# Healing the Economy: Estimating the Economic Impact of India's Vaccination and Related Measures†

***Working Paper****

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## Introduction

The COVID-19-induced pandemic impacted the world economy to a degree not caused by a disease since the Spanish Flu of 1918-20. Both Spanish Flu and Covid-19 wreaked havoc to the global economy. Pushing people into poverty and increasing inequality were some of the common features that both came with (Sharma et al. 2021). Back then, the Spanish Flu infected about 500 million people – about one-third of the global population. The current pandemic infected more than 730 million people[3] – about 9% of the world's population[4]. While the Spanish Flu reduced the world GDP to a great extent[5], the Covid pandemic is expected to cost about $8.5 trillion to the world.[6] Starting in a province of China, the Covid virus slowly proliferated to the rest of the world. It caused global panic due to its adverse effects. Halting economic activity and causing mass damage to people's lives, the pandemic accelerated the hunt for a solution. According to April 2021 World Economic Outlook Report, the global economy contracted by 3.5% in 2020 (Yeyatti & Filippini, 2021). Inequalities within nations were further reinforced in more ways than one. The outbreak had an impact on all segments of the population but with pronounced effects on the lives of those belonging to vulnerable social groups.

Against this backdrop, the development of a vaccine was regarded early on as essential, but such development takes time. Accordingly, in the interim, the global response was to contain the spread via isolation that ranged from tracking and quarantining, especially in earlier stages of the pandemic, to simple mask-wearing and social distancing that persisted throughout most of 2022. Solutions to reduce the impact of the catastrophe were decided on and implemented primarily at the national level. Isolation strategies were accompanied by economic relief package(s) that nations rolled out to reduce economic and social damage. Finally, with the development of the vaccine, the focus shifted to vaccinating the masses to develop immunity against the virus. By the end of 2022, the number of confirmed cases and confirmed deaths globally surpassed 730 million and 6.7 million, respectively, and the cumulative global vaccination doses crossed 13 billion[7] (WHO). According to the World Bank's future estimates, all advanced economies will have attained a full output recovery by 2023, and output in emerging and developing economies is expected to remain 4% below its pre-pandemic trend. As a major developing economy with increasing geopolitical clout, India's post-COVID-19 progress has been a subject of much discussion regarding its Covid management, vaccine administration, and economic growth, to name a few. India has registered a positive development on multiple economic parameters. The Goods and Services Tax (GST)[8] revenue collection was the highest at ₹1.68 lakh crore for April 2022 (PIB, 2022). The Second

[3] By end of 2022. For more information see https://covid19.who.int/
[4] Considering global population of 8 billion.
[5] Although data is scant for that time, some estimates like Liang et al. (2021) suggests that the Flu contracted the Mexican economy suffered a $9 billion economic loss. Other estimates like Barro et al. (2020) suggests that it reduced the GDP per capita by about 6% for a typical country.
[6] COVID-19 to slash global economic output by $8.5 trillion over next two years. See more at https://www.un.org/en/desa/covid-19-slash-global-economic-output-85-trillion-over-next-two-years
[7] Vaccine data is as on 5th January, 2023.
[8] GST is a form of indirect tax levied on goods and services in India.

Advance Estimates of National Income released in February 2022 showed that the economy surpassed its pre-COVID level in 2021-22. The country also witnessed a strong export performance that outperformed its pre-pandemic level.

However, the impact of the pandemic is an area that needs attention. The pandemic's effects are reflected in the recalibrated relationship between the market economy, state, and society in multiple countries. In their efforts to combat the pandemic's adverse impact, the state and civil society came to be perceived in a different light, altering the public's perception of the role of markets, government, and society (Miranda & Snower, 2021). A substantial body of work has developed in the past couple of years studying the impact of the pandemic on different areas, including political, environmental, economic, and social matters. In conjunction with this branch of study, there is another area that calls for a deeper analysis studying the impact of a country's strategy in combating COVID-19. How the world's second most populous country embarked on a strategic battle against the virus is an area that warrants deeper investigation.

India systematically tackled COVID-19 using a strategy based on three cornerstones – Containment, Vaccination, and a comprehensive yet targeted Relief Package. The uniqueness of each of the three approaches is in the manner in which they were implemented. The calibrated approach used by India in formulating a relief package, as opposed to a front-loaded stimulus package, played a major role in bringing a resilient post-pandemic trajectory. This paper will attempt to study the impact of the three cornerstones. The Economic Survey (2021-22), for instance, suggested that in the context of macroeconomic stability indicators, vaccination progress should be perceived as much more than just a health indicator. It must be considered a buffer against economic disruptions as well. Vaccinating hundreds of millions of people belonging to different social groups across the country was a herculean task that India managed to perform successfully. India attained a milestone when it delivered the highest single-day vaccinations of 25 million doses on 17 September 2021. The country emerged as an example for the world for harnessing cooperative federalism in tackling the virus, with every state playing a vital role in combating the pandemic as per its own strength. India's strategic choices and their implementation have global ramifications. Moreover, while times have improved, understanding how the three strategies led to the revival of the economy and society is imperative. There has been little empirical analysis of the effects of vaccination, containment, and relief measures on the economic activity in India. Against this backdrop, assessing its strategy against COVID-19 and its impact is a prerequisite for greater crisis preparedness in the future.

# India's COVID-19 Containment Strategy

## Background

Early on in the pandemic, the question was how to save lives. Given the uncertainties that the pandemic brought with its onset, the larger goal was to save lives by somehow containing the virus. In epidemiology, two factors are particularly important for evaluating the severity of a contagious disease: first, the basic reproduction number R0 - the expected number of new cases of the disease caused by a single individual; second, case fatality rate CFR or the fraction of individuals infected who lose their life due to the disease. Another key factor is regarding the 'uncertainty' in CFR and R0 since the two also get affected by asymptomatic patients who are initially hard to detect. This makes it very difficult to ascertain the true number of individuals infected with COVID-19, and hence determine the CFR and R0. Thus, the reported indicators were uncertain at the onset of the pandemic and showed wide variation. For example, the CFR was as high as 9% in Italy as on 17th March 2020. Other countries, especially the European Union region, were seeing the proliferation of the pandemic with CFR being about 2.25% for France and 3.36% for Spain, for example.[9]

With a lack of information on the trajectory and intensity of the virus, the only option that seemed relevant was a lockdown. However, containing the spread of the virus meant closing down spaces and restricting the movement of individuals. This meant a significant impact on economic activity and the countless livelihoods dependent on it. But given the priority was saving lives and containing the spread of the virus, lockdown became a viable option. Stringency measures are non-pharmaceutical interventions (NPI) associated with reduced hospitalization rates. With this, they help prevent the health infrastructure from reeling under pressure. Acting as a suppression strategy against COVID-19, stringency measures are applied with the purpose of flattening the pandemic's curve in a particular region.

Studies have highlighted the importance of an early lockdown to curb the spread of the virus. Evidence suggests that stringent lockdowns if introduced early on in a country during the pandemic, were effective in limiting the spread of the virus. Lockdowns came with short-term economic costs, but their imposition was necessary to put economic activity back on track in the long-term (Caselli et al., 2020). Cerqueti et al. (2022) calculated the number of lives saved due to non-pharmaceutical intervention to be more than 21,000 in Italy. Moreover, Ruktanonchai et al. (2020) conducted a study in the European context and concluded that the effect of premature termination of countries' stringency measures could trigger a resurgence of the epidemic five weeks after the early termination.

The question was whether the mitigation efforts that involved restricting mobility were worth the economic costs. While stalling the spread of the virus was imperative, the economic imperative of livelihoods weighed heavy. Therefore, while initially the debate was to save lives, it slowly traversed into the policy debate of trade-off between lives and livelihoods. As a result, it was increasingly perceived by governments worldwide that they needed to strike a balance. It was not a matter of choosing one of the two but striking an appropriate balance. While it is known that a lockdown

[9] https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200317-sitrep-57-covid-19.pdf

imposes substantial economic and humanitarian costs on a country, several studies point to the decrease in the number of cases, delays in peak, and the reduced pressure on health infrastructure as evidence of its significance. Moreover, the lockdown and containment strategy were the only tools governments had to combat virus transmission in the initial period in the absence of vaccination.

In the Indian context, the focus at the outset of the pandemic outbreak was on border control. A strict lockdown in the initial period was announced, after which three more lockdown phases followed in succession. A containment strategy followed this in the unlock phases that got decentralized gradually, with specific regions gaining more control over its implementation (see table below). Both strategies were equally important in tackling the virus. *Against this backdrop, we lay out some of the strategies India followed to contain the spread of the virus. The idea is to approach it from a theoretical perspective since doing a cost-benefit analysis in something beyond the scope of this paper since the objective of this section is to see things at the central government level and not at the state government level.* Moreover, it is learned that containment was mainly at the discretion of the state level, which requires disaggregate data in terms of, say, red, orange, green zones[10], essential and non-essential goods, number of hospitalisations, number of home isolations etc., something not available in a uniform format at the state level. Therefore, the idea is to comprehend different strategies that were adopted by local authorities to balance lives and livelihoods.

**Phases of Lockdown and Unlock in India (2020)**

| Phases | Start | End |
|---|---|---|
| Lockdown 1 | 25-Mar-20 | 14-Apr-20 |
| Lockdown 2 | 15-Apr-20 | 3-May-20 |
| Lockdown 3 | 4-May-20 | 17-May-20 |
| Lockdown 4 | 18-May-20 | 31-May-20 |
| Unlock 1 | 1-Jun-20 | 30-Jun-20 |
| Unlock 2 | 1-Jul-20 | 31-Jul-20 |
| Unlock 3 | 1-Aug-20 | 31-Aug-20 |
| Unlock 4 | 1-Sep-20 | 30-Sep-20 |
| Unlock 5 | 1-Oct-20 | 31-Oct-20 |
| Unlock 6 | 1-Nov-20 | 30-Nov-20 |

## India's Strategy

After detecting the first case of COVID-19 in Kerala, the authorities became vigilant and undertook precautionary measures, such as screening passengers arriving from particular countries. This got complemented by a quarantine period of 14 days for people who returned to India from COVID-19 affected countries. The culmination point was reached with the

[10] In the vein of containing the spread of the virus, colour coded zonal classification was implemented across the country. These classifications differed across states relative number of cases, hospitalisations, CFR, etc.

announcement of a complete lockdown with limited mobility. However, before delving into the economic aspect, a brief discussion on the decision to have a lockdown follows.

We have already seen why lockdown was viable, given that the initial intent was to contain the spread. Moreover, studies show that density and city size aggravate the spread of the virus (Stier et al., 2020). This had significant policy implications in terms of early measures to prevent the spread in India, given it has a population density of 382 persons per square km versus the global average of 58 persons per square km.[11] Thus, having no lockdown would have been potentially very dangerous, given that both CFR and R0 could have risen substantially. Also, the government was aware of the fact that it needed to rigorously revamp its health infrastructure given India's relatively insufficient health infrastructure (Patnaik & Sharma, 2020) coupled with the destruction that the virus was causing even in nations with a relatively nuanced health infrastructure (such as Italy and Germany). Therefore, the decision to lockdown became all the more relevant so that time could be bought to enhance the healthcare infrastructure.

Studies in the Indian context also suggest the benefits of having a lockdown in terms of saved lives, reduced cases, or providing the necessary time to enhance the health infrastructure. For example, Ray et al. (2020) calculated the impact on the number of cases by varying the length of the lockdown in their paper. They deduce that having a lockdown would reduce the number of cases and provide valuable time to enhance the health infrastructure. Likewise, Agrawal et al. (2021) tried to predict the number of cases and deaths in counterfactual scenarios of no lockdown and a delayed lockdown (i.e., lockdown on different dates as against the actual date of 24$^{th}$ March 2020). They predicted that the peak would get realised in September 2020. With a no-lockdown scenario, however, the peak would have been much larger and preponed to around mid-May. The authors also concluded that the difference in terms of the number of deaths – between the counterfactual scenario of no lockdown against the actual scenario – would have been about 2 million.

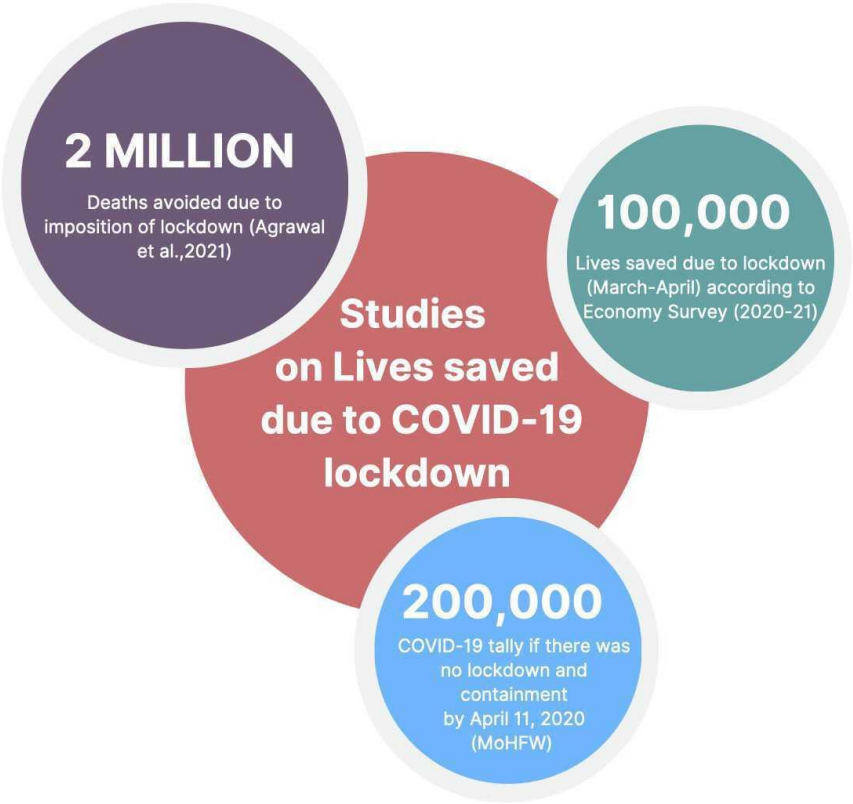
The Economic Survey (2020-21) also highlighted that India was able to save more than 100,000 (0.1 million) lives through the lockdown in March-April 2020. Moreover, the country took around 175 days to reach the peak from its first 100 cases, while most countries reached their first peak in less than 50 days (Russia, Canada, France, Italy, Germany, etc.). India thus benefited from successfully pushing the peak of the pandemic curve to September 2020 through the lockdown and buying the necessary time to revamp its health infrastructure.

According to the Ministry of Health and Family Welfare statistical analysis, the COVID-19 tally could have reached about 2 lakhs (0.2 million) without lockdown by April 11, 2020, with a presumed R0 value of 2.5 and a peak growth rate of 28.9%.[12] However, due to lockdown measures, the actual cases only went up to about 7500 by April 11, 2020, making a case for lockdown stronger.[13]

[11] As per the Economic Survey 2020-21

[12] https://timesofindia.indiatimes.com/india/without-lockdown-virus-could-have-affected-8-2-lakh-by-april-15-analysis/articleshow/75102680.cms

[13] https://www.thehindu.com/news/national/coronavirus-without-lockdown-india-would-have-seen-over-8-lakh-cases-by-april-15-says-health-ministry/article31319364.ece




Given that the lockdown was implemented, the government had a myriad task to increase the capacity of the existing healthcare infrastructure. To this end, looking at certain factors gives some context. For example, more than 1900 dedicated COVID-19 hospitals were identified at both Centre and State levels, having more than 1.7 lakhs (0.17 million) isolation beds and more than 21,000 ICU beds.[14] With the passage of time, where less than 100 tests per day were being conducted at the beginning of the pandemic, the country was able to increase the same to 100,000 (0.1 million) tests per day before May end. Moreover, having just one COVID-19 testing laboratory, the capacity was increased to more than 550 by mid-May.[15] The result was also reflective in the doubling rate[16] which increased to about 6 days by mid-April from about 3 days before any such lockdown was announced. Therefore, India performed well, particularly in how it scaled up testing and treatment facilities during the national lockdown in 2020 (Babu, et al. 2021).

[14] https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1615405

[15] https://main.icmr.nic.in/sites/default/files/press_realease_files/ICMR_Press_Release_India_testing_story_20052020.pdf

[16] Number of days it takes for the number of cases to double.

**Box 1: Containing the Virus: Role of the Society**

Containing the spread of the virus was not just in the hands of the authorities. This involved community participation at all levels – local people, civil societies, NGOs, among others. Although the role of the government involved ensuring social distancing, ensuring that people wear masks, spreading awareness about personal hygiene, augmenting healthcare services, among others, the role of the community cannot be negated. It was on the people and other stakeholders to adhere to the safety protocols and follow other community guidelines.

Nonetheless, it cannot be taken away that the people faced multiple hassles like getting supplies of essential goods and services like consumer goods, medicine supplies, and even ready ambulance services. The role of NGOs and other voluntary organisations were crucial in this regard. Media reports suggests that there were multiple such organisations that helped people avail such services. Many organisations ensured that ready ambulance services were available both for hospitalisation and cremation. Moreover, there were examples where resources were mobilised in ensuring essential goods reached people's home, along with basic medical equipment like masks and sanitisers.

Voluntary associations were also formed in preventing the spread of fake news relating to vaccination. Many local doctors volunteered for free for to take virtual sessions within the community that guided people in developing better immunity and also suggested them in taking preventive action. All of these examples, not only complemented the efforts of the government in containing the virus, but also showed the willingness of people to help and participate at the community level.

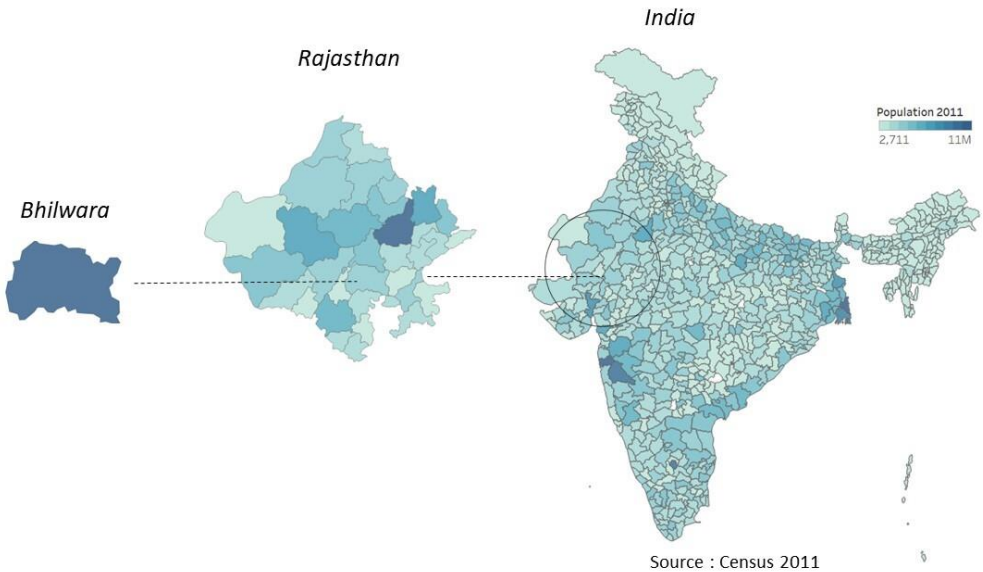
Source: Media Reports

However, to move towards containment, the government devised a strategy to unlock the nation in a phased manner. This meant opening certain regions and allowing the economic activity. The broader idea was to pass the authority of locking and unlocking to state authorities since they had a better understanding of their local regions and better control over the health authorities. The states had a mammoth task to ensure that the lives and livelihoods of the people were saved. In this regard, containment becomes extremely important since until early 2021, i.e., when the vaccine became available, containment was the sole factor that could strike a balance between lives and livelihoods. Containment worked as a double-edged sword since it not only ensured some economic activity but also reduced the burden on health infrastructure by measures such as quarantining[17] and home isolation[18] which restricted potential patient traffic to their respective homes. Therefore, it is essential to understand some of the successful containment strategies implemented by the local authorities that also serve as a reference point for future pandemic

[17] Quarantine refers to separation of individuals who are not yet ill but have been exposed to COVID-19 and therefore have a potential to become ill. There will be voluntary home quarantine of contacts of suspect /confirmed cases.
[18] Isolation refers to separation of individuals who are ill and suspected or confirmed of COVID-19. Pre-symptomatic cases/ very mild/ mild cases can opt for home isolation.

response preparedness. Being a diverse country in terms of demographics, density, health infrastructure, and awareness, the containment strategies differed as per native circumstances.

The case study of the Bhilwara district of Rajasthan serves as one example of how effective and quick response coupled with the delegation of power can act as a significant weapon in containing the spread of the virus. Bhilwara, where by the end of March 2020, there were about 26 new cases, got reduced to just 10 new cases by the end of May 2020 (for the whole of May). Although the number is small, the amount of effort put into was myriad. By imposing an effective lockdown and delegating the power to the district administrator, the district could contain the spread of the virus. Some of the measures under the containment was constant co-ordination among public health department, police, local municipal corporation, community leaders, supplier, etc., cluster mapping of positive cases, rigorous phase-wise screening in affected epicentres with clear demarcation of areas along constant follow-up, enhancing the capacity of health infrastructure – adding beds, training staff, conducting sanitation drives, etc., and continuous delivery of information and services concerning cases, beds, protocols, etc. simultaneously ensuring door step delivery of essential commodities (Golechha, 2021). The Bhilwara model might look typical, but the learning remains in its quick response action and the ability to comprehend that local authorities can best handle local containment against the top-down approach. By this approach, a district like Bhilwara – whose population is almost equivalent to Namibia (a Southern African country) – was able to contain the virus effectively. The figure below depicts the Indian strategy of delegating power towards the lower level.




Another example that stands out is the one of Dharavi, Mumbai. Being one of the largest urban slum settlements of the world, with a population density of more than 2.2 lakh people per square kilometre[19], the Dharavi model (chasing the virus) serves as an example of how community engagement, constant coordination and collaboration, pervasive commitment, and quick response

[19] https://pib.gov.in/PressReleseDetail.aspx?PRID=1633177

action can help prevent the spread of the virus and loss of livelihoods (Golechha, 2020). The model was based on four T's - tracing, tracking, testing, and treating under which thousands of people were screened in clinics, homes, and even mobile vans. To facilitate things, the process was based on a PPP model wherein gloves, sanitisers, and PPE kits, among other necessary equipment, were provided by the BMC to private doctors. Moreover, the fact that with such a dense population – where about 8-10 people live in a 10x10 room – home quarantine becomes unfeasible; efforts were made to enhance the health infrastructure capacities wherein institutional quarantine facilities were created in available schools, marriage halls, sports complexes, etc. which were supplemented with community kitchens. As a result of the above measures, the COVID-19 growth rate was reduced from about 12% in April to about 4% in May to about 1% in June 2020.

Yet another prominent example is the Kerala model. The state's effective COVID-19 management is another example of how good governance can help contain the spread of the virus. One of the biggest strengths of Kerala is its available health infrastructure which enabled it to conduct mass screening and training of its health care professionals. This was complemented by basic training of local representatives of self-help groups known as 'Kudumbashree' to develop a response action (Rahim, 2020). As Kerala witnesses the movement of people from in and outside the country, one of the response actions included airport screening and sending symptomatic patients to the nearest health facility where they would be further admitted or referred for home quarantine. This was accompanied by active contact tracing and mapping of all potential patients. Despite an already robust health infrastructure, the same was enhanced further by adding hospital beds and ICU units. The state also ensured the use of ICT services to communicate information regarding hygiene, free consultation and psychological support. Therefore, a collaborative effort at the state and local level was able to contain the spread and serve as a guiding tool for its peers.

Other studies have also focused on the overall efficacy of containment. For instance, a study by Chowdhry & Jain (2021) attempted to construct a stringency index at the State level in India to assess the impact of stringent lockdown/containment policy on health and economic outcomes. The study explored the effect of lockdown on Covid-19 spread and deaths using the index. The results confirmed that higher stringency reduced cases and deaths per capita. Findings revealed that a 1% increase in the stringency index in the previous month led to a 4.6% lower virus spread in the current month. Similarly, 5.9% fewer deaths per capita got reported when stringency was higher by 1% in the previous month. India's strategy of imposition of a stringent lockdown in the initial stages to control the spread and focus on ramping up testing infrastructure and health facilities is validated by this analysis. The lockdown, therefore, was a critical instrument in 'flattening the curve' and saving lives.

From the above examples, it can be argued that although centralized coordinated policies may be necessary, their effectiveness is highly dependent on states' capacities. Therefore, given the regional disparities in the country, it is necessary to look into sub-national-level mitigation strategies to provide an overview of the growth rate of the epidemic during different phases of the mitigation strategies deployed by states for sound decision-making and learnings which can be applied in future pandemics.

## Conclusion

In this section, we have tried to develop an argument for why lockdown was a plausible and effective strategy for containing the spread of the pernicious virus. The Indian government was witnessing the damage in other parts of the world and therefore had to ensure minimizing it in the country. However, as highlighted in the economic survey, the government took the firm stand of a lockdown with the vision that a short-term restriction would be more prudent as against a permanent damage in terms of loss of lives. We have seen evidence of how various models have come up with different numbers of confirmed cases and deaths that happened and would have happened in the counterfactual scenario of delayed or no lockdown. It can be ascertained that the numbers show variation due to their different methodologies adopted, varying time periods, and data sources, to mention a few. However, as a caveat, it should be kept in mind that all models are susceptible to change with the availability of more reliable data.

Moreover, no model is a panacea and cannot precisely predict an active virus such as COVID (Babu et al. 2021). Also, most models that have tried to predict the COVID trajectory are prone to an underestimate since these models have not fully captured cases like underreporting or false negatives. India is no exception, with scholars and media highlighting the loopholes in reporting actual numbers (Bhaduri et al., 2020; Chatterjee, 2020). Therefore, although various estimates can be arrived at, the broader learning is that lockdown and containment measures were essential in containing the spread of the virus. Lastly, as can be ascertained from various examples mentioned above, the key to containing the spread of the virus lies in a bottom-up approach as against a top-down approach. India was quick to realise this and therefore delegated the power to the local authorities. Thus, the lockdown and subsequent containment measures helped flatten the curve and struck a balance between saving lives and sustained economic activity.

Although containment can be thought of as a useful measure, given the magnitude of the pandemic, it was expected that other supportive measures would be required. This was essential given that a balance between lives and livelihoods needed to be maintained. In this regard, the government came up with a targeted fiscal relief package where the idea was to sustain the economic activity that came to a sudden halt due to the pandemic. We unfold the relief package in the next chapter.

# India's COVID-19 Relief Package and its Impact on Economic Recovery

The impact of the pernicious COVID-19 virus and the fight against it to save lives has been discussed in the previous chapter. This chapter moves beyond containing the spread of the virus and focuses more on the nation's response in dealing with the halted economic cycle that the pandemic perforce at its outset. The COVID virus being new to the world did not have an immediate response function. Therefore, as the cases started to increase, governments across the globe moved towards locking down the economy, leading to the cessation of economic activity in virtually all sectors. Although the impact was heterogeneous across sectors, the overall effect was reflected in numbers whereby Q1 GDP for 2020-21 dipped by about 24% relative to the previous year and about 29% sequentially. However, the phase-wise opening up of the economy, after about 45 days of the complete lockdown, brought about challenges to provide the kick start to the engine. Against this backdrop, the revival of economic activity and its growth would arguably not have been possible without the government's proactive measures in the form of economic 'relief packages'.

The relief package under the 'Aatmanirbhar Abhiyan' was a comprehensive package spanning across sectors with a vision to revitalise the growth cycle of the nation along with empowering the relatively lower strata of society and small businesses that required that initial boost or support to restart their businesses. The myriad package was designed to take care of the country's heterogeneity and diversity in terms of people, businesses, location, and income, among other paradigms. Being implemented stage-wise, the package was a kind of a learning or outcome-based model under which subsequent phases were launched by taking into account the feedback of the former ones. Whether the entire credit should be given to the relief package can be of debate, the numbers show that the Q2 GDP for 2020-21 saw an increase of about 22% sequentially[20], which carried forward to other quarters as well. Against this backdrop, the chapter first delves into the literature to comprehend the effect of some of the relief measures (global and local) that helped in the resurgence of the economic activity. This would also entail developing a mechanism to trace the impact of such measures in the Indian scenario. The second section will try to map the impact of relief measures by assessing the economic and social impact of the same, along with drawing some inferences.

## Literature Review

Although the literature is relatively new regarding COVID-19 relief measures, it captures their brief account of how they were infused to combat the effects of the virus at the health and economic level. There have been efforts in other directions whereby dashboards and data points can be accessed that map the COVID atrocities via numbers. International Monetary Fund (IMF) has made one such data point available. The IMF has provided a policy tracker summarizing the fiscal measures and relief packages rolled out by different economies to combat the adverse effects of COVID-19 on society. It provides an overview of the measures that India has initiated. In May

[20] Although this was still lower by about 6.6% relative to Q2 of previous year.

2020, India announced a relief package for around 10% of its GDP – about ₹20 lakh crores (about $ 282 billion)[21]. IMF Policy tracker states that India's central government fiscal support measures can be divided into two broad categories: (i) above-the-line measures, which consist of government spending, foregone or deferred revenues and (ii) below-the-line measures formulated to support businesses and increase credit provision to several sectors. In the initial months of the pandemic, the relief response was more in the area of above-the-line measures providing support in-kind in the form of food and cooking gas, cash transfers to low-income households, employment provision to low-wage workers, insurance coverage for workers in the healthcare sector, etc. Later in the pandemic, in October and November 2020, the measures announced included support schemes for certain sectors, some of which included credit support to businesses, and poor households and targeted support for some sectors.

Although literature is scant, some studies have tried to map the potential impact of the relief package(s). For instance, Deb et al. (2021) investigated the effects of COVID-19 related fiscal policy measures based on the daily fiscal policy announcements, classifying them by the type of fiscal measure, and high-frequency economic indicators. They conducted this study for 52 countries for the year 2020 and concluded that fiscal policy measures positively impacted economic activity and reduced unemployment. However, the study adds that the degree of this effect depends on certain country specific characteristics like the stringency in containment policies, among others.

Similarly, Gourinchas et al. (2021), by studying the effects of fiscal policy at the firm, sector, country and global level, deduced that business failures would have amplified in the absence of policy support. Moreover, fiscal policy does have the capacity to reallocate resources to demand deficient sectors and also exert a positive influence on employment. Walmsley et. al (2022), using a computable general equilibrium model also explored the effect of fiscal stimulus in the context of US economy. Their results indicated that the initial rounds of the fiscal stimulus were more effective relative to the later rounds. Moreover, they found that unemployment benefits had a greater impact than direct or indirect benefits since these benefits gets saved rather than getting expended.

As for the Indian context, Varshney et al. (2021) examine the impact of India's Pradhan Mantri Garib Kalyan Yojana, implemented after the COVID-19 lockdown, on the procurement of agricultural inputs for the farming season. Based on a quasi-experimental method and survey data from about 1800 households in the states of Rajasthan, Madhya Pradesh, and Uttar Pradesh, the study concluded that about 89-94% of households in the survey benefited from the direct cash transfer in the package and thus observed a positive impact of the government's package on easing credit constraints for the agricultural sector. Similarly, Prusty et al. (2022) attempt to explore the impact of India's monetary and fiscal stimulus package measures by analysing the feedback from respondents using structural equation modelling (SEM) during the post-lockdown period. Their results showed a positive perception among stakeholders (academicians, professionals from

[21] Taken average exchange rate for the year 2019-20. See https://rbidocs.rbi.org.in/rdocs/Publications/PDFs/137T_15092022C8DE38B03F9541259D5539E0D1AFCD67.PDF

corporates and entrepreneurs) with regard to the impact of the stimulus measures on the Indian economy's revival.

A study by Das & Mishra (2021) based on a telephonic interview with a sample of around 200 people in Delhi (largely migrant workers), found that almost all workers did not have a job in the first phase of the national lockdown and relied on savings, borrowings and other sources for finance. They thus calculated the actual and potential impact of relief measures given by the state and central government and found that 75% of the respondents could get some assistance.

Against this backdrop, we attempt to map the impact of the COVID-19 relief package on the Indian economy. The Indian government launched the relief package under the ambit of 'Aatmanirbhar Abhiyan' with the motive to not only lubricate the engine of growth but with the ideology of making India self-reliant. The package was comprehensive, encompassing sectors from farming, MSMEs, tourism, health, insurance, and employment, among others. Having reached about 10% of the GDP, the package was a combination of direct transfers, loan extensions, subsidies, tax reliefs, moratoriums, etc. Given the magnitude of the relief package, it becomes essential to map its impact on the economy since fiscal stimulus working through an income multiplier can potentially improve consumption in the near term (Rao et al., 2021). Although studies have tried to assess the impact of relief package(s) in the Indian or global context, they have done it at a macro level by focusing on either just a few aspects of the entire package or specifically on a particular policy under the package. As highlighted above, Varshney et al. (2021), for example, studied the impact of India's Pradhan Mantri Garib Kalyan Yojana on the farm sector. Others have also focused on specific outcomes either through telephonic surveys or other primary survey techniques. Although the available literature ascertains the impact of particular arms of the relief package(s), evaluating the entire package in a granular way spanning across sectors is something that has not been explored at much length.

Therefore, *this study attempts to assess the impact of the Indian relief package by classifying it into four components: MSMEs, social sector, employment, and agriculture, and studying the schemes revolving around a particular component by calculating their potential economic impact.* Since covering all schemes or the broad components under one realm is not possible given the heterogeneity in terms of area and their respective targets, a detailed descriptive methodology is developed separately for all components to ascertain their potential economic impact. In this regard, all data pertaining to the number of beneficiaries, the amount disbursed, wages, etc. have been sourced from the government. As a corollary, while citing government data makes the whole exercise reliable, it restrains the study so that not all measures undertaken can be evaluated since data pertaining to those measures are either available in discrete format or are not available altogether. Thus, the study only assessed those measures on which data was available in a complete format.

## Potential Economic Impact of the Relief Package

### *Impact on MSMEs*

MSME is one of the most pivotal pillars of the Indian economy. For long, MSME has contributed to the Indian economy both in terms of generating output and in terms of employment. Being the heartland of the Indian manufacturing and services sector millions are associated with it for their

livelihoods. As per government data, the sector contributes roughly 30% to the Indian GDP and employs approximately 11 crore people.[22] With such magnitude, the sector is bound to make an impact if provided with adequate support. This has exactly been the case whereby we discuss two schemes that the government launched for the promotion and well-being of the sector; Subordinate Debt for Stressed MSMEs, and Guaranteed Emergency Credit Line (GECL) / Emergency Credit Line Guarantee Scheme (ECLGS) for MSMEs. The former essentially entails providing credit facility through lending institutions to stressed MSMEs, and the latter involves providing 100% guarantee to lenders (banks and NBFCs) so that they can extend credit to businesses and MSMEs to meet their working capital requirements. The figure below gives the number of beneficiaries that availed the scheme's benefit.

**Schemes and Number of Beneficiaries under MSME Relief Package** [23] [24]


To calculate the economic impact, we first evaluate the contribution of MSMEs to Indian GDP. We take the figure of 2019-20 for GDP since that was just before the pandemic hit and thus captures the true essence of the contribution of MSMEs.

Contribution of MSMEs to the GDP is about 30%[25]. Therefore, for 2019-20, MSMEs contributed 1,45,15,958[26] crore * 30% = ₹ 43,54,787,40,00,000 (approx. ₹ 43.5 lakh crore) or **$ 614 billion**.

Assuming the total number of MSMEs in India to be about 6.3 crore[27], we get the contribution of one MSME to the above figure as 43,54,787,40,00,000 / 6,30,00,000 = ₹ 6,91,236

Assuming the relief package helped sustain operations for the aforementioned beneficiaries in the figure (1,13,00,782), we can say that the economic impact is -

1,13,00,782 * 6,91,236 = ₹ 7,81,150,73,46,552 (approx. ₹ 7,81,150 crore) or **$ 110.18 billion**.

This comes out to be roughly 5.38% of the GDP. However, if we apply a shutdown rate of 9%[28] to the number of beneficiaries, the number of such beneficiaries would then reduce to 1,02,83,711

[22] National Sample Survey 73rd Round (2015-16).
[23] https://pib.gov.in/PressReleasePage.aspx?PRID=1844601
[24] Ibid.
[25] https://www.pib.gov.in/PressReleasePage.aspx?PRID=1744032
[26] https://www.mospi.gov.in/documents/213904/416359//Press%20Note_PE%20FY22m1653998874449.pdf/9616eef9-71b9-7522-808a-5fd438857454
[27] National Sample Survey 73rd Round (2015-16).
[28] http://164.100.24.220/loksabhaquestions/annex/179/AU809.pdf

since 9% of the total number of beneficiaries would have shut down. This then gives the economic impact as: –

1,02,83,711 * 6,91,236 = ₹ 7,10,847,12,56,796 (approx. ₹ 7,10,847 crore) or **$ 100.26 billion,** which comes out to be about 4.90% of the GDP.

Therefore, one can argue that the relief package brought respite to the MSME sector by ensuring their working capital requirements. It is not unknown that the more than 90% of the MSMEs belong to micro and small enterprises[29] who generally face the problems pertaining to regular cash flows. These cash flows often become part of machinery, labour, electricity, rent, etc., and become pivotal in MSMEs' day-to-day operations. Therefore, the government by identifying the right target area was able to help sustain the operations of these MSMEs.

***Impact on Social Sector***

Keeping aside industries for a moment, it cannot be refuted that the general public was affected mostly by the pandemic. Masses of people got devoid of basic amenities like food, shelter, and health with the slowdown in economic activity and many also lost their jobs as a consequence of the slowdown with businesses trying to lower costs due to dampened demand. All this even led to large number of migrants to reverse migrate. Therefore, the government had a large problem at hand to not only stop the reverse migration process but to also help million others who got devoid of the basic amenities. Against this backdrop, the government launched the Pradhan Mantri Garib Kalyan Package for the poor to help them fight the battle against the atrocities of pandemic. The package essentially had two components shown in the figure below. Be it in terms of health services, livelihoods, shelter, or food.

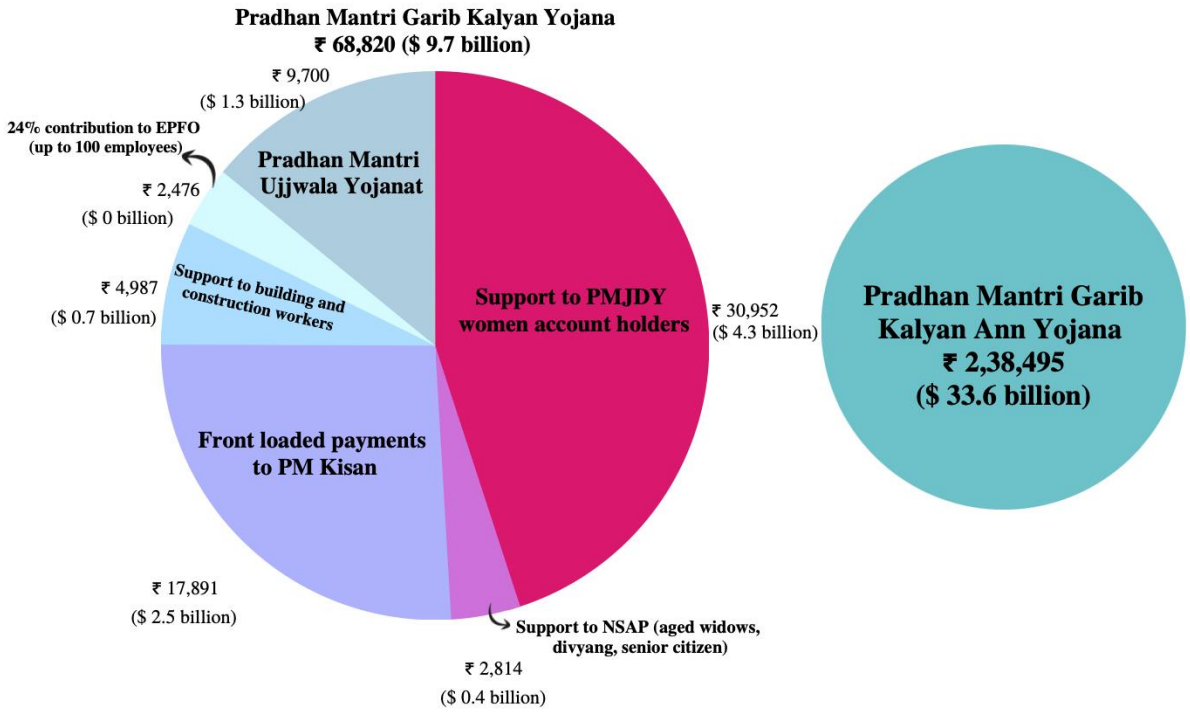
The Pradhan Mantri Garib Kalyan Yojana (PMGKY) was a comprehensive scheme including multiple initiatives ranging from Jan Dhan Accounts to PM Kisan to EPFO contribution, among others. Excluding Ann Yojana, the PMGKY amounted to ₹68,820 crores ($ 9.7 billion). On the other hand, the Pradhan Mantri Garib Kalyan Ann Yojana was a scheme encompassing the distribution of free food grains to people over and above what they had already received. This latter involved the distribution of free food grains to approximately 80 crores (800 million) people (for details, see figure below). Considering the schemes as fiscal stimulus, we apply the fiscal expenditure multiplier of 0.78[30] to get the economic impact of this fiscal stimulus, i.e.,

68,820 crore * 0.78 = ₹ 53,679,60,00,000 (approx. ₹ 53,679 crores) or **$ 7.57 billion** for PMGKY, and 2,38,495 crore * 0.78 = ₹ 1,86,026,10,00,000 (approx. ₹ 1,86,026 crore) or **$ 26.24 billion** for PMGKAY.

[29] National Sample Survey 73rd Round (2015-16).

[30] "Rebalancing Monetary and Fiscal Policies Post-Pandemic" (2022), Reserve Bank of India. Available at https://m.rbi.org.in/scripts/PublicationsView.aspx?id=21036
In terms of recession/slowdown the paper considers the fiscal multiplier to be 0.78. Being a robust estimate, we insert this multiplier to calculate the economic impact.

**Pradhan Mantri Garib Kalyan Package*** [31] [32] [33]




Note – * Rupees (₹) figures are in crores

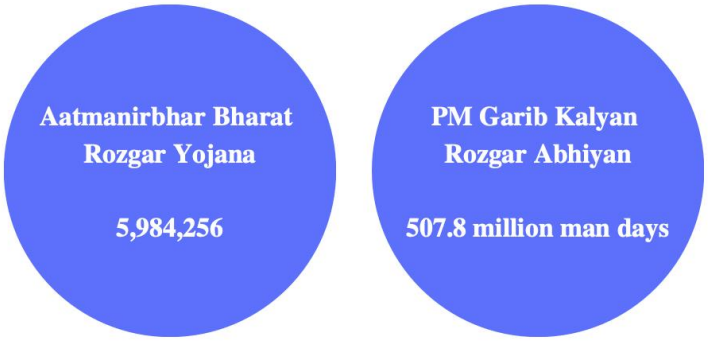
With a comprehensive package that encompassed people belonging to old age, women, farmers, and the working class, the PMGKY ensured that the impact on the livelihoods of these people was moderated to an extent, whereas, on the other side, by distributing free food grains to poor people under the PMGKAY, the government ensured that no one slept hungry. Of course, one can delve deeper into the analysis of this and bifurcate the schemes to calculate the economic impact in a more robust and nuanced way, but this can be considered a starting point to comprehend the economic impact of the welfare schemes.

### *Impact on Employment Generation*

As highlighted in the above section, the government had to not just deal with the problem of reverse migration but sustain them in a way by providing them with economic opportunities so that livelihoods could be ensured. Moreover, this should not be confused with just migrant workers. Instead, the aim of the intended scheme(s) was to encompass all people whose jobs or employability got affected due to COVID-19. In this vein, the government launched programmes – two of which we have tried to map for their economic impact. The details of the same have been given in the figure below: -

[31] The Pradhan Mantri Garib Kalyan Yojana details have been taken till September 2020, whereas the Pradhan Mantri Garib Kalyan Ann Yojana has been taken till March 2022.
[32] https://www.india.gov.in/spotlight/pradhan-mantri-garib-kalyan-package-pmgkp
[33] https://pib.gov.in/PressReleseDetailm.aspx?PRID=1845417

**Employment Generation Schemes and Beneficiaries**[34] [35]




Whereas the former entailed 24% contribution towards EPFO to establishments employing up to 1000 employees, the latter provided immediate employment & livelihood opportunities to migrant workers of 116 districts belonging to Bihar, Jharkhand, Madhya Pradesh, Odisha, Rajasthan and Uttar Pradesh. Therefore, the economic impact of the above two schemes can be calculated as: -

For Aatmanirbhar Bharat Rozgar Yojana, the benefit was availed by 59,84,256 beneficiaries. We can assess the economic impact by assuming a minimum wage earned in a year, i.e.,

59,84,256 * 269[36] * 312[37] = ₹ 50,224,66,37,568 (approx. ₹ 50,225 crore) or **$ 7 billion** and;

Through PM Garib Kalyan Rozgar Yojana, 50.78 crore man days were provided. Considering that the scheme offers 125 days of employment for one person, the number of beneficiaries can be calculated as 50.78 crore man days/125 days. Thus, beneficiaries of the scheme become 40,62,400.

Looking at the minimum wage approach, the economic impact can be calculated as: -

40,62,400 * 269 * 312 = ₹ 34,094,91,07,200 (approx. ₹ 34,095 crore) or **$ 4.81 billion**.

Although the exact number of people who lost their jobs or livelihoods cannot be mapped altogether, the government made some efforts to provide economic opportunities through the mentioned schemes. The schemes might not have encompassed all the people, but they certainly did help in preventing job losses and the consequent economic loss that the nation would have otherwise witnessed. What remains a learning, though, is that the COVID relief package did reach millions in securing a livelihood and such schemes with an enlarged scope became necessary in the long run to safeguard against such pandemics.

### *Impact on Agriculture*

Being one of the oldest and largest employers in the country, the agriculture sector assumes its importance when it comes to relief package. It is not unknown that agriculture is one of the most informal sectors of the economy and encompassing their diversity under one scheme is not

[34] https://labour.gov.in/aatmanirbhar-bharat-rojgar-yojana-abry
[35] https://pib.gov.in/PressReleseDetail.aspx?PRID=1813766
[36] If the median of the minimum wages in different states is drawn, it would be ₹269/day in the country. See https://pib.gov.in/PressReleseDetailm.aspx?PRID=1705410. More on this in the next chapter.
[37] We take 26 days as the working days in each month as per Section 26 of The Minimum Wages (Central) Rules, 1950. See https://labour.gov.in/sites/default/files/TheMinimumWages_Central_Rules1950_0.pdf for more details.

possible. The government thus announced a slew of measures to assist the agriculture sector. These measures varied from providing loans to subsidies to seed funds and covered farmers, fishermen, and beekeepers, among others. The table below highlights some of the schemes that were launched.

| S.no. | Scheme | Amt. (₹ crore) | Beneficiaries | Amt. Availed/Disbursed (₹ crore) |
|---|---|---|---|---|
| 1 | **Emergency Capital Funds through NABARD** | 30,000 | | 25,000 |
| 2 | **Pradhan Mantri Matsya Sampada Yojana** | 20,000 | 8,12,195 | 360.99 |
| 3 | **Agriculture Infrastructure Fund** | 1,00,000 | 10,394 projects | 7677 |
| 4 | **Kisan Credit Card** | 2,00,000 | 2.5 crores | 1.35 lakh |
| 5 | **Operation Green Scheme** | 38.22 | | 38.21 |
| 6 | **National Beekeeping & Honey Mission** | 500 | 45 projects | 88.87 |

Starting from the first, emergency capital funds through NABARD was a scheme that provides additional financial support in terms of loans to small and marginal farmers. Under the scheme ₹30,000 crore ($4.23 billion) was sanctioned from which ₹25,000 crore ($3.52 billion) was disbursed to cooperatives, district cooperatives and regional rural banks.[38] This scheme becomes important because Indian agriculture is characterised by a large number of small and marginal farmers who often fall short of capital and rely on loans to resolve their working capital requirements. Therefore, to sustain their operations, the government announced this emergency capital fund over and above the ₹90,000 crores ($12.70 billion) already approved earlier by NABARD.

The second scheme, Pradhan Mantri Matsya Sampada Yojana, was a scheme that provided "livelihood and nutritional support for socio-economically backward traditional fisher's families during the fishing ban/lean period". The scheme entailed the upgradation of fisheries infrastructure and addressed issues like disease, sustainability of marine fisheries, sanitary and phytosanitary matters that impacted the competitiveness of India's exports. Under the scheme, more than 8 lakh beneficiaries had enrolled themselves, and an amount of almost ₹361 crores ($0.05 billion) was spent for the welfare of the fishermen. This was pivotal given the sector provides livelihood to about 16 million fishers and fish farmers at the primary level and almost twice the number along the value chain.[39]

The third scheme, the agriculture infrastructure fund for farm gate infrastructure, was essentially a medium to long-run debt financing scheme for investment in postharvest management infrastructure and community farming projects. This scheme was critical since it realised that making agricultural products available to the market involves assistance not just at the time of sowing but also at the time of harvesting. Such assistance not only helps to utilize the harvest

[38] https://www.pib.gov.in/PressReleseDetailm.aspx?PRID=1660691
[39] https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1842803

optimally but also helps in providing a fair deal to the farmers. For example, due to the limited infrastructure connecting farmers to markets, 15-20% of yield is wasted which is relatively higher compared to other countries where it ranges between 5-15%.[40] Against this backdrop, the scheme assumed importance since it helped about 10,394 projects with an overall assistance of ₹7,677 crore ($1.08 billion).[41]

The fourth scheme, Kisan Credit Card, was a scheme which envisaged to provide universal access to institutional concessional credit to all farmers including animal husbandry, dairy and fisheries farmers with a special focus on coverage of PM-KISAN[42] beneficiaries. The scheme included small farmers, marginal farmers, sharecroppers, oral lessees, tenant farmers, and SHGs. As per the latest figures, the scheme – with an outlay of about ₹2,00,000 crore ($28.21 billion) covered about 2.5 crore beneficiaries with a sanctioned credit limit of about ₹1,35,000 crore ($19.04 billion), i.e., out of ₹2 lakh crores more than two-third amount was sanctioned for disbursement as loans.[43]

The fifth scheme, the operation green scheme, aims to protect the growers of fruits and vegetables from making distress sales due to lockdown and reduce post-harvest losses. It involved a subsidy @50% of the cost of the two components namely; transportation of eligible crops from the surplus production cluster to the consumption centre; and hiring of appropriate storage facilities for eligible crops (for a maximum period of 3 months). Before the pandemic, the scheme covered tomatoes, onions and potatoes; however, given the pandemic the scheme expanded to 41 notified fruits and vegetables (short run) and 22 fruits and vegetables (long run).[44] In terms of numbers, the scheme got an allocation of ₹38.22 crore ($5.39 million) of which ₹38.21 crores ($5.38 million) was disbursed.

The sixth scheme, the national beekeeping & honey mission, was a scheme under the broad schema of promoting and developing scientific beekeeping in the country. Beekeeping is considered with the potential to produce honey and associated high-value products like bee wax, propolis, royal jelly, etc. Being a commercially viable product, India's export of honey has increased by about 110% between 2013-14 to 2019-20. Therefore, to achieve the broader goal of its promotion and development, 45 projects with an amount of ₹88 crores ($12.41 million) were sanctioned.[45]

With the above schemes, and others not mapped due to data gaps, the government intended to ensure sustained livelihoods and improved capacity at various levels for farmers across classes and sizes. These schemes varied from DBTs to loan extensions to subsidies to financing projects. Thus, it would not be wrong to say that schemes pertaining to agriculture and the allied sector did have an impact on the sector. Although the exact impact at a granular level is beyond the scope of this paper, an attempt to know its direction gives a positive indication.

Although we have tried to track the impact of some of the components of relief package, it goes without saying that this is not all that the government came with. As mentioned earlier, we're

[40] https://agricoop.nic.in/sites/default/files/FINALSchemeGuidelinesAIF%20%282%29.pdf
[41] https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1808326
[42] Under the PM-Kisan, the government directly transfers ₹6000 (in 3 instalments each) to eligible farmers.
[43] https://pib.gov.in/FactsheetDetails.aspx?Id=148600
[44] https://pib.gov.in/PressReleasePage.aspx?PRID=1808203
[45] https://www.indiabudget.gov.in/economicsurvey/doc/echapter.pdf

restricted by data limitations and, therefore, only took those schemes on which a complete set of information was available via government sources. This chapter thus tried to assess the economic impact of the relief package by bifurcating it into four components. As noticed, the relief package tried to provide active support to various sectors of the economy like MSMEs, agriculture, social sector, among others. In this regard, the package brought respite to relatively lower strata of society in terms of taking care of their basic requirements and helping small businesses manage their inter-temporal budget constraints.

Although the impact on one particular person/business might appear to be relatively small, the overall impact turns out to be massive. This was evident when we assessed the economic impact on MSMEs, which was about 5.38% of the GDP. Similarly, the overall success of the relief package can also be ascertained by the number of enrolled beneficiaries. This hints at two things; first, the pandemic brought about with itself a dire need to come up with some kind of assistance which the government provided in the form of a relief package; second, the package(s) were well received given the number of beneficiaries that got enrolled to the same. Although the number of beneficiaries might not look great in relative terms, this might be more to do with our overall population size. However, that does not imply that the package(s) were not well received. Its phase-wise implementation suggests that they were well received and required multiple extensions, which the government was keen to provide.

Moreover, as highlighted earlier, there were some other measures that we haven't discussed in this chapter. For example, the relief package introduced by RBI in the form of moratoriums and reducing interest rates. The central bank reduced the repo rate, reverse repo rate and cash reserve ratio to inject liquidity into the system. The measures aimed to relieve the immediate liquidity crunch that the pandemic might have induced on loans of different sizes. Moreover, they sought to provide credit at a friendly rate. Likewise, other government schemes like fertiliser subsidy, infra debt financing, and income tax relief, among others,[46] had some impact on their targeted sectors, something beyond the scope of the current paper and open to future research.

Having discussed the first two sets of measures; containment and relief package, we now turn to one of the most significant interventions the world awaited in the face of the pandemic, i.e., vaccination. As was mentioned in the introduction of this paper, one of the most effective tools in combating the virus was the development of a vaccine. With persistent efforts at the global level, the world finally developed vaccines to combat the virus. The effect of vaccination in preventing the loss of lives and livelihoods is much discussed among scholars. The next chapter also attempts to add to the literature by calculating the potential income generation of the lives saved due to Covid-19 vaccination in the Indian context.

[46] https://static.pib.gov.in/WriteReadData/userfiles/Aatma%20Nirbhar%20Bharat%20%20Presentation%20Part%205%2017-5-2020.pdf

# India's COVID-19 Vaccination

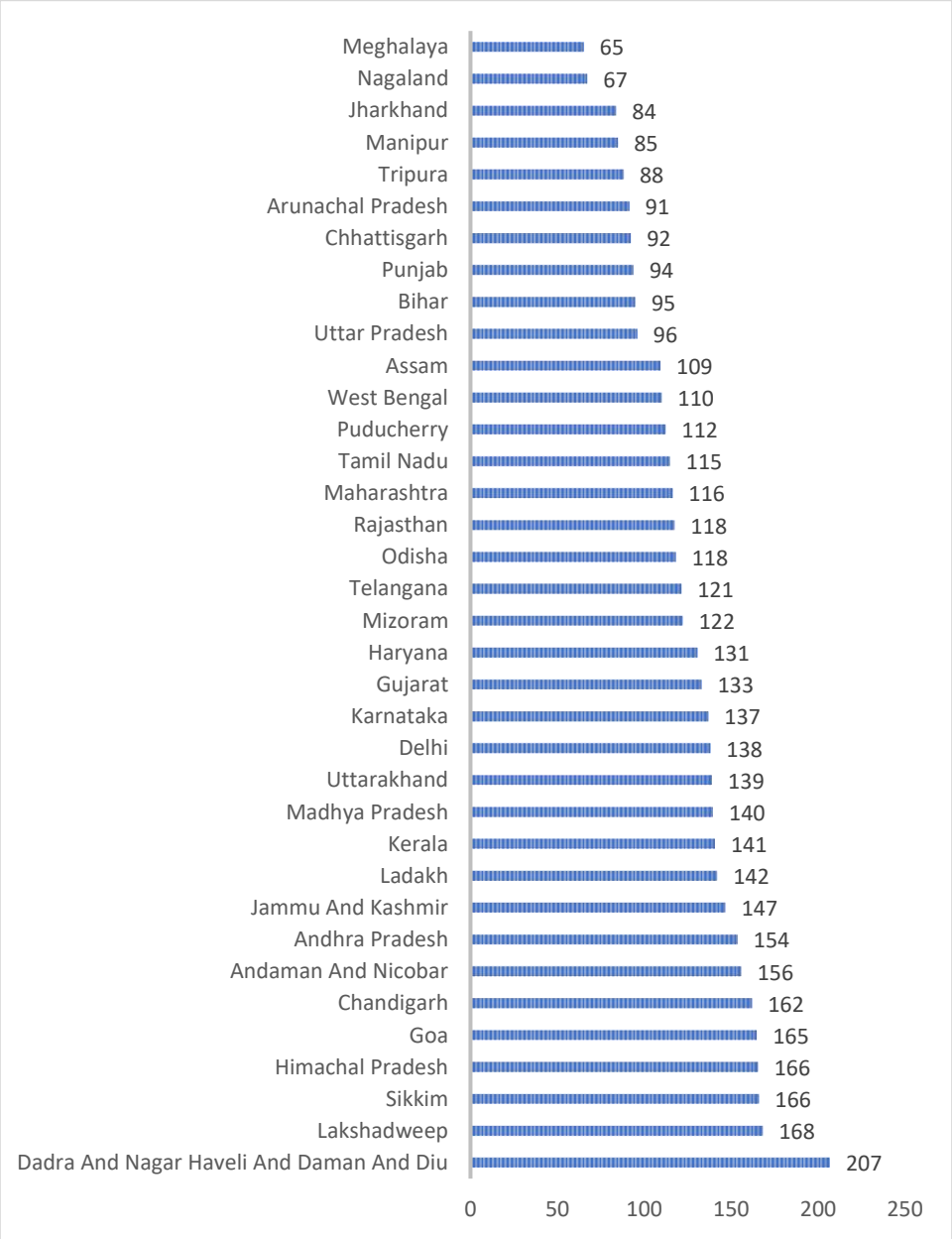
## Background

The Indian government announced its first nationwide Covid-19 lockdown on 25th March 2020. As discussed in the previous chapters, the initial idea was to somehow contain the spread of the virus which was later transcended to striking a balance between lives and livelihoods. Although containment and relief package(s) brought some respite within the economy, the larger remedy lied in developing a vaccine (see box 2 below). To this end, the nation saw its first COVID-19 Vaccination on 16th January 2021. With this, the world's largest vaccination programme was set off to a start. Implemented in a phase-wise manner, the journey which started in early 2021, soon took off in a way that it became one of the largest vaccination programmes of the world. In July 2022, the country crossed a global milestone of administering over 2 billion cumulative COVID-19 vaccination doses. Progressing through different age brackets, the pace of the vaccination campaign was commendable. Divided into phases, each of which expanded vaccination eligibility to additional segments of the population, the government program started with the elderly, healthcare workers and frontline workers, moving to those above 45 years of age and subsequently including the younger age groups. The table below gives a snapshot of the phases of vaccination in India.

| Phase | Month | Eligible Population |
|---|---|---|
| I | Feb-2021 | Frontline Workers |
| II | Mar-2021 | 60 and above and 45 years and above (with co-morbidities) |
| III | Apr-2021 | 45 years and above |
| IV | May-2021 | 18 years and above |
| V | Jan-2022 | 15-18 age group |
| VI | Mar-2022 | 12 years and above |
| VII | Apr-2022 | 18 years and above (Precautionary Dose – 3rd dose) |

The graph shows the state-wise vaccine doses administered in the country. Moreover, we compare India's vaccination doses with some selected countries in the figure that follows. As can be observed, the pace of vaccination differed across states, where almost 70% of the states/UTs received at least one dose by December 2021. With time, the country could vaccinate an even larger population, with a larger number of people getting at least two doses.

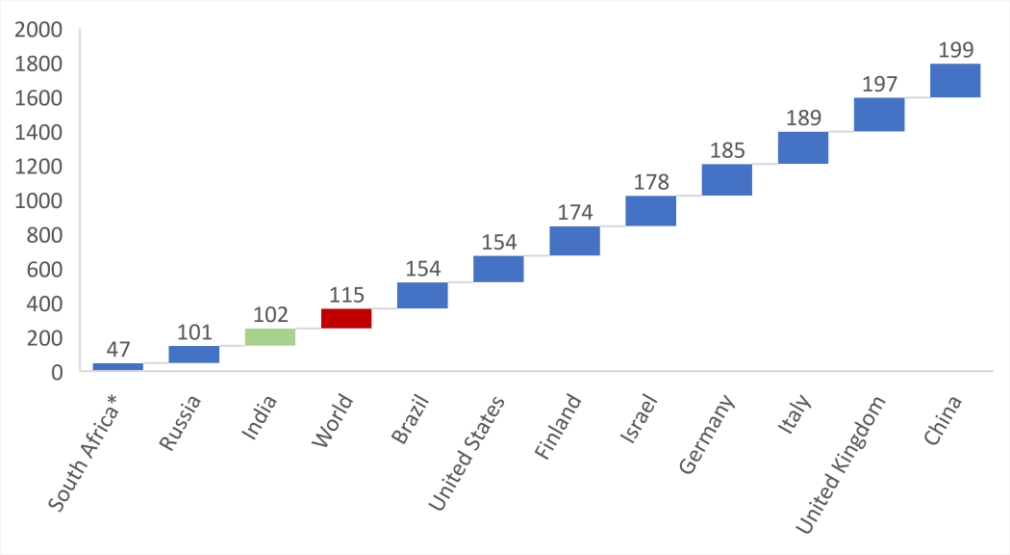
**State-wise Vaccination Doses Administered Per 100 People in India till 30 Dec 2021**




Source: https://www.mygov.in/covid-19

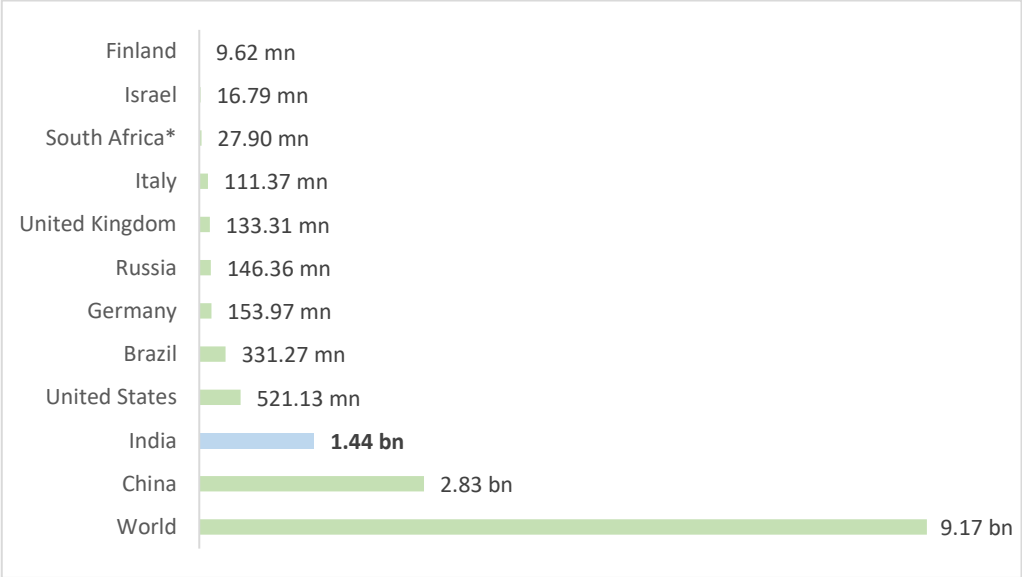
The international comparison shows that by the end of 2021, India with 102 doses was closer to the global average of about 115 doses per 100 people.[47] Moreover, India had one of the largest vaccine drives in the world with total doses being administered tallying up to more than 1.44 billion by the end of 2021.

**Vaccination Doses Administered Per 100 People till 31 Dec 2021 (some selected countries)**




* South Africa data is till 29 Dec 2021
Source: https://ourworldindata.org/covid-vaccinations

**Total Vaccination Doses Administered till 31 Dec 2021 (some selected countries)**




* South Africa data is till 29 Dec 2021
Source: https://ourworldindata.org/covid-vaccinations

[47] At the time when India achieved the 2 billion vaccination mark, it administered about 140 doses per 100 people in the country.

**Box 2: Developing a Cure for the Virus – The Vaccine Development**

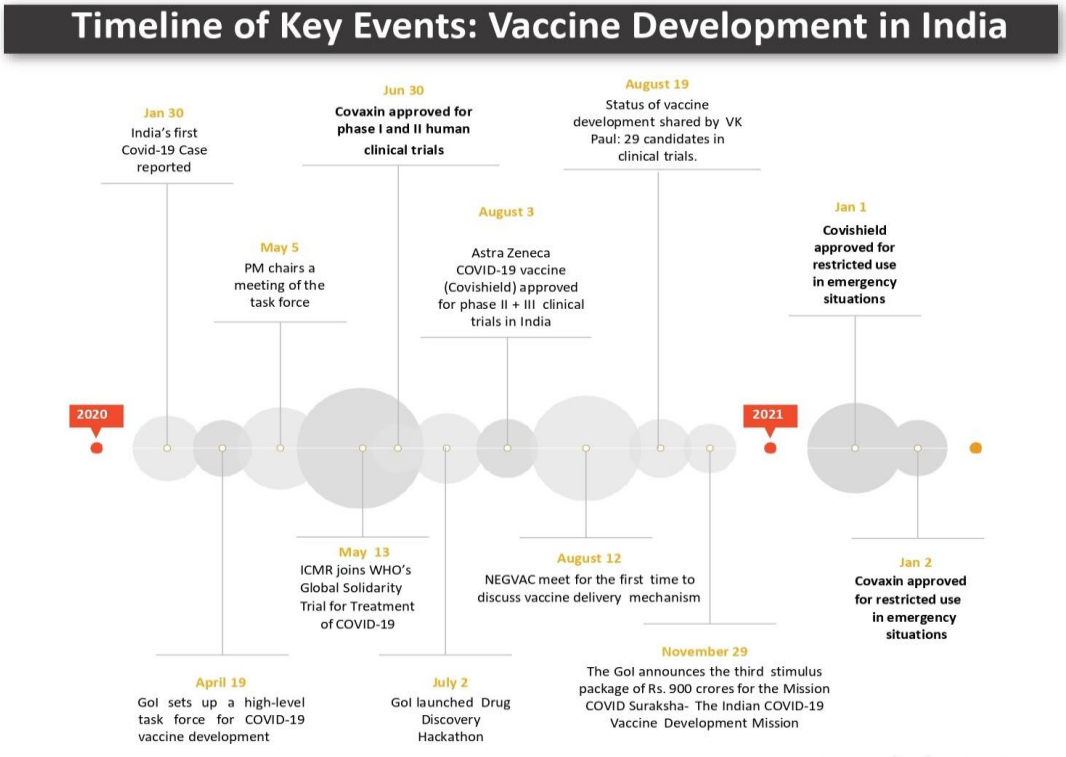
The global hunt for developing a vaccine to combat the virus began right after the pandemic hit the ground. Time demanded developing a vaccine in lesser time which was a challenge both at the global and the country level. For India, setting up of a high-level National Task Force in April 2020 for COVID-19 related works in the domain of science and vaccine development was the beginning of the journey. The task force was keen in developing an indigenous and was also open for global tie-ups. Moreover, as the nodal agency, the Department of Biotechnology (DBT) was tasked with identifying a pathway for vaccine development. This included identifying partner agencies, monitoring their progress, and undertaking the multi-stakeholder facilitation at the government level.

National efforts towards the development of the COVID-19 vaccine were led by Indian Council of Medical Research (ICMR) in association with Bharat Biotech International Limited (BBIL). While BBIL deployed the human resources and financial resources for the development of the vaccine, ICMR provided technical guidance and helped with preclinical studies and clinical trials. In June 2020, their vaccine (COVAXIN) got approved for phase 1 & 2 human clinical trials. The positive results and expedited regulatory process helped get them a nod for Covaxin to receive approval for restricted use in January 2021.

As for global tie-ups, the Serum Institute of India (SII) took the lead in this endeavour through its Oxford-AstraZeneca tie-up for manufacturing of the vaccine in India with the brand name 'Covishield'. Indigenous manufacturing process and knowledge transfer helped development of the vaccine. Showing positive results, Covishield got the nod to conduct phase 2 & 3 clinical trials in India in August 2020. An unprecedented move taken by SII was its decision to begin production of the Covishield vaccine post technology transfer from AstraZeneca/ Oxford University for phase 2 & 3 trials in India, even as phase 3 clinical trials continued in the United Kingdom (UK). The decision gave the manufacturer head start on vaccine production and building inventories which paid off as the vaccine candidate received approval for restricted use in January 2021.

In this way, India was able to come-up with two vaccine candidates and roll-out a vast vaccination drive. After the success of both the vaccine candidates, others like Sputnik V, a Russian based vaccine – developed by Gamaleya Research Institute of Epidemiology and Microbiology and manufactured by Dr. Reddy's Laboratories in India – emerged as the third candidate in April 2021. The development of all these vaccines helped fight the country the pernicious attack of the virus and not only inoculate a large number of people but also decrease the burden on healthcare system. A brief timeline is presented in the figure below.

*continued…*




Source: IFC, 2021

The challenge of the vaccination program derived not only from the scale, as India is home to about 17% of the world population, but also from the population's heterogeneity across diverse linguistic, cultural, and socioeconomic groups. Nevertheless, the country also emerged as a significant global vaccine supplier. India supported the international community through Vaccine Maitri, under which more than 7.23 crore (1 crore = 10 million) doses of COVID-19 Vaccine were exported to 94 countries and 2 UN Agencies by the end of November 2021.[48] This was further extended to about 11.46 crores by the end of FY22.[49]

The UNDP defines Vaccine Equity as vaccine allocation across all countries based on needs regardless of their economic status. It associates access and allocation with the 'right of every individual to enjoy the highest attainable standard of health without distinction of race, religion, political belief, economic, or any other social condition' (Mathivathanan, 2021). Vaccine distribution, however, is influenced by social, political, economic, and health-related matters. There are multiple obstacles to attaining vaccine equity, from vaccine shortage, wastage, vaccine hesitancy, and vaccine efficacy, to lack of storage facilities for imported vaccines and soaring vaccine prices in private hospitals (ibid.). There were concerns about the uneven worldwide vaccine roll-out, with high-income countries experiencing a higher rate of inoculation and lower-income countries witnessing a relatively slower pace (Bajaj et al., 2022).

[48] https://pib.gov.in/PressReleasePage.aspx?PRID=1778837

[49] https://www.thehindubusinessline.com/data-stories/data-focus/why-the-world-favoured-indias-covid-vaccines/article65317065.ece

For India, vaccinating the people was a mammoth task given factors like large population, geographical reach, cold storage capacities, and a smaller number of healthcare facilities. However, India set an example of how emerging nations can expand vaccination coverage across the length and breadth of the country. With a strategic prioritised vaccination drive and efficient coordination among the stakeholders, India proved that expanding vaccination coverage was not an insurmountable goal despite a range of challenges. For instance, adopting a phase-wise approach didn't lead to the crowding of vaccination sites. However, given the size of the population, the fear that crowding could lead to chaos was still there. To tackle this, vaccination sites were segmented into different areas – registration, waiting, vaccination, and observation along with segmented entry and exit points. Moreover, to track the vaccination status of each individual, the vaccination process was routed through the CoWIN app, an interface that mapped the complete vaccination journey – both for the people and the authorities. Lastly, to support the native cold storage capacity of the country, 29000 cold chain points, 240 walk-in coolers, 70 walk-in freezers, 45000 ice-lined refrigerators, 41000 deep freezers and 300 solar refrigerators were used for the Covid-19 vaccine storage.[50] It was through persistent efforts at multiple levels with constant co-ordination that India's vaccination drive became successful (IFC, 2021).

From developing vaccine manufacturing capacities, ensuring adequate supply across different regions, to creating a ground-level ecosystem for administering the vaccine - the vaccination campaign involved multiple stages and actors working together. Challenges appeared and had to be solved at each of these stages. However, one significant challenge in vaccine administration was vaccine hesitancy among people. Frontline workers such as Accredited Social Health Activists (ASHA) from inside each community played an important role in countering vaccine hesitancy through exhaustive door-to-door awareness campaigns (see box 3 below). The public health strategy adopted by India involved strategic and extensive action in getting vaccination to the people, and the people to vaccination. A systematic study by Robertson et al. (2021) showed a strong relationship between vaccine hesitancy and socioeconomic variations. Chandani et al. (2021) deployed an online survey investigating vaccination willingness, hesitancy among individuals, and sociodemographic characteristics. The authors pointed out a that a majority of Indians would accept the vaccine, but considering the size of the population, hesitancy among a small pool of individuals could still render a substantial number unvaccinated, to the extent that "herd immunity" throughout the population would not be achieved. Thus, tackling vaccine hesitancy among people was essential. Sharma (2022) overviews the major reasons behind vaccine hesitancy in India. In addition to fear of side effects and misinformation due to lack of awareness or inaccessibility to sources of credible information, especially in rural areas, there were other barriers to accessing reliable information, such as linguistic and religious differences, and there were challenges in physically accessing vaccination centres. Sharma (2022) also pointed out that in India, vaccination as a practice was still considered limited to infants and children, and vaccinating the adults was also a contributing factor preventing its adoption.

[50] https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1680841

**Box 3: The Role of ASHA Workers as Frontline Workers in Vaccination Drive**

Making Covid vaccination successful was not an easy task. Given the diversity of a country like India, workers from all sectors involved in conducting the exercise undertook huge efforts to make the drive a success. A special mention, however, needs to be given to the health team community including ASHAs, ANMs and AWWs who took it upon themselves to ensure that everyone was covered across all sections of the society. Their role was pivotal given the myths and hesitancy that was associated with vaccination along with reaching to places where conventional health services took time to reach.

Before making people understand the process of getting vaccinated, they had to make people come on board to get vaccinated. This involved instilling confidence and faith by first taking the dose themselves and making people believe that there were no adverse effects. The second task was to constantly counter fake news that was being spread time and again about the vaccination drive. After dealing with these challenges, did they actually succeeded in getting people vaccinated. However, this is way easier said than done.

Right from getting people registered for vaccination, to mobilizing people to the health centres, from reporting any adverse event post vaccination, to follow-up after a couple of weeks post vaccination, and to making people understand the importance of getting the second dose as well, were some of the many responsibilities that these front-line workers shouldered with flying colours. The key here was being part of the local community, that really helped in instilling the confidence and mobilising people which augmented the vaccination drive.

The role that ASHAs played in the vaccination drive is a testimony of their importance in the healthcare system especially at the local level. They served as the point of contact between the authorities and the masses. Their role can only be applauded in how they dealt with the humongous task of getting people vaccinated despite all odds. To this end, they were recognised at the global level where the WHO honoured about 1 million ASHA workers for their commitment and persistent efforts in making vaccination drive a success and in dispensing their duties round the clock towards regional health issues.

Source: IFC and NHSRC, 2022.

Vaccination is more than the immediate solution to put countries back on track to recovering from a contagious disease. Successful and expansive vaccination coverage brings along a myriad of benefits that surpass mere recovery to pre-pandemic lifestyles such as the resumption of education institutes, physical retail, and other economic/social activities that require physical attendance. Thus, there is a need to view the benefits of vaccination through an expansionary lens. We turn to the literature to get a sense of this expansionary lens.

## Literature Review

Assessing the impact of vaccination pertaining to different diseases has been a subject of study for years. COVID-19 vaccination's impact has been a subject that has seen multiple studies using different methods. Most studies have been done at the national level. There was a growing

realisation among policymakers, researchers, and the scientific community that awareness of the benefits of vaccination must reach the masses to tackle any form of mistrust or hesitancy that would hamper vaccine uptake. Instilling confidence among the masses concerning vaccination is critical, given the significance of vaccination as a tool to tackle the onslaught of the pandemic. Vaccination was not just considered to be a potent tool in terms of protecting an individual but also in terms of preventing its spread to others. Reduced transmission, therefore, became the broader goal, along with helping the burdened health infrastructure. In recent years, scholarly work has called attention towards understanding the benefits of vaccination from a broad perspective. The focus has shifted from a narrow understanding of vaccine impact to a broader one that accounts for vaccination's long-lasting economic and social impact. The Economic Survey of India emphasized vaccination as a macroeconomic indicator. Moreover, economists pointed to the importance of distributing vaccines worldwide for economies to return to normalcy. A study by Chang et al. (2018) projects that, because vaccinations help families avoid heavy healthcare costs associated with various diseases, between 2016 and 2030, around 24 million people will be saved from slipping into poverty.

Wang et al. (2021) studied the economic impact of mass vaccination against COVID-19 in Israel. The study followed the vaccinated cohort till day 180 using a susceptible-infectious-recovery (SIR) model. They also applied the model to a counterfactual scenario where Israel would not have implemented the vaccination program. The study highlights the importance of vaccination not just to save lives but also to reduce productivity loss. The study uses a probabilistic approach to provide a cost-utility ratio and benefit/cost (B/C) ratio of three vaccines compared to no vaccination. They conclude that, from a payer's perspective, a dollar invested in vaccination would have $2.79, $4.77, and $7.21 in return for Moderna, Pfizer, and AstraZeneca, respectively. Additionally, they conducted a cost-benefit analysis for the COVID-19 vaccines adopting four approaches. As mentioned before, the first benefit-cost ratio utilised a payer's perspective, wherein the benefit was the saving on COVID-19-related medical costs, considered as the direct cost of the vaccine. The second benefit-cost ratio was calculated as the direct cost of medical expenditure saved and the indirect cost divided by the direct vaccine cost. Here, the indirect cost was considered of productivity loss due to COVID-19-related hospitalization, a half-day course for vaccine jab, and two-day sick leave if vaccination had adverse effects. For the third ratio, the calculation was cost saving on the medical cost, plus the indirect cost and the economic impacts in terms of productivity and education loss, divided by the investment on the vaccine. The investment cost was measured with the vaccine price and administration fee regardless of vaccination coverage. For the fourth benefit-cost ratio, the study took the product of the lives saved from vaccination and the value of statistical life (VSL) ($2.7 million) divided by the investment on the vaccine. The study concludes that mass vaccination against COVID-19 with three current available vaccines is a cost-saving endeavour in terms of the gains incurred through lives saved.

Similarly, Deb et al. (2022) analysed a daily cross-country database of vaccinations and certain high-frequency indicators of economic activity to examine the economic effects of the COVID-19 vaccine empirically. The study analyses 46 countries over the period from December 2020 to June 2021, using high-frequency indicators such as nitrogen dioxide (NO2) emissions, carbon monoxide (CO) emissions, and Google mobility indices. The data collected on nitrogen dioxide (NO2) and carbon monoxide (CO) emissions at a daily frequency come from The World Air

Quality Index project. The paper posited that an increase in vaccination per capita brings a significant increase in economic activity. The paper also suggested that country-specific features such as the stringency level in containment measures and the pandemic outbreak's severity influence vaccination's impact on economic activity.

Demiralp et al. (2021) showed that the global GDP loss resulting from a situation of no COVID-19 vaccinations across countries as compared to a counterfactual scenario of global vaccinations could be greater than the cost of distributing vaccines globally. The study used an economic-epidemiological framework, for a sample of 65 countries and 35 sectors, which combined the SIR (Susceptibility-Infection-Recovery) model with international production and trade networks. The paper highlighted that increasing the supply of vaccines would result in significant economic benefits for the world economy, the benefits of which far outweigh the costs. They further pointed out the importance of an equitable vaccination distribution by estimating the costs of inequitable vaccine distribution through a SIR-multi-sector macro framework for 65 countries. By accounting for the economic interdependence of the economies, they concluded that up to 3% of advanced countries' pre-pandemic GDPs will be borne by the vaccinated countries through their trade relationships with unvaccinated countries. To put it simply, the paper suggested if country A is fully vaccinated and wants to export to country B, which is not fully vaccinated, the exports of country A will be lower compared to the counterfactual where country B is also inoculated. This study is a significant contribution to understanding the significance of an equitable distribution of COVID-19 vaccination.

On the other hand, Plotkin & Rodrigues (2020) looked at vaccination's economic and social impact but in a descriptive format. They highlighted the cost savings and productivity gains as two major aspects of the economic impact, whereas improvement in life expectancy, opportunity, and strengthening of health care infrastructure were major aspects of the social impact that improved due to vaccination.

Another major factor that is considered by multiple studies valuing the importance of vaccination is R0, i.e., transmission rate. Orenstein & Ahmed (2017) discuss the importance of the same. In mathematical models, one can estimate how many people a typical transmitting case can infect if it comes into contact with susceptible individuals. This is what R0 stands for. The paper points to the immunity threshold needed within the population to end the transmission. It can be calculated in percentage (%) as $(R0 - 1)/R0 \times 100$. This is useful in setting targets for vaccination coverage.

Scholars have also calculated the health impacts on the population caused due to Covid. For instance, Office for National Statistics (2020) conducted a study in the context of England. The study utilises data from the pandemic's initial months to model future scenarios. It studied the total health impacts of COVID-19 in terms of excess morbidity and excess mortality across the four categories of impacts - Health impacts from contracting COVID-19, Health outcomes for COVID-19 worsened because of lack of NHS critical care capacity, Health impacts from changes to health and social care made to respond to COVID-19, and Health impacts from factors affecting the wider population. The study considered the number of deaths at a constant level of 900 per week from June 2021 to March 2021. The study also estimated the years of life lost (YLL) to COVID-19. They calculate YLL as a product of the number of excess deaths and the life

expectancy of COVID-19 victims. The life expectancy of COVID-19 victims was calculated using mortality rates based on the hazard rates in Banerjee et al. (2020). The paper presented a model where the health impact was seen in a scenario with mitigations. The authors suggested that in the absence of mitigations, the number of COVID-19 deaths would have been much higher, and the quality-adjusted life-year (QALY) impact would have been more than three times for the scenario presented.

However, all methodologies differ in their technique and their targeted objective. For instance, Odihi et al. (2020) discuss the usual measures taken by economists to assess the economic value of vaccination measures. They suggest that assessing the costs related to disease prevention is a primary factor in multiple analyses. To understand the positive impact of vaccinations, costs averted can be a useful lens. Costs generally include medical costs that an individual bears, the health system, or society, including insurance reimbursement payments and out-of-pocket payments for items such as diagnostic tests, medications, hospitalization, and transportation to and from healthcare facilities. More often than not, studies include indirect costs due to productivity loss, lost wages, disability, or premature death. There is a need to explore the broader effects on the economy and society beyond assessing the health costs. Apart from analysing costs incurred due to COVID-19, delayed elective procedures, forgone routine health services during lockdown periods, accessibility issues faced by patients due to overburdened healthcare facilities, and delayed care-seeking due to fear of the pandemic are some of the additional costs that need to be factored in. While traditional cost-effectiveness or cost-of-illness analysis are helpful in these assessments, many benefits of preventing or treating COVID-19 extend beyond the health area. Odihi et al. (2020) suggest that these broader impacts need economists to predict economic scenarios simulating the absence of COVID-19 or vaccination. A significant contribution to the impact evaluation of the vaccination field comes from the study conducted by Watson et al. (2021) across 185 countries. They estimated the number of lives that would have been lost in a scenario of no vaccination. The study concluded that based on reported COVID-19 deaths, vaccinations averted 14·4 million deaths across 185 countries.

Bloom et al. (2014) described a theoretical framework outlining the full economic benefits of vaccination, going beyond the benefits typically assessed by economists in economic evaluations of vaccinations. Concerning the economic valuation method, the authors suggested that while the cost-effectiveness analysis (CEA) stands to be the most widely used method for assessing the economic impact of vaccination, the benefit-cost analysis (BCA) lens could capture the range of benefits and costs more comprehensively. The method presented direct insight pertaining to the desirability of a health intervention in the form of the estimated benefit-cost ratio. As Nandi et al. (2016) highlighted, considering the range of benefits that can be derived from vaccinating individuals, it is hard for any one methodology to capture all the benefits, especially the non-health-related ones. In this context, it is important to utilise multiple approaches to move towards a fuller understanding of vaccine gains.

Thus, studies assessing the economic impact of vaccination have done so using different methodologies. Major studies have used econometric modelling to simulate a counterfactual scenario of no vaccination and compared it to the observed one where vaccination was introduced. The economic variables used for these studies have been different - from high-frequency indicators

such as NO2 and CO2 emissions, google mobility indices, to employment and GDP. Various studies have conducted cost-benefit analyses of vaccinating the population to make a strong case for investing in vaccination programmes for producers and consumers. Re-emphasising the need to expand the approach to assessing the benefits of vaccination, there is still a vast scope to do so holistically, using different methodologies. Our study is a step in this direction. This study offers an aggregated view of India's potential income generation from the lives saved due to COVID-19 vaccination. The approach followed is described below.

**Working Method**

As mentioned above, different studies vary in their methodologies to calculate the economic impact. One of the most common techniques used to calculate the economic impact is the direct-indirect-induced one. The direct-indirect-induced impact analysis is typically utilised to assess changes brought about by an initial change through subsequent rounds of expenditure. It is a commonly used methodology in economic impact analysis (Bhatia et al, 2007; Carrera et al. 2014). However, most studies use this method to assess the impact on a specific industry or event. For instance, Lemma (2014) analyses the impact on the tourism industry. The author suggests that direct impacts accrue to the tourism enterprises, expenditure on food and beverage suppliers to tourism enterprises, for instance, is an indirect contribution, and induced impact happens through what those working in the tourism sector spend within the local economy. The study highlights the different activities that play out at the three levels of impact.

Carrera et al. (2014) use the method to study the impact of a flood event. The subject areas where the assessment of direct and indirect impacts have been undertaken are more industry-specific, or event specific. Diersen et al. (2002) assess the impact of drought on South Dakota's economy using a direct-indirect-induced vantage point. The study divides the total effect of the drought on the South Dakota economy into three separate facets - the direct effect calculated as loss in agricultural income; the indirect effect, or the effect on businesses related to agriculture, using an indirect multiplier; and the induced effect to capture the effect on local consumers. While such studies utilise this approach in a technical fashion, other work adopts the direct-indirect impact lens to understand how effects manifest in phases. Similarly, Kapoor & Goyal (2021), in their study on the development of the Kevadia region as an eco-tourism centre, establish this development's direct and indirect economic impact on the local community, allied industries and regional economy. The study pegs the cumulative economic impact generated through the Kevadia ecosystem (direct and indirect combined) at around ₹10,630 crores. The method highlights that impact plays out at multiple levels in areas beyond the immediate effect.

Our study assesses the impact of vaccination, taking the lives saved due to vaccination and assessing their potential income-generating contribution to the economy through direct and total impact. It uses the Keynesian multiplier approach to estimate the total impact using an income approach. Multipliers are summary measures that show the total effects of a project in relation to its direct effects. For instance, a multiplier of 1.60 shows that for every one rupee of value generated directly by the project at maturity, another 60 would get added as downstream effects. Bleaney et al. (1992) calculate the multiplier effect on gross output and income of having a University (University of Nottingham). The authors found that the disposable income and gross

output multipliers were more than unity. Similarly, Janeczko et al. (2002) studied the impact of the tourism sector on the Snowy Region of Australia by estimating the multiplier and studying its impact on the gross regional product of the Snowy Region. They estimate that for each $100 of visitor expenditure in the region, there is $39.80 generated of total regional income. Moreover, to measure the economic impact of any interjection, the impact generated may be categorised into primary (direct) and secondary (indirect and induced). Furthermore, it may be noticed that as the size of the interjection increases, the indirect and induced effects eventually disappear, and we are left with the multiplier effect (Hsu, 2019; Janeczko et al., 2002).

Against the above backdrop, this chapter assumes that incomes earned as a result of life saved due to Covid vaccination can be accounted for in two ways; one being the 'direct impact', i.e., how much the people who got saved by Covid vaccination would earn; and second, the 'total impact', i.e., how much economic impact would their earned incomes create, in turn, as a result of the 'multiplier' effect. We estimate direct impact through the potential income earned by the lives saved. Under this, three approaches are used - Minimum Wage[51], GDP per capita[52], and GDP per employed[53]. The first method assumes a minimal approach, wherein the assumption is that the lives saved earn a minimum wage. The second method assumes a scenario wherein the lives saved contribute to the economy in terms of GDP per capita, while in the third scenario, we do so in - the GDP per person employed.

At the direct impact level, we can gauge the first-level impact or the effect in the first rung in the economy from a particular change. In the case of vaccination, the first-rung impact of the lives saved can be seen in their potential contribution to the economy as 'earners' in different scenarios. The total impact derives from the change in the direct impact. The study assesses the total impact through the consumption multiplier applied on the income earned subsumed in the direct impact.

In gauging the economic impact of India's vaccination strategy, we first take the number of COVID-19-related deaths averted due to vaccination from Watson et al. (2022) - 'Global impact of the first year of COVID-19 vaccination: a mathematical modelling study', published in 'The Lancet Infectious Diseases'. Based on the officially reported death rate, the study estimates deaths averted due to COVID-19 vaccination in India. The number of deaths averted goes on to contribute significantly to the economy and society in general.

Additionally, it must be understood that the world has made significant efforts to extend general vaccination coverage to the world. The scientific community, policymakers, researchers and governments have undertaken tremendous efforts to showcase how vaccine benefits outweigh its costs. The emphasis has long been on showing, through various means, that vaccines be perceived as an investment with large-scale impacts. The study is an attempt to build a complete understanding of the gains from saving lives due to COVID-19 vaccination by incorporating both the direct and the total impact of the deaths averted. However, it should be highlighted that saving lives has value far beyond the economic value generated. The idea this paper espouses is not to limit the impact to an economic sense since the value that a saved life adds to society is incalculable.

[51] Minimum wage is the lowest wage that an individual is entitled to by the law.
[52] GDP per capita is broadly defined as GDP of a country divided by its total population.
[53] GDP per employed is broadly defined as GDP of a country divided by its employed population.

Approaching it from an economic perspective is just one way to incorporate the effect of vaccination.

## Income Generating Potential of Lives Saved through COVID-19 Vaccination

A Lancet modelling study estimates that in India around 34,22,000[54] deaths were prevented by vaccination in the year 2021, an estimate based on officially reported deaths in India. We base the income generation potential of vaccination on the estimated number of lives saved or deaths averted as per the cited study.

### I. Minimum Wage Method

1) Direct Impact

The Ministry of Labour and Employment constituted an expert committee in 2017 which set ₹375 per day (or INR 9,750 per month)[55] as of July 2018, as the level of a single national minimum wage at an all-India level, irrespective of sectors, skills, occupations and rural-urban locations for a family comprising of 3.6 consumption unit. The report also recommended national minimum wages for different geographical regions of India, taking into account different region-specific realities and the labour market conditions. The report has clubbed all states into five different groups and set different minimum wage levels. Another report by ILO titled "Global Wage Report 2020-21: Wages and Minimum Wages in the Time of COVID-19" took the national floor level minimum wage as the average wage for India at ₹176/day. However, actual wages are far higher. If the median of the minimum wages in different states is drawn, it would be ₹269/day in the country[56]. Moreover, applying the workforce participation rate of India, i.e., 38.2% (PLFS 2019-20)[57], we calculate the potential economic impact as: -

*Direct Impact = Lives saved due to vaccination × minimum wage × 312*[58]* - *Eq. (1)*

**Table 1 - Direct Impact - MWM**

| | |
|---|---|
| Lives saved due to vaccination | 34,22,000 |
| WFPR (%) | 38.20 |
| Minimum wage | 269 |
| Impact | ₹ 1,09,71,10,17,312 (approx. 11,000 crore) |
| | $ 1,547,470,518 (approx. **$ 1.5 billion**) ** |
| *To account for 1 year | |
| **Average exchange rate of 2019-20 taken 70.897[59] | |

[54] (Watson et. al., 2022). Global impact of the first year of COVID-19 vaccination: a mathematical modelling study. The LANCET Infectious diseases.
[55] https://pib.gov.in/PressReleasePage.aspx?PRID=1564590
[56] https://pib.gov.in/PressReleseDetailm.aspx?PRID=1705410
[57] We use all India WPR of 38.2%. For details see Periodic Labour Force Survey (PLFS) 2019-20.
[58] We take 26 days as the working days in each month as per Section 26 of The Minimum Wages (Central) Rules, 1950. See https://labour.gov.in/sites/default/files/TheMinimumWages_Central_Rules1950_0.pdf for more details.
[59] https://rbidocs.rbi.org.in/rdocs/Publications/PDFs/137T_15092022C8DE38B03F9541259D5539E0D1AFCD67.PDF

The benefit side should be viewed parallel to the cost side. Although attaching a cost to a life is not something we wish to do, incorporating government expenditure on the roll-out of the vaccination is something that can be done. As per the government's data, the vaccination expenditure incurred for the year 2021 turned out to be about 19,675 crores.[60] [61] . Comparing Cost with the Impact in Eq. (1) implies: -

$$Net\ Benefit = Impact - Cost\ of\ Vaccination \quad - Eq.\ (2)$$

| Table 2 - Net Benefit / Loss - MWM | |
|---|---|
| Direct Impact | ₹11,000 crores |
| Expenditure incurred on Vaccination | ₹ 19,675 crores |
| Net Benefit / Loss | ₹ (-) 8,675 crores |
| | **$ (-) 1.2 billion** (approx.) |

*(-) minus sign implying a net loss*

2) Total Impact

As mentioned earlier, total impact captures the economy wide broader change due to an initial change in income level. The Reserve Bank of India conducted an econometric investigation over the period of 1970 to 2000, of the real private final consumption expenditure in relation to real GDP at factor cost and estimated the marginal propensity to consume with respect to current income level then of 0.60. This gives a multiplier value of 2.5, which implies that a one per cent increase in an initial change in expenditure would raise income by 2.5 per cent. Applying this multiplier to the direct impact at the first level, we get,

$$Total\ Impact = Direct\ Impact\ in\ terms\ of\ Income\ earned \times Multiplier - \quad Eq.\ (3)$$

| Table 3 - Total Impact - MWM | |
|---|---|
| Direct Impact in terms of Income earned | ₹ 1,09,71,10,17,312 |
| Multiplier* | 2.5 |
| Impact | ₹ 27,427,75,43,280 (approx. **₹ 27,400 crore)** |
| | $ 3,868,676,295 (approx. **$ 3.87 billion**) |

[60] https://pqals.nic.in/annex/177/AS96.pdf

[61] https://economictimes.indiatimes.com/news/india/rs-19675-cr-spent-on-covid-19-vaccine-procurement-govt-data/articleshow/88455933.cms?from=mdr

| * Multiplier taken from RBI[62] |
|---|

Using Eq. (2) –

| Table 4 - Net Benefit / Loss -MWM | |
|---|---|
| Total Impact | ₹27,400 crores |
| Expenditure incurred on Vaccination | ₹19,675 crores |
| Net Benefit / Loss | ₹ 7,725 crores |
| | **$ 1.09 billion** (approx.) |

*no (-) minus sign implying a net benefit*

## II. GDP Per Capita

1) Direct Impact

Under this approach, we calculate the potential economic impact at a GDP per capita level at constant and current prices.

$$Impact = Lives\ saved\ due\ to\ vaccination \times GDP\ per\ capita - Eq.(4)$$

| Table 5 - Direct Impact – GDP per capita | | | |
|---|---|---|---|
| | GDP per capita | Impact | Net Benefit / Cost |
| GDP per capita at constant prices | ₹1,08,645[63] | ₹ 3,71,78,31,90,000 (approx. ₹ 37,000 crore)<br>**$ 5,243,990,437 (approx. $ 5.2 billion)** | ₹17,325 crores<br>**$ 2.44 billion** (approx.) |
| GDP per capita at current prices | ₹1,51,760[64] | ₹ 51,932,27,20,000 (approx. ₹ 51,900 crore)<br>**$ 7,325,030,960 (approx. $ 7.3 billion)** | ₹32,225 crores<br>**$ 4.55 billion** (approx.) |

[62] https://www.rbi.org.in/scripts/PublicationReportDetails.aspx?ID=267

[63] Constant prices are adjusted for inflation. Here the base year is 2011-12. Current prices are not adjusted for inflation. For details see https://www.rbi.org.in/scripts/PublicationsView.aspx?id=20407

[64] https://www.rbi.org.in/scripts/PublicationsView.aspx?id=20407

2) Total Impact

$$Impact = Direct\ Impact\ in\ terms\ of\ GDP\ per\ capita * Multiplier - Eq.(5)$$

**Table 6 - Total Impact - GDP per capita**

| | GDP per capita | Impact | Net Benefit / Cost |
|---|---|---|---|
| GDP per capita at constant prices | ₹1,08,645 | ₹ 9,29,45,79,75,000 (approx. ₹ 92,000 crore)<br>**$ 13,109,976,092 (approx. $ 13.1 billion)** | ₹72,325 crores<br>**$ 10.20 billion** (approx.) |
| GDP per capita at current prices | ₹1,51,760 | ₹ 12,98,30,68,00,000 (approx. ₹ 1,29,000 crore)<br>**$ 18,312,577,401 (approx. $ 18.3 billion)** | ₹1,09,325 crores<br>**$ 15.42 billion** (approx.) |

## III. GDP Per Employed

1) Direct Impact

The GDP per employed is a measure of the overall productivity in the economy. Among the three approaches used here, this measure offers a best-case scenario wherein we calculate the GDP per employed as total GDP divided by the total workforce for the year 2019-20. The total GDP (at constant prices) was 1,45,15,958 crore, and the total population was 1341 million[65]. Applying the WFPR[66] of 38.2% as per Periodic Labour Force Survey (PLFS)[67] 2019-20, we get the total workforce or total employed as 51,22,62,000 (about 5.1 million). This gives GDP per employed (at constant prices) as: -

1,45,15,958 crore / 51,22,62,000 = ₹ 2,83,370

Similarly, for GDP per employed (at current prices), we get,

2,00,74,856 crore / 51,22,62,000 = ₹ 3,91,887

[65] https://www.mospi.gov.in/documents/213904/416359/Press%20Note_PE%20FY22m1653998874449.pdf/9616eef9-71b9-7522-808a-5fd438857454

[66] Workforce participation rate (WFPR) essentially means the number/percentage of employed in the country.

[67] Annual edition from Government of India that maps the employment and unemployment scenario of India.

As done earlier, applying the WFPR of 38.2% to the lives saved due to vaccination, we get the direct impact as: -

$$Impact = Lives\ saved\ due\ to\ vaccination \times WFPR \times GDP\ per\ employed - Eq.(6)$$

**Table 7 - Direct Impact - GDP Per Employed**

| | GDP per person employed | Impact | Net Benefit / Cost |
|---|---|---|---|
| GDP per person employed at constant prices | 2,83,370 | ₹ 37,042,23,97,480 (approx. ₹ 37,000 crore)<br>**$ 5,224,796,500 (approx. $ 5.2 billion)** | ₹17,325 crores<br>**$ 2.44 billion** (approx.) |
| GDP per person employed at current prices | 3,91,887 | ₹ 51,227,62,53,948 (approx. ₹ 51,200 crore)<br>**$ 7,225,640,774 (approx. $ 7.2 billion)** | ₹31,525 crores<br>**$ 4.44 billion** (approx.) |

2) Total Impact

$$Impact = Direct\ impact\ in\ terms\ of\ GDP\ per\ employed \times Multiplier$$ - *Eq. (7)*

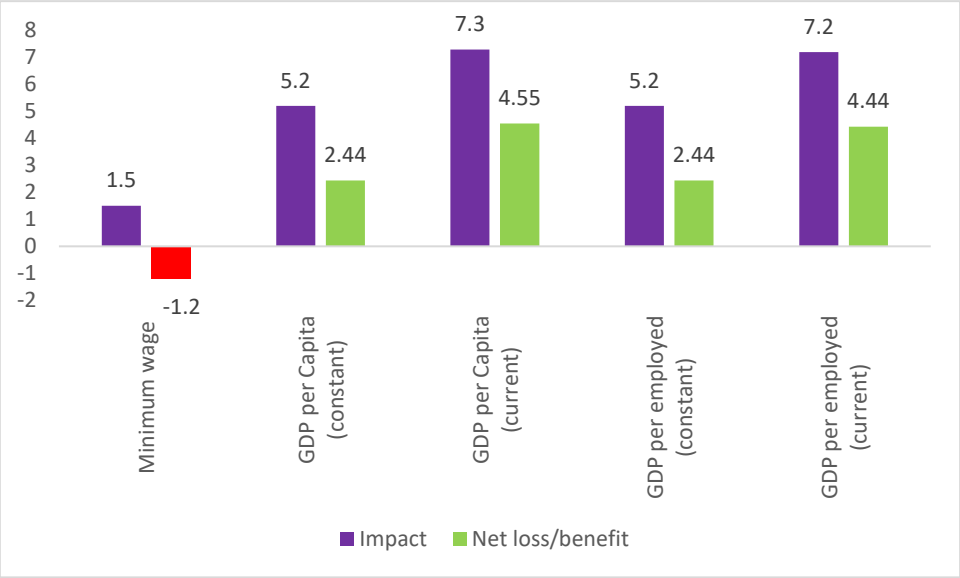
**Table 8 - Total Impact - GDP Per Employed**

| | Impact | Net Benefit / Cost |
|---|---|---|
| GDP per person employed at constant prices | ₹ 92,605,59,93,700 (approx. ₹ 92,600 crore)<br>**$ 13,061,991,251 (approx. $ 13 billion)** | ₹72,925 crores<br>**$10.28 billion** (approx.) |
| GDP per person employed at current prices | ₹ 1,28,069,06,34,870 (approx. ₹ 1,28,000 crore) | ₹1,08,325 crores (approx. ₹ 1083.25 billion)<br>**$ 15.28 billion** (approx.) |

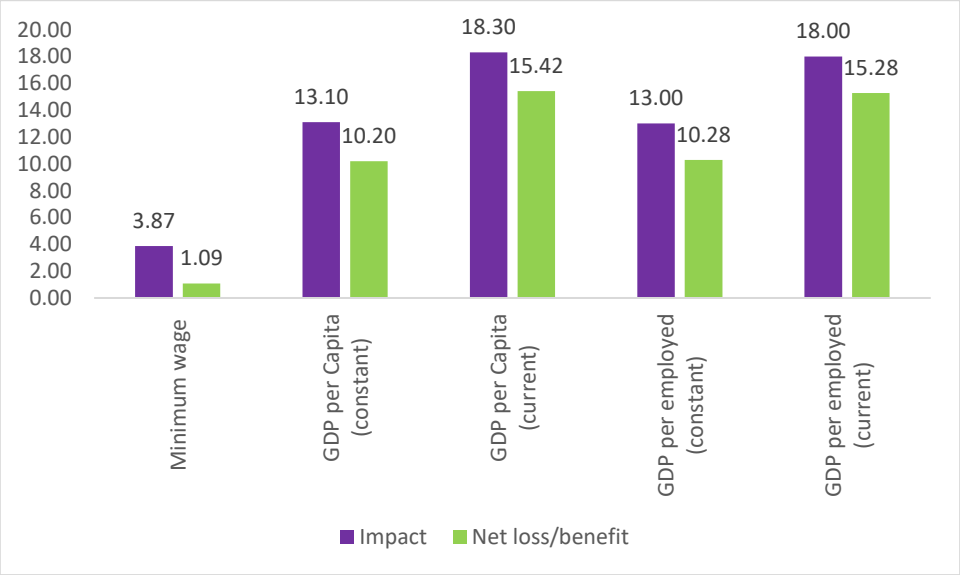
| | | |
|---|---|---|
| | **$ 18,064,101,935 (approx. $ 18 billion)** | |

The figure below gives a snapshot of the cost-benefit analysis using the above approaches.

**Direct Impact ($ billion)**




**Total Impact ($ billion)**




*Direct impact can be captured via all three scenarios (GDP per employed, GDP per capita and the minimum wage). The difference is bound to be large since GDP per employed worker comes out to be the maximum. At the other end, we have a scenario wherein a person earns a minimum wage. Thus, the difference in direct and total impact across the working method is evident.* The study has the potential to gain more nuance with an age-wise

disaggregation of the lives saved due to COVID-19 vaccination. In reality, the lives saved number would have variation not just in terms of age but also in terms of income-earning potential. Moreover, if within the working-age bracket, there are a higher number of individuals aged under 30-35, the individual lives saved due to vaccination would have a greater number of years to contribute to the economy through income generation. Using the COVID-19 age-group-specific death rate, the study aims to make this analysis more nuanced.

Thus, age distribution would help us build a more nuanced understanding of vaccination's impact on people's lives. To do this, one way would be to distribute the same according to the age profile of the number of deaths that happened, i.e., if we're to get the age profile of the number of deaths that happened in India as per official estimates, we could use that with the assumption that the age profile of the number of lives saved due to vaccination would be similar to those who died due to COVID. To this end, the age profile of the number of deaths that happened by August 2020 are available. This is shown in the table below.

| **Table 9a – Age Profile of Total Deaths** | |
|---|---|
| Total Deaths = 56,288 | |
| **Age Group** | **% Of people** |
| 0-10 | 0.50% |
| 11-20 | 0.70% |
| 21-30 | 2.60% |
| 31-40 | 6.10% |
| 41-50 | 13.40% |
| 51-60 | 25.30% |
| 61-70 | 28.60% |
| 71-80 | 17% |
| 81-90 | 5.30% |
| 90 & above | 0.50% |

Source: https://www.hindustantimes.com/india-news/90-of-those-killed-by-covid-in-india-are-older-than-40-69-are-men/story-glg0Ct4rHQ1YVvZgnckUcM.html

Using the above age-profiles, one can see that 47.4% of the people who died were in the age group 21-60, the broad working age group[68]. However, we may caution that this is a broad assumption where the actual age distribution (as data gets available) might differ from what is suggested above. Therefore, by applying the above age profiles to the number of lives saved due to vaccination, we get,

[68] Generally, 15-59 is considered to be the working age group in the Indian Context. However, since there is only a small %age of people belonging to 0-20 age group according to the reported figures, we can broadly consider 21-60 as 15-59 and 0-20 as 0-15 to make the comparisons parallel to the level of ones on which WFPR is calculated. All other ages are considered 60 & above.

| Table 9b – Percentage of People in Different Age Profiles | | |
|---|---|---|
| **Age Group** | **% Of Lives Saved** | **No. of Lives Saved (out of 34,22,000)** |
| Less than 15 | 1.20% | 41,064 |
| 15-59 | 47.40% | 16,22,028 |
| 60 & above | 51.40% | 17,58,908 |

Following the same methodology as above, we get,

### I. Minimum Wage Method

This would imply that out of the total lives saved due to vaccination, those belonging to the working age category (15-59) earned a minimum wage of 269 and thus the potential economic impact by these people would be:

$$Impact = Lives\ saved\ due\ to\ vaccination\ (15-59) \times WFPR\ (15-59) \times minimum\ wage \times 312 \quad \text{- Eq. (8)}$$

| Table 10 – Direct and Total Impact - MWM | | |
|---|---|---|
| | Impact | Net Benefit/ Loss |
| **1) Direct Impact** | ₹ 7,337,59,92,065 (approx. ₹ 7,300 crore)<br>**$ 1,034,966,107 (approx. $ 1.03 billion)** | ₹12,375 crores<br>**$ - 1.74 billion (approx.)** |
| **2) Total Impact** | ₹18,343,99,80,163 (approx. ₹ 18,300 crore)<br>**$ 2,587,415,267 (approx. $ 2.58 billion)** | ₹1,375 crores<br>**$ - 0.2 billion (approx.)** |

Since we are now dealing with only working-age individuals, we would not use the GDP per capita approach and rather skip to GDP per person employed.

### II. GDP Per Person Employed

1) Direct Impact

$$Impact = Lives\ saved\ due\ to\ vaccination\ (15-59) \times WFPR\ (15-59) \times GDP\ per\ employed \quad \text{- Eq. (9)}$$

| Table 11 - Direct Impact - GDP Per Employed | | | |
|---|---|---|---|
| | GDP per person employed | Impact | Net Benefit / Cost |

| | | | |
|---|---|---|---|
| GDP per person employed at constant prices | ₹2,83,370 | ₹ 24,774,27,40,010 (approx. ₹ 24,700 crore)<br>**$ 3,494,403,713 (approx. $ 3.49 billion)** | ₹5,025 crores<br>**$ 0.71 billion** (approx.) |
| GDP per person employed at current prices | ₹3,91,887 | ₹ 34,261,62,23,151 (approx. ₹ 34,200 crore)<br>**$ 4,832,591,268** (approx. $ 4.8 billion) | ₹14,525 crores<br>**$ 2.05 billion** (approx.) |

2) Total Impact

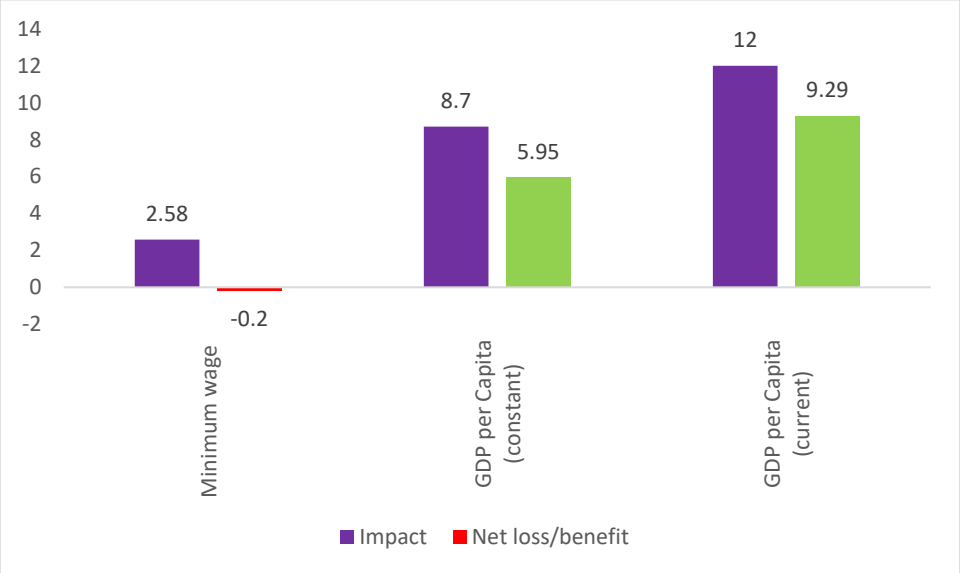
**Table 12 - Total Impact - GDP Per Employed**

| | Impact | Net Benefit / Cost |
|---|---|---|
| GDP per person employed at constant prices | ₹ 61,935,68,50,025 (approx. ₹ 61,900 crore)<br>**$ 8,736,009,281 (approx. $ 8.7 billion)** | ₹42,225 crores<br>**$5.95 billion** (approx.) |
| GDP per person employed at current prices | ₹ 85,654,05,57,878 (approx. ₹ 85,600 crores)<br>**$ 12,081,478,171 (approx. $ 12 billion)** | **₹65,925 crores**<br>**$ 9.29 billion** (approx.) |

The figure below gives a snapshot of the cost-benefit analysis by using the above approaches, after age-profiling, i.e., for the working-age group (15-59).

**Direct Impact ($ billion)**


**Total Impact ($ billion)**




## The Elderly

For the elderly, i.e., above the 60-year age bracket, the analysis cannot be done in this particular way since they are generally not fully financially independent. However, the elderly constitute a large section that is more prone to the virus. Therefore, the fewer people who fall ill, the less the burden on healthcare services. For instance, an analysis conducted by Reed et al. (2012) to quantify the potential public health impact of a QIV vaccine strategy in the United States estimated that over 10 years (from 1999 to 2009), QIV could have prevented up to 2.7 million cases of influenza, more than 21,000 hospitalisations, and about 1300 influenza-related deaths. Surely, preventing hospitalisation leads to a reduced burden on the healthcare system.

It is common knowledge that the global health systems came under tremendous pressure due to the sudden surge in the number of COVID cases. Even developed economies like Spain, Italy, US, among others, found it overwhelming to deal with the sheer amount of pressure that the virus brought with its spread. Therefore, for the elderly, vaccinating them led to easing the burden on the healthcare system since that led to a smaller number of cases and, in turn, lesser hospitalisations.

Since the number of elderlies that got saved by vaccination was 17,58,908, it can be argued that hospital beds got saved, which in turn, got used in dire need of the same. Although there might be a case that out of these 17,58,908 some still contracted COVID and required hospitalisation, we leave out that possibility for simplicity and also due to the fact that such hospitalisation was required due to some co-morbidities or other critical illness (Aggarwal et al. 2021). As per the Ministry of Health and Family Welfare, there were 4,94,720 oxygen-supported isolation beds[69] in the country in December 2021. Since 17,58,908 lives were saved due to vaccination in the elderly age group, it can be presumed that it led to the prevention of occupancy of oxygen-supported isolation beds. Thus, vaccination did prevent healthcare infrastructure from being overwhelmed. Therefore, vaccination not only saved lives but also indirectly assisted in providing treatment to those who required oxygen-supported isolation beds.

## Lifetime Earnings

To account for the lifetime income generating potential of a person, we apply the value of statistical life formula used by scholars like Abelson (2008) in order to get the lifetime potential income generation of the lives saved of people by vaccination: -

$$VSL\ (a) = VLY/(1+r) + VLY/(1+r)^2 + \dots\ \dots\ \dots + VLY/(1+r)^n$$

Where 'a' is the age. Here we take the median age of the working age group (15-59), which turns out to be about 37; 'r' is the discount rate. Here we take CPI (General) for the pre-pandemic year 2019 as the discount rate (7.74)[70] to account for the reduction in the value of money earned over time, and 'n' is the remaining working-age years. Here 'n' would go up to 23 since 60 is the retirement age. Value of Life Years (VLY) is the numerator, essentially the wage earned over one year. This minimum wage is enhanced based on CPI-IW as per the central labour commissioner office[71]. Scrutinising data for 2019 reveals that the CPI-IW for 2019 was about 7.49 after considering the base effect.[72] Applying the above rates to the VSL formula, we get,

[69] https://pib.gov.in/PressReleseDetailm.aspx?PRID=1787361. We have taken number of oxygen supported beds with the presumption that elderly population generally requires oxygen support in combating COVID given they are immune compromised and suffer other comorbidities. This is also evidenced in Aggarwal et al. (2021) where it is observed that out of total deceased persons in the elderly age group, majority suffered breathlessness or Acute Respiratory Distress Syndrome (ARDS).

[70] We take the percentage increase from January 2019 to December 2019 (base year 2012).

[71] See https://clc.gov.in/clc/min-wages for more details.

[72] Since CPI (General) is available at the base year 2012 as compared to CPI-IW which is available at a base year 2001, we recalculated the CPI-IW for 2019 at a base year for 2012 using simple base change formula. We take the percentage increase from January 2019 to December 2019 for CPI-IW as well (with new base year 2012).

$$VSL\ (37) = 83{,}928/(1.0774) + 90{,}214/(1.0774)^2 + 96{,}971/(1.0774)^3 + \ldots\ \ldots\ \ldots + 4{,}11{,}153/(1.0774)^{23}$$

Where each numerator is a product of the number of working days (312) and minimum wage (269), in which minimum wage is enhanced by 7.49% each year.

VSL (37) = ₹ 17,46,672 (approx. **$ 24,637**) **for one person over his/her lifetime**.

This implies that for 8,74,273 employed persons out of 16,22,028 lives saved (15-59), the cumulative potential income generation would be: -

VSL (37) = 8,74,273 * 17,46,672

VSL (37) = ₹ 1,52,706,81,69,456 (approx. ₹ 1,52,000 crore)

Or = **$ 21,539,249,467 (approx. $ 21.5 billion)**

## The Social Aspect

One cannot completely comprehend the impact without underlining the social aspect pertaining to vaccination. Health and socioeconomic aspects of a region share a bidirectional association. A healthy population is able to contribute to the economy productively, while greater economic growth helps a society improve its investment in health. These benefits of vaccinations and other public health interventions, including sanitation, clean water, and antibiotics, are essential for social and economic reasons. The emphasis of this paper is to understand the benefits of vaccination from a long-term perspective. Through various public health interventions, individuals are enabled to participate in society in a better way. Vaccinating children would go a long way in contributing to a burgeoning adult workforce in the future. When an adult suffers from COVID-19, research has shown how it substantially affects the economy via lost office hours, absenteeism, and the concomitant loss in wages (Faramarzi et al., 2021). Vaccination protects individuals from suffering an illness and allows individuals to avoid the costs attached to that illness. COVID-19 vaccination helped prevent severe illness and, thus, contributed to healthcare expense savings. Tarazi et al. (2022), based on Medicare FFS claims data and country-level vaccination rates, show a positive association between COVID-19 vaccinations and reduced hospitalizations, estimating savings of about $2.6 million in early 2021.

Besides savings, COVID-19 vaccination, by allowing people to return to office spaces, also led to productivity gains. Gorlick (2021) discusses Economist Nicholas Bloom's research on productivity losses brought about by work-from-home mode during COVID-19. Their research points to individuals facing a loss of motivation, feeling of loneliness and isolation due to extended periods of working from home. Vaccinating individuals at a rapid pace was essential to opening up public spaces and allowing free movement of people, which in turn helped individuals return to a work mode they were more comfortable with. Additionally, the lack of vaccination restricts access to multiple spaces. It can limit one's access to employment opportunities and a lot of physical spaces (Mathivathanan, 2021). Thus, the social impact of vaccination reflects in a range of spheres. To

quote Bloom et al. (2005), 'Vaccination is not purely a health sector issue—it has resonance for wider economic planning and for long-term economic progress' the resonance goes beyond an economic impact and encompasses society in general.

## Future Work

Apart from the methodology we have applied in construing the potential income generation, there might be other techniques to do the same. As mentioned before, for example, the age profile of deaths averted, based on a much larger dataset, can be one such addition. Moreover, approaching the same in a more disaggregated way, say at the state level, can be another way to approach things. However, such formal and detailed analysis requires quantifiable and consistent data – something we found lagging in the Indian landscape, at least at the current juncture. The availability of the same at a future point in time can open avenues for more nuanced research with more disaggregated policy responses. This would ensure more informed decision-making based on more robust research. In the Indian context, an age-stratified fatality comparison is important to arrive at the lives saved from 'vaccine as a health intervention'. It is desirable to calculate Quality Adjusted Life Years (QALY); however, it would require disaggregated COVID-19 case and death data which is not available for India at the national and state level. It would also require age stratification of vaccine rollout %age among citizens to understand vaccine efficacy as an intervention. Moreover, in calculating the lifetime earnings on the minimum wage method, we have taken CPI-IW and CPI (General) rates that can change in future, given the sensitivity of prices over months and years which in turn depend upon the multitude of national and international factors. Also, we have only discounted the income based on CPI (General), whereby additional factors such as borrowing cost could be incorporated further. Nonetheless, the assumption allows us to map a potential income generation effect and take us closer to the approximate income that might have been lost had the number of people not been saved due to vaccination.

Apart from making an attempt, our paper is also a call for more research in this domain, given the paucity of existing work in the Indian context. This paper, therefore, tries to study the impact of various interventions (vaccine, containment, and relief package) to understand the broad impact of the interventions in combating the pernicious virus and thus try to build an understanding towards the bigger question of whether each of these interventions were useful in combating the forms of roadblocks that the virus brought with its onset. Our analysis reveals that the three interventions were useful in combating the virus. Although the exact impact – both economic and social – is hard to capture, our paper is an attempt in the direction to map the effects of the interventions that India undertook.

# Way Forward

There is a significant surge in the discussions around the world on building a resilient health infrastructure at a global level. Countries have realised the importance of collaboration and cooperation in facing challenges like COVID-19. While forces of globalisation and digitalisation deepened the relationships between nations by reducing barriers, the need of the hour is to ensure preparedness and resilience in the face of challenges that may arise in future. This would require a deeper understanding of countries' strategies in combating COVID-19. This study forms a significant contribution towards these efforts by estimating the impact of strategies employed in combating COVID-19 in India and lays the ground for assessing the effects of the strategies employed by other countries.

In building our pandemic preparedness, how various regions tackled COVID-19 is a trove of experience and resources that should be understood well. They are not mere learnings from a crisis, but are essential resources for building strategies to combat global uncertainties in the future. This study highlighted how disaggregated data, age-wise and region wise at a sub-national level, can help bring more nuance in assessing the positive economic impact of vaccination. Availing age-group-wise COVID-19 death rate in India can help make the study more robust. This might be complemented with more data like hospitalizations, available beds, oxygen, etc. at a disaggregated level. Thus, the calculations that are done in this paper are by no means plenary and adds to literature by highlighting some of the ways in which the objective of this paper can be approached.

Additionally, the impact of a localized containment strategy, whereby states and districts actively engaged in demarcating red from green and orange zones, restricting the spread of the virus, can be seen better with more granular data at a district-level over the entire localized containment period. Containing the virus in a nation as populous and diverse as India is a highly arduous task. It was successful due to the strategy adopted by different regions engaging multiple actors. The study aims to get a deeper understanding of how to assess this better. Furthermore, the study highlights the lack of work on the assessment of social measures or relief packages' impact on society. It attempts to open up further discussion on adopting different methodologies to dig deeper into the impact of India's COVID-19 relief package. Each of the three strategies - Vaccination, Containment, and the Relief Package, was equally important and in conjunction with one other, brought the nation to a post-pandemic era.

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