
| Tetanus (DPT) booster-1 | | | | thigh |
| MR 2nd dose | 16-24 months | 0.5 ml | Sub-cutaneous | Right upper Arm |
| OPV Booster | 16-24 months | 2 drops | Oral | Oral |
| JE-2 | 16-24 months | 0.5 ml | Sub-cutaneous | Left Upper Arm |
| Vitamin A*** (2nd to 9th dose) | 16-18 months. Then one dose every 6 months up to the age of 5 years. | 2 ml (2 lakh IU) | Oral | Oral |
| DPT Booster-2 | 5-6 years | 0.5 ml. | Intra-muscular | Upper Arm |
| TT/Td | 10 years & 16 years | 0.5 ml | Intra-muscular | Upper Arm |

*One dose if previously vaccinated within 3 years
**JE Vaccine is introduced in select endemic districts after the campaign.
*** The 2nd to 9th doses of Vitamin A can be administered to children 1-5 years old during biannual rounds, in collaboration with ICDS.
^Rotavirus vaccine and PCV in selected states/districts as per details below:
Rotavirus: Andhra Pradesh, Assam, Haryana, Himachal Pradesh, Jharkhand, Madhya Pradesh, Odisha,
Rajasthan, Tamil Nadu, Tripura & Uttar Pradesh.
 PCV: Bihar, Himachal Pradesh, Madhya Pradesh, Uttar Pradesh (12 districts) & Rajasthan (9 districts).

## 3. Result and discussion:

When we look at the above chart it is clear that different vaccines are used in India as per the recommendation. We have shown the graph in fig 1 indicating the differences in morbidity and mortality produced by COVID-19 across countries that never used the BCG vaccine. Our data suggests that BCG vaccination seem to significantly reduce mortality associated with COVID-19. We also found that the earlier that a country established a BCG vaccination policy, the stronger the reduction in their number of deaths per million inhabitants, consistent with the idea that protecting the elderly population might be crucial in reducing mortality. However, there is still not proof that BCG inoculation at old age would boost defences in elderly humans, but it seems to do so in Guinea pigs against M. tuberculosis .BCG vaccination has been shown to produce broad protection against viral infections and sepsis raising the possibility that the protective effect of BCG might be not directly related to actions on COVID-19 but on associated co-occurring infections or sepsis. However, we also found that BCG vaccination was correlated with a reduction in the number of COVID-19 reported infections in a country suggesting that BCG might confer some protection specifically against COVID-19. The broad use of the BCG vaccine across a population could reduce the number of carriers, and combined with other measures could act to slow down or stop the spread of COVID-19.[7]

## 4. Conclusion

The correlation between the beginning of universal BCG vaccination and the protection against COVID-19 suggests not only vaccine but also other vaccines might confer long-lasting protection against the current strain of coronavirus. However, randomized controlled trials using BCG are required to determine how fast an immune response develops that protects against COVID-19.

**Figure 1: Higher death rates were presented in countries that never implemented a universal BCG vaccination policy**
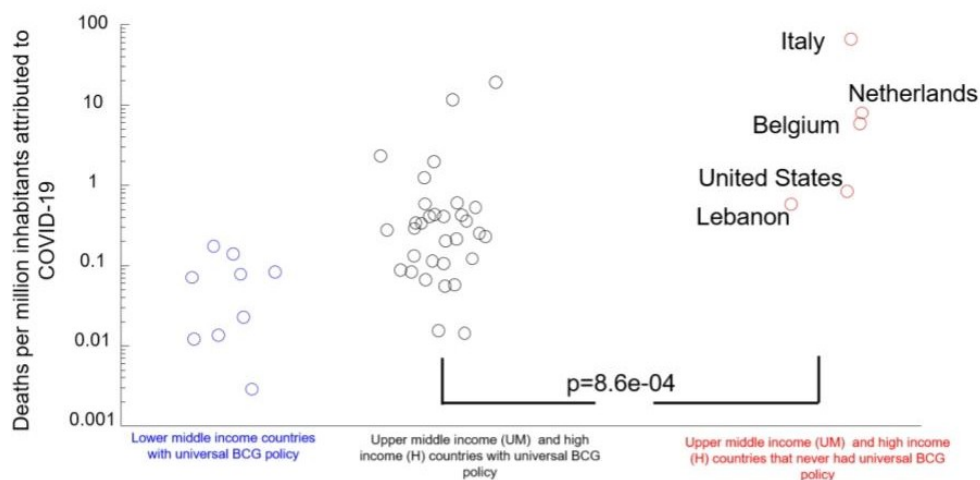


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