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Research Article

Beyond the Epidemic Diseases Act, 1897: Rethinking India's Public Health Laws for Pandemic Preparedness – Lessons from Singapore

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A B S T R A C T

The Epidemic Diseases Act (EDA), 1897, was enacted in the late 19th century in the wake of the third plague pandemic in India and was a significant step in colonial public health legislation. However, more than a century later, the COVID-19 pandemic laid out how outdated this law is for addressing current public health challenges. This research article examines the historical antecedents and shortcomings of the EDA, 1897, and compares India's public health response with that of a country like Singapore which has a comprehensive and exhaustive approach to tackling public health through a legal mandate under the Infectious Diseases Act, 1976. The article also examines the Public Health (Prevention, Control and Management of Epidemics, Bio-terrorism and Disasters) Bill, 2017 which tried to replace the EDA but never came into being due to its centralisation of power and non-consultation with civil society. The study compares the effectiveness of lockdown measures taken against the COVID-19 pandemic in both countries through a comparative analysis of COVID-19 data and stresses that legal frameworks, governance, and public accountability are critical in the management of epidemics. The study further provides practical suggestions to reinforce India's public health system, focusing on revamping legal provisions, strengthening healthcare infrastructure capacities, upgrading Centre-State coordination, and ensuring India has access to devolved and contextual measures in future crises. Adaptation of world-class practices including that of Singapore can help India build a future-ready proactive public health system that can ensure protection for its population against future health challenges.

Keywords: COVID-19, Epidemic Diseases Act, Infectious Diseases Act, Public Health Bill, Public Health Governance, Pandemic

Introduction

Historically, pandemics have posed severe risks to public health, economies, and societies, frequently exposing weaknesses in governance and healthcare systems. One of the most devastating global health crises of our time is the COVID-19 pandemic, which began at the end of 2019. Its fast transmission and high mortality led the pandemic to overwhelm healthcare systems, shutter economies and disrupt the day-to-day lives of billions. To hold back the spread of the virus, governments all over the world had no alternative but to impose unprecedented restrictions, including lockdowns, travel bans, and large-scale vaccination initiatives. The crisis highlighted how essential well-established legal frameworks, governance mechanisms, and public health preparedness measures are to managing infectious disease outbreaks.

In India, as per the Constitution, public health is a shared responsibility of the Union and State Governments. Although public health comes under Entry 6 of the State List (Seventh Schedule), some provisions such as Entry 29 of the Concurrent List (Prevention of infectious or contagious diseases) authorise both the central and state governments to take measures in the face of a health emergency. Further, the Directive Principle of State Policy (DPSP), especially Article 47 impresses and obligates the state to raise the health of the public as a primary duty. However, the COVID-19 crisis exposed the fault lines in India's legal preparedness, governance coordination and health infrastructure, disclosing the deficiencies in its existing law.

One of the most serious flaws when it came to managing the pandemic was India's dependence on the Epidemic Diseases Act (EDA), 1897 which was enacted way back in 1897, during the third plague pandemic and in colonial times. Although groundbreaking for its time, the EDA provided neither extensive mechanisms for modern disease surveillance, coordinated emergency response, nor public health enforcement. Hence, it had to buttress it with the Disaster Management Act (DMA) of 2005, which, proved instrumental in disaster relief but was not pandemic-specific. The lack of a modern and well-defined legal framework resulted in piecemeal responses, legal ambiguities, and governance difficulties, hampering the country's ability to mount an effective response to COVID-19.

Instead, Singapore's Infectious Diseases Act, 1976 (IDA) offered a structured and proactive legal mechanism for rapid recognition, obligatory reporting, enforceable quarantine measures, and stringent penalties for noncompliance. The pandemic's impact was significantly mitigated by Singapore's swift and coordinated responses, underscoring the efficacy of a modern legal framework for managing public health emergencies.

Materials and Methods

The study aims to find the effectiveness of the legal framework related to the epidemic in India. First, the historical background and limitations of India's Epidemic Diseases Act, 1897 which contrasted with Singapore's Infectious Diseases Act, 1976, have been studied to analyse how legal preparedness shaped each country's pandemic response. Additionally, it evaluates India's Public Health (Prevention, Control, and Management of Epidemics, Bio-terrorism, and Disasters) Bill, 2017, which sought to replace the outdated EDA. For the purpose of this study, doctrinal and non-doctrinal methods have been utilised. It is substantially doctrinal and non-doctrinal, combining critical, comparative, historical and analytical approaches. The study underscores the importance of legal modernisation, governance coordination, and public accountability in managing future pandemics.

Plague, Panic, and the Birth of the Epidemic Diseases Act, 1897

In the late 19th century, India was engulfed in the painful bubonic plague pandemic. It exposed the inadequacies of prevailing public health legislation and led to several legislative responses following the outbreak, which had spread from Hong Kong in 1894 to Bombay in 1896. One of them, the EDA, became one of the key pieces of legislation in the country shaped through international pressure and domestic disorder. This chapter provides insights into the historical context, the aftermath that underlined the Act and the response that aimed at providing a balance between public health imperatives and the quotidian realities of life in colonial India.

When the plague hit Bombay in 1896, the early response was one of indecision and denial. The Bombay Municipal Act of 1888, especially Section 434, gave the Municipal Commissioner wide-ranging powers to prevent the disease, including a special prerogative to forcibly enter and disinfect buildings, remove plague patients from homes and isolate infected areas. While these measures were theoretically effective, they caused widespread panic and resistance. The general public at large took the intrusive actions of the authorities with doubt, leading to mass exodus, riots, and even violent confrontations. The Act's provisions, while crucial for disease control, highlighted the absence of a cohesive legal framework to manage such a large-scale health crisis.

The Indian Railways Act of 1890 also played a role in the early response to the plague. Chapter VI, Section 71 of the Act empowered railway authorities to refuse transport to individuals with infectious diseases and enforce medical inspections at key stations. However, the extensive railway network, a symbol of colonial modernity, inadvertently

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facilitated the spread of the plague to India's interior regions. Similarly, Act I of 1870, which focused on quarantine measures at seaports, proved insufficient to contain the disease. Ships arriving from infected areas were subjected to quarantine, and the transportation of potentially contaminated goods was restricted under the Sea Customs Act of 1878. But such measures were primarily reactionary and piecemeal, unable to match the magnitude of the crisis.

The Bombay plague broke out internationally. European nations, fearing the spread of the disease, imposed stringent quarantine measures on ships arriving from India. Countries like France, Malta, and Egypt, following guidelines set at the Venice and Dresden Sanitary Conferences, tried to keep their ports from being poisoned. The upcoming Venice Sanitary Conference (1897) raised fears that the restrictions on Indian trade would only intensify. On top of widespread, domestic unrest, the British colonial government faced enormous pressure to show it could actually succeed in containing the epidemic. International quarantine restrictions and bans have further stunted India's trade, especially regarding the export of raw hides. The Secretary of State for India also expressed deep concern about the economic damage and called for firm action to restore confidence in Indian commerce. The plague transmission risk from Mecca pilgrims also complicated things. In 1897, Russia and Austria called on the British government to ban pilgrims from India. Reluctantly at first, the colonial authorities banned pilgrimages from Bombay, a measure that averted further restrictions on trade but also reflected the crisis' global dimensions. To tackle these problems, the British colonial government passed the EDA. This law established a common legal foundation for the control of infectious diseases.

The Epidemic Diseases Act, 1897: India's Response to a Public Health Crisis

Sir John Woodburn introduced the EDA on January 28, 1897, in the Council of the Governor General of India, to meet the pressing need for effective measures against the spread of dangerous epidemic diseases, especially the plague. In 1877 a Select Committee, comprised of notable men including Sir James Westland and MD Chalmers, reviewed the bill and forwarded it to the Council after incorporating suggestions from the Medical Boards of Calcutta and Bombay. Both pages of Woodburn's morning notes on public suggestions were blank, indicating that the press probably sided in favour of the measure. Council members, however, recognised that the bill had passed under great haste because of the exceptional conditions presented by the plague. However, some raised questions about public consultation, vagueness in some provisions and the powers extended to local governments to regulate public health. Passed in haste, the Act became law on February 4, 1897, and gave the government broad powers to impose regulations to stop epidemics. Among other things, it allowed for the inspection of vessels and the segregation of suspected individuals, revealing fears of an expanded outbreak of plague and the effects on commerce. Some vernacular newspapers criticised, more generally, scofflaw risk of abuse of power, and harsh enforcement measures such as forced segregation and property destruction. The print media criticised the style adopted by the authorities in the state of emergency, saying that the response to the health crisis had not been well planned. These aspects revealed layers of complexity that surrounded the EDA's adoption, driven by both the urgent need for public health tools and the nuanced interplay of governance amid crisis conditions.

Overview and Shortcomings of the Epidemic Diseases Act, 1897

The EDA is divided into four main elements that retaliate to measures which prevent the spread of infectious disease. It first empowers the government to take necessary actions to prevent the spread of the epidemic. Furthermore, it empowers the State Government to take special measures and to prescribe regulations, as to certain activities, when it is of the opinion that it is necessary for the purpose of checking the outbreak of the epidemic disease, or the threat of an outbreak of a dangerous epidemic disease. However, if the government considers that the suspected or confirmed outbreak is beyond containment by existing provisions of the law, it can, as a necessary public health measure, issue a public notice. Such measures can also entail inspections, quarantines and the separation of suspected infected persons by rail or otherwise. The State Government may also prescribe how to meet the costs, including compensation payable for action taken. Moreover, it also empowers the Central Government to take necessary measures when it is of the view that India, or any part of the country, is facing or is threatened by a dangerous epidemic. If existing laws are deemed insufficient to prevent or control the outbreak, the Central Government can prescribe regulations for inspecting and detaining any bus, train, ship, aircraft, or goods vehicle entering or leaving ports, land borders, or airports. Second, it ensures the protection of medical workers and facilities, allowing them to perform their duties without interference. It prohibits violence against healthcare personnel and damage to property during an epidemic. Third, the Act enforces penalties for disobeying government orders. It outlines penalties for disobeying regulations or orders under the Act. Violators are subject to punishment under Section 188 of the Indian Penal Code, 1860 (IPC). Acts of violence against healthcare personnel or damage to property carry a minimum imprisonment of three months, extendable up

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to five years, with fines ranging from ₹50,000 to ₹2 lakh. If grievous hurt is caused, imprisonment ranges from six months to seven years, with fines between ₹1 lakh and ₹5 lakh. It makes offences related to violence against healthcare personnel and property damage cognizable and non-bailable. Investigations must be conducted by an officer of at least Inspector rank and completed within 30 days. Trials should proceed swiftly, with a goal of concluding within one year. It allows certain offences to be settled with the court's permission and further creates presumptions of guilt and culpable mental state in such cases, unless proven otherwise. It mandates compensation for harm to healthcare workers or property, with unpaid amounts recoverable as land revenue. These provisions ensure quick legal action and accountability for epidemic-related offences. Fourth, it safeguards and protects officials from liability when acting to control or prevent the spread of an epidemic. It provides legal protection to individuals acting under the Act. It ensures that no legal proceedings can be initiated against any person for actions taken in good faith while implementing measures under the Act.

Since its enactment, there have been major advancements in scientific knowledge regarding the spread of diseases, and the structure of society has changed significantly, making the Act antiquated and unable to provide for the requirements in disease prevention and management of epidemics. Some of the key lacunae of the Act are as follows:

- **No compensation mechanism for frontline workers:** The Act fails to introduce a law-regulated compensation mechanism for those who attend during pandemics. Compensation was chaotic and messy, including to the families of the deceased.
- **No compensation to families of deceased breadwinners:** The Act additionally fails to mention compensation for those families who lost their sole breadwinner to the pandemic, resulting in the intervention of the Supreme Court to provide monetary relief.
- **Vaccination policy:** The Act does not have any provisions for vaccination, which is a fundamental element in the pandemic, as it plays a central role. It does not include any provisions under which the state can compensate for the side effects of the vaccine, penalise a person refusing to take the vaccine without a valid reason or have medical exemptions.
- **No guidelines to reserve hospital beds:** The Act fails to prescribe the process for reserving hospital beds during an epidemic, leading to different policies in different localities.
- **Outdated legal framework:** The Act was instituted in colonial days and does not cater to contemporary needs, particularly with regard to the arbitrary limitation of movement of people in public spaces, which impacted access to emergency medical care and essential services for vulnerable groups.
- **Insufficient to prevent illegal fundraising:** Although there are legal restrictions regarding illegal fundraising, the Act is devoid of mandatory provisions to avoid scams during pandemics.
- **Limited scope on transportation:** The Act is outdated in its focus on sea travel, neglecting air travel, which plays a significant role in the spread of diseases today.
- **Inability to address existing factors in the spread of disease:** The Act fails to take into account today's challenges, including increased international travel, urbanisation, migration, and other ecological changes that add to the spread of disease.
- **Outdated scientific and legal norms:** The Act is based on out-of-date scientific as well as legal paradigms, lacking up-to-date knowledge about epidemic control that is more coordinated and scientifically driven.
- **Coordination between centre and states:** The Act fails to keep up with the changing political and administrative dynamic between the Centre and the States, which has proven to be a major hindrance to coordinated responses to an epidemic.

Overview and Pitfalls of the Public Health (Prevention, Control and Management of Epidemics, Bio-Terrorism and Disasters) Bill, 2017

Aspiring to empower the state and local governments to effectively respond to public health emergencies such as epidemics and bioterrorism, the Ministry of Health and Family Welfare had put up a draft Bill for public comment in 2017. The Bill was drafted by the National Centre for Disease Control (NCDC) and the Directorate General of Health Services (DGHS) to allow authorities to take measures including quarantining people, decontaminating locations, isolating infective agents, and conducting surprise inspections in emergencies. The Bill was supposed to be a replacement for the antiquated EDA but was never tabled before Parliament, partially because of the apparent focus on bioterrorism that the government was not enthusiastic about.

The Public Health Bill, 2017 defined contemporary terms such as "Bio-terrorism", "Public Health Emergency", "Social Distancing" and "Quarantine", underlining the need for updated laws to tackle the challenge of contemporary times in public health issues. It also defined terms like 'epidemic', 'isolation', and other specific ones like public health emergency of international concern, 'ground crossing', 'disinfection', and 'decontamination', providing clarity on the powers and provisions of public health emergencies. The Bill's definition of the term "clinical establishment" was very broad, as it included all medical

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facilities, from standalone clinics to research laboratories, with the only exception of facilities run by the armed forces. This broad definition is useful for the purposes of using these provisions during health emergencies such as those set out in Section 3 of the Bill.

The authority given to state governments, union territories and local administrations under Section 3 allows them to take measures to enforce health on individuals or groups or under quarantine or isolation or under social distancing. These authorities also allow them to prohibit behaviour, regulate drugs and hazardous substances, carry out medical testing and enact different forms of decontamination. They may also issue directions to all clinical establishments. These powers can be used when authorities anticipate an existing or potential public health emergency, allowing rapid response to control the spread.

The Bill would grant the powers set out in Section 3 to the Central government if it considers it necessary or expedient to do so in the interest of the general public, thereby overruling India's federal structure in a health emergency. Under Section 13 the Centre has the power to frame the first rules for carrying out the provisions of the Bill which the State Governments must follow. While states are allowed to amend some of these rules so that they can be implemented more effectively at the local level, they can only change three kinds of rules which implies limited administrative discretion. Dr Ambedkar's opinion that the federal character is subject to transformation implies that, if a federal structure has to be changed due to circumstances, it must be justified and hence the provision laid down in Section 4 of the Bill that the federal system can be temporarily suspended since national pandemics are in question (of course, only for the limited period of time) with the condition that it should not adversely affect the socio-legal framework of the states.

The Bill designates anyone authorised under the Act as a public servant, as per Section 21 of the IPC. This would have acted as a deterrent against violent acts toward healthcare workers by invoking Sections 185, 186, and 187 of the IPC. Unlike the rushed ordinances that impose stricter punishments after incidents occur, the Bill's provisions would have provided a proactive legal framework to handle such misconduct. The Bill also proposes penalties for various infractions, with fines up to ₹10,000 for first-time violations and ₹25,000 for repeated negligent actions. Wilful violations can lead to fines of up to ₹1 lakh and imprisonment for up to two years. These penalties are both economically relevant and sufficiently punitive.

Additionally, since all persons authorised to carry out provisions under the Act are considered public servants, obstructing their work would be punishable under Section 188 of the IPC, which would have provided the additional legal basis to enforce lockdowns and health protocols. Violations, under the current EDA, are only punishable with a month's imprisonment or fine of ₹200, extending to six months and ₹1,000 if the offence is harmful to public health or safety. But under the recent Epidemic Diseases (Amendment) Act, 2020 a violation is punishable by three months to five years of imprisonment along with a fine between ₹50,000 to ₹2 lakhs. It further states that the victim may compound this offence with the Court's permission. In case of grievous harm to healthcare personnel, it is punishable by six months to seven years along with a fine between ₹1 lakh to ₹5 lakhs. These offences are also deemed cognizable and non-bailable. A notable difference between the Public Health Bill and EDA is that it does not require offenders to be aware that rules are being violated unlike Section 188 of IPC, If knowledge was mandated this substantial would reduce more efficiently lockdowns and health enforcement directives.

There are two schedules to adduce Section 14 of the bill. Diseases that are subject to epidemic outbreaks are listed in the first schedule, including SARS, which is also related to the novel Coronavirus (SARS-COV-2). Schedule II contains potential bio-terrorism agents.

The draft Bill creates a four-tier health administration in the country. The state, district and local public health authority will have specifically and separately defined powers and responsibilities for managing public health emergencies. The Union Health Ministry will lead the national authority. The health ministers of respective states will also oversee health authorities at the state level. District Collectors will lead the districts and local health units will be run by Block Medical Officers or Medical Superintendents. These authorities would have the responsibility of preventing new, infectious diseases as well as non-communicable diseases.

There have also been concerns over the wide-reaching powers granted to state, district and local authorities under the Bill. Although it mentions that state governments and union territories will be able to conduct medical examinations and laboratory tests and administer vaccines or treatments to anyone they want, it is silent on the question of the need to obtain consent from people, giving rise to ethical dilemmas. Moreover, while the Bill lists the powers of the union and state governments, it does not explicitly state what their responsibilities are when it comes to preventing and controlling epidemics or what rights citizens have in these situations. Such a law should be clear about the basis on which citizens' rights can be limited and should make government action predictable and transparent.

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Singapore's Legal Framework for Infectious Disease Control: The Infectious Diseases Act, 1976

The compelling stringent legal framework under the Infectious Diseases Act, 1976 during the COVID-19 pandemic has been largely attributed to Singapore's success in infectious disease control. This legislation establishes strong and sustainable policy, infrastructure, and funding mechanisms for preventing, detecting, and responding to infectious disease outbreaks in order to protect public health and safety. The Act enhances the ability of authorities to respond swiftly and decisively, stressing the importance of early detection, containment, and transparency with the public. Its provisions range from individual accountability to systemic safeguards, creating a model for efficacious public health infrastructure.

Mandatory reporting of infectious diseases by medical practitioners, laboratories and other persons prescribed by regulations is a cornerstone feature of the Act. This provision allows for the reported location of suspected or confirmed cases of infectious diseases to be conducted directly to the Director of Medical Services for action. Through public health surveillance programmes and epidemiological investigations, public health authorities can better track disease prevalence and assess potential risks, thus supporting early detection. Through these efforts, people could be asked to give information, samples or medical tests to be conducted so that data will be available to inform public health responses.

It covers medical examinations and treatment of suspected cases and of individuals who have been in contact with cases or are carriers of infectious diseases. This applies to minors as well, for whom their parents or guardians must ensure compliance. These measures help to ensure that people who may be spreading disease are identified and treated, thereby decreasing the risk of further transmission. The Act allows for examinations after death if a person dies and is suspected to have had an infectious disease, so the cause of death and/ or the spread of the disease can be determined. Such efforts are critical to both understanding the disease and preventing future outbreaks.

The Act breaks normal confidentiality by requiring healthcare providers to get and provide patient information where it will provide effective disease control. Patients have to share this information, and healthcare providers are required to do so, even when doing so clashes with standard confidentiality procedures. By this provision, authorities will know what they are dealing with and how to appropriately put public health systems in place. It also establishes severe consequences for those who provide false or misleading information, which is especially relevant in circumstances such as blood donation, as misinformation could result in infectious diseases passing onto others. The situation illustrates the need for transparency and accountability, especially in a public health context.

Environmental provisions are also critical to the Act. It gives authorities the power to order the cleansing and disinfection of premises or vessels suspected to be harbouring infectious agents. The breach of such orders would lead the authorities to take such actions as they deem necessary, and the costs thereof are recoverable from the defaulter. Likewise, the Act makes provisions for killing infected animals or destroying infected food and water, eradicating potential avenues of spread. The disposal of bodies of individuals who died from infectious diseases further prevents the spread of disease through improper handling of infected corpses.

The Act also allows for people suspected of having infectious diseases to be isolated, either at hospitals or at their homes. Parents or guardians must ensure minors obey isolation orders, and noncompliance is deemed an offence. In a worse case, the Minister can also impose isolation or create restricted areas of an outbreak, imposing restrictions on access and a ban on gatherings. This is crucial to keeping outbreaks of disease up and preventing them from reaching outside the area.

The Act makes provision for imposing penalties for not complying with social distancing, allowing courts to close or disinfect crowded premises, and imposing restrictions on releasing identities to aid in contact tracing. Meetings and public entertainment may be banned or limited and certain occupations and trades may be ordered to implement preventive measures. The Act imposes individual responsibility on everyone and caregivers to not put others at risk of infection, specifically that an individual must act in a manner to not expose others to an infection, a concept that makes this Act relevant in the public health realm where the burden of responsibility is both personal and existent. The Government is also enabled to disseminate health advisories to all operators.

The Act sets forth a systematic and reliable framework to tackle the spread of international disease for responding to public health threats. The Act positively contains provision for the authorities to declare an area as an "infected zone" and prohibits the entry of a person or group of persons from such area to the country in order to stop the introduction of lethal infectious diseases to the country. Except as otherwise declared, vessels, persons, and articles arriving from infected places are infected; and such measures are taken under the Act which relate to the inspection, disinfection, and treatment of vessels, persons, and articles. Vessel operators are required by the Act to furnish correct health-related information and face substantial penalties for refusal or incorrect disclosures. This includes, for example, an authority to perform medical examinations, isolate or quarantine individuals, and mandate vaccination or prophylaxis for travellers arriving

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from international locations to minimise the potential for public health threats. It also covers the sanitation of vessels, food, and water supplies, and prohibits the importation of disease vectors without prior approval. The framework, however, goes beyond the prevention of human exposure and discusses the management of human remains and any contaminated products to prevent the spread of infection. There is a large burden, under the Act, on the owners, masters, and agents of vessels to comply with any health directives and significant financial and legal liability for failure to comply. In public health emergencies, the government can even require medical examinations for people entering or leaving Singapore, enhancing its capacity to contain an outbreak.

The Act requires that all international travellers be vaccinated or undergo preventive treatments and that the onus lies on transport operators to ensure that they do. In the face of an outbreak, authorities can issue vaccination or prophylaxis orders, together with fines to save lives. Disseminating such directives transparently guarantees public information and compliance, which are essential in sensitive situations.

The Act further emphasises national public health research by providing the Director of Medical Services with the ability to conduct or assist in research to increase knowledge or identify new or improved materials, devices, processes or products for the detection, prevention or treatment of infectious diseases with a possibility for extension to other suspected infectious diseases as determined or notified by the appropriate Minister. The Director should consider the likelihood of an outbreak occurring, the number of lives lost or disabled and the total public health benefits among other factors before pursuing research of this type. The Director may compel persons or health professionals to furnish anonymised information or samples, including human samples, within reasonable time limits. Identifying information may be authorised as well as necessary. Penalties are harsh for not complying including declining to provide information, to de-anonymise data, or to violate conditions, while privacy is protected, the research is carried on honestly and responsibly.

Data and Methodology

Data for India and Singapore

India dataset is from February 2, 2020 to August 4, 2024. Singapore dataset has been used for the period of January 26, 2020 to March 3, 2024. Furthermore, Interrupted Time Series (ITS) analysis has been applied to examine the effect of an intervention (lockdown) by studying changes in level and trend before and after the intervention. Compares patterns in COVID-19 cases before and after the lockdown. Where, it compensates for changes in levels and slopes of the outcome variable (new cases). ITS can be calculated using regression using time, treatment, and interaction factors.

In the study, the ITS model used to examine the influence of lockdown on new COVID-19 case growth rate may be expressed by the following equation:

$$Y_t = \beta 0 + \beta 1\ Time_t + \beta 2\ Treatment_t + \epsilon_t$$

where:

Y_t = Growth rate of new COVID-19 cases at time *t* t (dependent variable)

$Time_t$ = Time trend, capturing the natural progression of cases over time

$Treatment_t$ = Lockdown intervention dummy (0 for pre-lockdown period, 1 for lockdown period)

ϵ_t = Error term

Ethical Clearance

IEC approval is taken from the Institutional Ethical Committee.

Results & Discussion

Figures 1 and 2 illustrate the total COVID-19 cases, new cases, and growth rate in India and Singapore. Initially, the rate of total COVID-19 cases was significant, but thereafter, the speed of new cases steadily decreased, likely owing to measures implemented by the governments of India and Singapore. The Indian Prime Minister prolonged the lockdown period from March 25 to April 14, 2020, and then extended it to May 31. On May 30th, limitations were removed, marking the commencement of the Unlock "1.0" phase. However, the lockdown duration was extended to June 30th for confinement zones. Prior to the enforcement of the lockdown, the growth rate of new cases was around 205%, which decreased to 188% the day after the lockdown in India. This has further decreased to 50% during five weeks of lockdown. In the seventh week, a negative rate of new cases has been recorded. This implies that the lockdown significantly helped to reduce the rate of new cases of COVID-19 in India, whereas, Singapore uses a DORSCON structure to monitor public health, with a risk assessment elevated to Orange from February 7 to 25, 2020. Furthermore, a Circuit Breaker lockout was imposed on 7th April to reduce transmission, ending on June 1, 2020. It has been noticed that before the implementation of the lockdown, the new case rate was approximately 197–250%. It has been revealed that following the implementation of the lockdown, the new case rate has been drastically reduced to 81% merely after three weeks. A new case rate of negative 27% has been detected in the fourth week of lockdown. In conclusion, the implementation of lockdown measures in both India and Singapore played a crucial role in curbing the spread of COVID-19.

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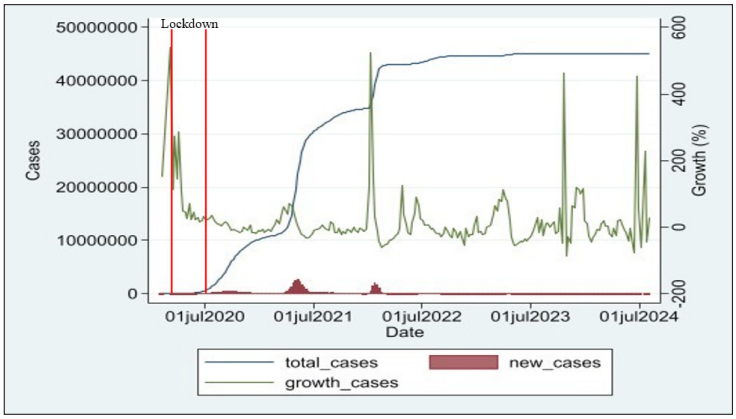

Figure 1.Trend of Total COVID-19 Cases, New Cases, and Growth Rate in India

The blue line represents the cumulative number of COVID-19 cases over time. The red bars indicate the number of new COVID-19 cases reported per time period. The green line represents the percentage change in cases over time. The vertical red line represents the lockdown period. Authors calculated using data from Our World in Data.

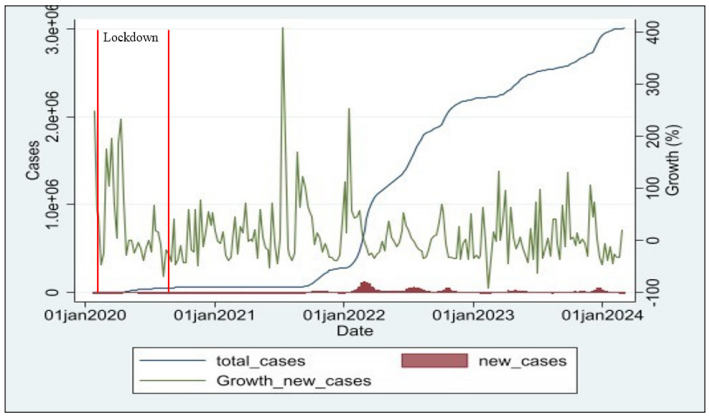

Figure 2.Trend of Total COVID-19 Cases, New Cases, and Growth Rate in Singapore

The blue line represents the cumulative number of COVID-19 cases over time. The red bars indicate the number of new COVID-19 cases reported per time period. The green line represents the percentage change in cases over time. The vertical red line represents the lockdown period. Authors calculated using data from Our World in Data.

Empirical Result

It has been observed from Table 1 that the coefficient for treatment in the case of India (-1.48, *P* = 0.04, p = 0.04) is negative and statistically significant at the 5% level, demonstrating that the installation of lockdown resulted in a decrease of 1.48 percentage points in the new case growth rate. In the case of Singapore, the coefficient for treatment (-20.7, *p* = 0.01, p = 0.01) is negative and statistically significant at the 1% level, showing that the implementation of lockdown resulted in a 20.7% point drop in the new case growth rate. The decline in case growth due to the lockdown was significantly more dramatic in Singapore (-20.7%) compared to India (-1.48%). This shows that the lockdown in Singapore had a more considerable and immediate effect on stopping the spread of COVID-19.

Table 1.Impact of Lockdown on New COVID-19 Case Growth Rate in India and Singapore

India			
Variable	Coefficient	p > |t|	[95% conf. interval]
Time	87.09	0.006	25.226 to 148.966
Treatment	-1.48	0.04**	-2.933 to -0.0276
Singapore			
Time	343.59	0.041	14.251 to 672.943
Treatment	-20.7	0.01*	-36.409 to -5.001

* and ** denotes a significant level at 1% and 5%, respectively

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Recommendations to Strengthen India's Public Health System

- **Modernising the Legal Framework:** Enact a new public health law or amend the EDA to include provisions for mandatory reporting, early detection, enforceable quarantine measures, and vaccination mandates. Ensure penalties for non-compliance are stringent yet fair.
- **Strengthen Healthcare Infrastructure:** Develop healthcare infrastructure including facilities for the treatment of patients, laboratories, and health surveillance systems to enable early detection and response.
- **Promote Public Awareness:** Develop clear communication strategies to disseminate health advisories and ensure public cooperation during health crises.
- **Enhancing Environmental Control:** Implement measures for disinfection of premises, safe disposal of contaminated materials, and regulation of food and water safety to minimise disease spread.
- **Encourage Innovative Public Health Research:** Develop a more structured public health research for aspiring innovators to come up with a localised solution for the prevention and treatment of diseases.
- **Strengthen Centre-State Coordination:** Ensure better facilitation of synergy of efforts between centre and states ensuring a cohesive response to public health crises.
- **Contextualise Global Best Practices:** Adapt global best practices, such as Singapore's model, to India's unique socio-economic and cultural context for effective implementation.
- **Build Capacity and Training:** Train healthcare providers and establish a better infrastructure to prepare the public health system.

If India can follow these measures then it can make a strong public health system, where it can be able to face such epidemics and protect its population from such threats at the global level.

Conclusion

This comparative study demonstrates how law, governance, and public accountability can be leveraged in dealing with public health crises. Although the lockdown in both countries decreased the growth rate of new cases substantially, it was the legal measures (e.g. detention if unwarranted assembly is detected) from the Infectious Diseases Act, 1976, in Singapore that were much more stringent than in India, which was a major reason behind the sharper decline in Singapore (-20.7%) than in India (-1.48%). The success story of Singapore is related to the fact that it adopts a multifactorial approach by mandating reporting, early detection, enforceable quarantine, compulsory vaccination, and rigid adjectives for not following the guidelines. Moreover, the prioritisation of environmental controls, public health research as well as simple messaging ensured a unified and effective response.

In contrast, India's EDA, though a landmark in its time, proved inadequate for modern challenges. The provisions in this colonial-era law have not been adequately broad and flexible enough to respond to modern public health concerns (including the rapid spread of COVID-19). The problem was compounded by deep-rooted issues of population density, inadequate health infrastructure, and the impracticality of policing a lockdown. However, the pandemic equally highlighted the necessity for India to evolve its public health laws and learn a leaf from global best practices, such as the Singapore model.

India needs a multi-pronged approach to creating a resilient and responsive public health system. Such measures would involve consolidating legal frameworks to include mandatory reporting, isolation and penalties for failure to comply; increasing healthcare infrastructure and surveillance capacity; and offering public education to secure compliance with health emergencies. However, these measures must be tailored to the unique socio-economic and cultural context of India. Finally, to be better prepared for future epidemics, India must focus on building capacity, forming collaborations with stakeholders, and maintaining the flow of investment in healthcare.

Singapore's experience with its Infectious Diseases Act, 1976, can give an invaluable roadmap, which emphasises the need for early intervention, systemic accountability, and scientific innovation, in the eventual control of an infectious disease. Incorporating these principles into its public health governance can help India lay a stronger foundation for protecting its people and preparing for pandemics. The lessons from Singapore's success, combined with India's adaptability and scale, can pave the way for a stronger, more proactive public health system capable of addressing future health challenges.

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