

# Role of vaccine science diplomacy in low-middle-income countries for eradicating the vaccine-preventable diseases: Targeting the “LAST MILE”

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## ABSTRACT

The meaning of “vaccine diplomacy (VD)” is defined as “the use of vaccines to increase a country’s diplomatic relations and influence over other nations.” The golden era of vaccine science diplomacy started during the time of Cold War between the United States (US) and the Union of Soviet Socialist Republics (USSR) with the development of a prototype of oral polio vaccine by the US Scientist Dr Albert Sabin working along with his Soviet counterparts. The foundation stone was already laid down by Edward Jenner when he shared his technique of the smallpox vaccine with other major countries to curb the spread of smallpox. Eventually, such a step led to the eradication of such a deadly disease. Only time has changed, not the tide. Even today, vaccines continue to remain as one of the important tools for achieving Millennium Developmental Goals (MDGs) and other targets in developing countries like India. During the wake of the Corona Virus Diseases-19 (COVID-19) pandemic, India’s role in developing its vaccine science diplomacy has been a point of attraction. The phase-3 trial of Covaxin being developed by Bharat Biotech started in Lucknow and Gorakhpur in October 2020, and it is widely considered as the forerunner for the Indian vaccine market. As per the Union Health Ministry of India- “The Union Government is working on at least five distinct ways, ranging from free vaccines to guaranteed supply, in which it can help its immediate neighbours and countries in West Asia, Africa and even Latin America—officials familiar with the plan said on conditions of anonymity. The idea is to leverage the country’s standing as the world’s vaccine factory to merge diplomatic ties. Historically, it is observed that by the development and introduction of newer vaccines from time to time, many dismaying hurdles to vaccine science diplomacy (VSD) arise from ongoing wars and political instability. The current scenario is that both VSD and VD are at crossroads, and there is a possibility of getting a good direction if we make a piggyback policy approach of vaccine diplomacy along with the foreign policy. The lessons learned from the past must be followed now and, in the future, to make a better world for all. We acknowledge that the COVID-19 episode has again highlighted the dire need for VSD, and we assume that not only COVID-19 but in future, emerging and re-emerging diseases will occur so we have to prepare ourselves for combatting those future emerging and re-emerging diseases.

**Keywords:** India, Ministry of Health, vaccine diplomacy, vaccine science diplomacy

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*“War means an enemy to the enemy game, war means your negligence towards me.”- Nirmalendu Guna*

## Vaccine Diplomacy and Vaccine Science Diplomacy

Vaccine diplomacy (VD) refers to “almost any aspect of global health diplomacy that relies on the use or delivery of vaccines and encompasses the important work of the GAVI Alliance, and elements of the WHO, the Gates Foundation, and other important international organizations”.<sup>[1]</sup> It is quite interesting to learn that during the Cold War between the two supreme nations of the world, the United States (US) and the Union of Soviet Socialist Republics (USSR), vaccine science diplomacy (VSD) entered its golden age. From the US, Dr Albert Sabin had improved the “live” oral polio vaccine (OPV), and to promote VSD, Dr Sabin travelled from the US to the USSR for collaborating on a project to develop a prototype of OPV with the Soviet counterparts.

Although this was the time of the “Cold War”, scientists from the US and the USSR worked together according to medical historian Saul Benison.<sup>[1]</sup>

VSD is a hybrid concept, having both components—“global health diplomacy and science diplomacy”.<sup>[1]</sup> In this scenario, there is a joint effort from scientists from two or more nations for the discoveries of life-saving vaccines or concerned technologies. It is the influence of VSD which can bring about nations engaged in conflict with each other or in wars or those nations who often have different ideologies to engage on a project or a technology for the development of a life-saving vaccine, and so on. When we talk about vaccines, we know that vaccines are unique when we compare them with other health-related technologies or inventions. Vaccines have been able to save more lives than any other invention made by scientists. That is why the world will always be around VD and VSD.

Taking an example of contagion diseases, it is not just COVID-19; we are struggling in the form of social distancing, quarantine, isolation, and lockdowns. Looking back in history, the first-ever documented quarantine was done to prevent the public from tropical infectious diseases in Dubrovnik in the fourteenth century and cholera in 1851.<sup>[1]</sup>

From those times to now, quarantines and/or lockdowns could not last too long, and eventually, the solution seems to be in the “vaccines”. For Instance, Turkey made a detailed assessment based on the documented cholera cases to structure the road map to survive from such epidemics/pandemics. WHO suggested, “WASH strategies” including improvement in safe water and food sanitation in the form of refuse disposal, and hygiene practices like washing hands with soap and water. Similarly to what we are currently practising for COVID-19. When the cholera vaccine was produced in the laboratories of Refik Saydam Institute of Hygiene, it was distributed to the affected areas

and to the other countries to control the growing epidemic of cholera. This was one of the good examples to fight against a disease or a growing epidemic/pandemic using the vaccine.<sup>[2]</sup> Similarly, the role of Refik Saydam Institute of Hygiene, Turkey has a significant role in the eradication of smallpox and needs a mention. The efforts by the Institute in reporting the smallpox cases, planning and organisation of vaccination programmes for the smallpox vaccination campaigns are worth mentioning. The health care personnel were divided into teams and were trained at the Institute. Some team members used to perform vaccination at fixed vaccination sites while some were formed into mobile teams to have a maximum reach. The case fatality ratio of smallpox was 32.9% in 1938 and dropped to 11.6% in the preceding years, 1938–1957, following the strategies of vaccination against smallpox. Because of the compulsory vaccination policy, smallpox did not remain an endemic disease in Turkey. The rule of the land was that a vaccination certificate against smallpox was essential to apply for schools’ admissions, military duties, to start a business or to travel.<sup>[3]</sup>

Another such example is hepatitis, a disease with a high mortality rate all over the world. Vaccination against this disease has been found quite successful in many countries. In the future, if we combine the vaccination protocols such as hepatitis A and hepatitis-B in campaigns for vulnerable communities, it could be an option to be more effective in reducing mortality and incidence of hepatitis cases.<sup>[4,5]</sup>

We can say that vaccines have the answers to many of the current problems humans are facing in recent times, may it be infectious diseases or COVID-19. The agony is that there still are people who are against the “vaccination” and reject them together. They are called anti-vaxxers. They have existed since the beginning of vaccination. The first known anti-vaxxers were from England in the late 1700s, when they started opposing the smallpox vaccine.<sup>[6]</sup> In response to that, the Vaccination Act of 1853 and 1867 was brought into force, which ordered mandatory vaccination for infants up to 3 months old to 14 years. Because of this act, the league against vaccination sprang up.<sup>[6]</sup> Later in the US, such anti-vaccination campaigns were also run against the vaccines. More recently, controversies surround questioning the safety and efficacy of diphtheria, tetanus, and pertussis (DTP) immunisation and COVID-19 vaccine too. The primary responsibility lies with the mass media to reach the public with reliable information for the sustainability of vaccination campaigns to carry out such preventive programmes.<sup>[7]</sup> To get vaccinated or not to get vaccinated is a decision which lies in our own hands. Those who have the vaccine are against the delivery of vaccines, and those who require the vaccine cannot afford the vaccine. These are some questions, which a society needs to answer. The vaccines may reach a particular group within no time as transportation is quick and easy but considering the spread of the disease, it seems much faster than expected. We must not stigmatise groups like refugees, migrants and those who are vulnerable to diseases. They should be professionally managed as they are the first step in shaping and developing public health foundation.<sup>[8]</sup> However,

vaccines have also been the cornerstone for the selective primary care approach promoted in developing countries such as India. Extreme focus on vaccine-based public health programmes weaken the general health system of countries as vaccine-based programmes consume a significant budget, human resources and political will.

## The Historical Aspects

To understand VD, we need to look at some important historical milestones achieved so far as narrated in Table 1. If we look from the historical viewpoint, diplomacy is associated with the development and distribution of many vaccines. Edward Jenner from Britain developed the smallpox vaccine in 1798, which was the first milestone that led to the coining of the term ‘vaccine’.<sup>[1]</sup> During the eighteenth century, Edward Jenner shared the method of preparation and administration of the smallpox vaccine with many countries like Russia, Spain, Turkey, some American tribes, Canada and Mexico.<sup>[1]</sup> During the wars between France and England, he played a diplomatic role by releasing prisoners for vaccine administration.<sup>[1]</sup> After almost a century of smallpox vaccine discovery, Louis Pasteur developed a new rabies vaccine.

**Table 1: Important historical milestones in vaccine diplomacy**

Timeline	Important events
1798	Smallpox vaccine discovery by Edward Jenner
During the eighteenth century	Sharing the method of preparation and administration of smallpox vaccine with many countries like Russia, Spain, Turkey, some American tribes, Canada, Mexico
1890s in nineteenth century	<ul style="list-style-type: none"> <li>· Louis Pasteur developed a new rabies vaccine</li> <li>· Dr Haffkine’s visit to India for cholera and plague vaccine trials</li> </ul>
Early twentieth century	<ul style="list-style-type: none"> <li>· Dr Sabin visited the USSR for collaboration to develop the oral polio vaccine</li> <li>· Development of the first draft of foreign vaccine policy</li> </ul>
Middle twentieth century	<ul style="list-style-type: none"> <li>· USSR proposed a new freeze-drying method for smallpox vaccine for global vaccination campaigns</li> <li>· Eradication of smallpox by 1970</li> </ul>
1980s	Launch of the Indo-US Vaccine action programme to strengthen collaboration in the fields of vaccine trials, epidemiology, laboratory set up and vaccine delivery
1990s	Children’s Vaccine initiative was launched for paediatric vaccines at a global level for the benefit of children in the developing countries
Early 2000s	<ul style="list-style-type: none"> <li>· Launch of GAVI alliance</li> <li>· Vaccines like rotavirus, haemophilus influenza Type B (Hib), pneumococcal vaccines were accessible to developing countries</li> </ul>
2009	Release of international framework sharing novel H1N1 influenza vaccines and other vaccines with developing countries (pandemic preparedness)
2012	Launch of Global Vaccine Action Plan and “a framework to prevent millions of deaths by 2020 through more equitable access to existing vaccines for people in all communities”
2014	World health resolution passed—“vaccines as a fundamental right to human health”

He mentioned the importance of a vaccine and mentioned that its usefulness to humanity should not be restricted to a single country.<sup>[1]</sup> So, scientists from his institute created many laboratories across different countries including France, India, China and North Africa for the preparation of the rabies vaccine. During the same duration in the 1890s, Dr Haffkine visited India for cholera and plague vaccine trials on human beings after testing vaccines on himself first.<sup>[1]</sup>

In the twentieth century, during the Cold War between the US and USSR, Dr Sabin visited USSR for collaboration to develop an OPV for testing in millions of children in the Soviet.<sup>[1]</sup> Thereafter, many international collaborations were made and a foreign policy was drafted for VD, putting aside all diplomatic strategies for the betterment of peoples’ health.<sup>[1]</sup> In the middle of the twentieth century during 1962–1966, USSR proposed a new freeze-drying method for the smallpox vaccine which was funded by the US for global smallpox eradication campaigns, especially for developing countries.<sup>[1]</sup> This resulted in the eradication of smallpox from the world by late 1970 by such collaborative efforts under the leadership of Dr Henderson.<sup>[1]</sup> Thereafter, during 1980, the Indo-US Vaccine action programme was launched to strengthen collaboration in the fields of vaccine trials, epidemiology, laboratory set up and vaccine delivery, which is continued to date with the support of US-NIH.<sup>[1]</sup> In the early 2000s, vaccines continued to remain as one of the important tools for achieving Millennium Developmental Goals and other targets in developing countries like India. After the launch of the GAVI alliance, many vaccines like rotavirus, haemophilus influenza Type B (Hib) and pneumococcal vaccines were accessible to the developing countries and some fragile states including North Korea.<sup>[1]</sup>

Many efforts were undertaken at the global level to ensure equitable access to vaccines for all developing countries, even in the twenty-first century. One such instance was observed during the 2009 pandemic—accessibility to the vaccine for novel H1N1 influenza. Since there was no clear-cut mention about equitable access for vaccines in the International Health Regulation 2005, a global level meeting was held in 2009 for pandemic influenza preparedness and a framework was released for sharing the H1N1 influenza vaccines and other vaccines with developing countries.<sup>[1]</sup> Finally, in the year 2012, under the aegis of the WHO, the Global Vaccine Action Plan was launched with a mention about “a framework to prevent millions of deaths by 2020 through more equitable access to existing vaccines for people in all communities”.<sup>[1]</sup> Finally, this resolution was passed in the World Health Assembly considering “vaccines as a fundamental right to human health”.<sup>[1]</sup>

## Present Status/Scenario of Vaccine Science Diplomacy

During the last few decades, the leading supreme nations of the world have managed a nexus on foreign policy relationships. This foreign policy has envisaged collaborations from fields like art, literature, culture, sports and other humanitarian ventures. The most sorted out productive endeavour among the nations has

mostly been manufacturing and testing of life-saving vaccines carried out in a joint surreptitious initiative to target the inflicted humankind, survivors and those who have faced bane.<sup>[9]</sup>

The legacy of VD, which started in the early twentieth century between the US and USSR for smallpox vaccine and polio vaccine, is still continuing.<sup>[10]</sup> Their aim to collaborate was to eradicate diseases like smallpox and polio, which they successfully did. Now, the focus has been shifted to diseases like sexually transmitted diseases, especially HIV/AIDS prevention along with tuberculosis coinfection.<sup>[11]</sup> Recently, with the formation of the Bilateral Presidential Commission (BPC) in 2009 and subsequent strengthening through the “Carnegie Endowment for International Peace public-private task force 2011”, the two nations (US and USSR) have decided on an alliance in areas of vector-borne diseases, non-communicable diseases arising because of alcohol consumption and smoking and the use of e-health in maternal and neonatal health care.<sup>[12]</sup>

The last decade has been a decade of progress for The Global Alliance for Vaccines and Immunizations (GAVI), the vaccine alliance, and their partners (UNICEF and WHO). The world has seen full benefits and public health impact with millions of children being immunised and many future deaths averted.<sup>[13]</sup> Two new vaccines for pneumococcal disease and rotavirus infection were introduced. The vaccine for human papillomavirus (HPV) has been there for some time, but what we expect in the years to come to include vaccines for two major baleful respiratory infections: respiratory syncytial virus (RSV) and a universal influenza vaccine. Vaccines under development for tuberculosis, malaria and Human Immunodeficiency Virus infection/ Acquired Immune Deficiency Syndrome (HIV/AIDS) are also exciting new prototypes to look for in the future.<sup>[14]</sup> The future has a surprise for VSD because of the ongoing coronavirus pandemic. The world is looking for vaccinations against Severe Acute Respiratory Syndrome Corona virus 2 (SARS-CoV-2), and efforts are underway all over the globe in different phases. Everyone is in a race to cover the “Last Mile”. What we believe is that VSD can play an important role in the current scenario where two nations with different political ideologies can produce breakthroughs; if they jointly partner to produce, test and deliver vaccines similarly, the way the US and USSR collaborated for the polio vaccine in the 1950s at the peak of the Cold War. Such collaborations will be integral in expanding VD and VSD. At present, scientists from different countries are publishing research data before they are peer-reviewed to present real-time data to the world without delay.

However, such efforts still fall short of the past interesting stories between the US and USSR that led to the development of OPV. Could lessons learnt from the Cold War ease the escalating tensions between countries like the US, China, Russia, Middle East countries, India and Pakistan? Confronting hostilities between these nations may be nowhere near us, but astounding occasions remain to blend activities related to science and development to eliminate the world’s major menacing diseases.<sup>[1]</sup>

India’s role in developing its VSD especially during the wake of the COVID-19 pandemic has been a point of attraction for the rest of the world. The Prime Minister of India, Honourable Narendra Modi Ji, during his speech at the United Nations General Assembly was loud and clear that India will keep helping all humanity. India’s COVID-19 vaccine production, capacity of vaccine delivery, cold chain and storage capacities for the COVID-19 vaccine will be used in fighting the pandemic. Recently, India has joined hands with neighbouring countries like Bangladesh and Myanmar on a collaborating project of vaccine development for COVID-19. India is on a path to discover five effective ways for VSD, ranging from supply of free vaccines to the low-income countries, delivering subsidised vaccines as part of India’s equitable distribution commitment, approaching countries for vaccine trails, the striking market price for the vaccine, guaranteed supply of COVID-19 vaccines. By such efforts, India will stand out as the vaccine factory for the world and this will help to merge diplomatic ties with other nations. Such ties will boost India’s “Neighbourhood First” and “Act East Policy”.<sup>[15]</sup>

Currently, Indian companies are running clinical trials for two vaccines from Zydus-Cadila and Bharat Biotech. Reports suggest that these vaccines have entered the phase III clinical trials in October 2020. Besides these two, the focus is on the vaccine manufactured by the world’s largest vaccine industry, the Serum Institute of India, in collaboration with other companies like AstraZeneca. The vaccine is currently in the third or final phase of its trial and is widely considered the forerunner for the global vaccine market.<sup>[15]</sup>

## Setbacks to Vaccine Science Diplomacy

Even with the large public health benefits by GAVI and its alliances by the development and introduction of newer vaccines from time to time all over the world, there are many daunting hurdles to the fore for warranting advancement and success towards the elimination of vaccine-preventable diseases (VPD). The major threat to VSD arises from ongoing wars and political instability. Measles re-emergence and an outbreak of VPD in the parts of the Middle East and Central Asian region were attributed to ongoing armed conflict. Similarly, ongoing conflict is a huge barrier for Ebola vaccination efforts in the Democratic Republic of Congo. Political instability and change of ruling party have been the reasons for interspersing ongoing vaccination programmes resulting in measles re-emergence,<sup>[15]</sup> while vector-borne diseases and neglected tropical diseases are also on a rise.<sup>[16]</sup>

History stands witness when the foundation stone for primary health care was laid down by the Alma-Ata Declaration. It was dismantled brick by brick by the International Development Partners of Developing countries. As the latter argued that the concept of primary health care is too expensive and unrealistic. The key aspects of the declaration like social and economic developments were openly challenged while the main yardstick,



i.e. the community participation was smashed down. The International Development Partners supported the idea of a selective, politically motivated and high technology prioritised primary health care, which was related not to the communities but directly to the International Health experts and named it as Selective Primary Health Care.

To understand the dynamics, we need to recall the health system of many low-income countries which emerged from colonial rule. Those were based on the past colonial health care services, which were costly and mostly based on urban settings. Later, such countries inherited the health system models from industrialised nations. Under such health models, the focus was mainly kept on the eradication and elimination of specific infectious diseases with some success stories ranging from the eradication of smallpox to the reduction in tuberculosis. These models were focusing on a single or a few diseases but ignoring others and such health models lacked interventions for the poor, thus, increasing poor health outcomes and out-of-pocket expenses. Experts argued that these narrow approach health models are not the best options but should be supplemented with a comprehensive approach to enhance the basic health care provisions.<sup>[17]</sup>

A path-breaking child survival revolution by the UNICEF helped in distinguishing selective primary health care (SPHC) from comprehensive primary health care (PHC). The GOBI (Growth monitoring, ORS therapy, breastfeeding and Immunisation) strategy adopted by the UNICEF was seen as a critical step to strengthen the processes involving local needs, sharing of knowledge from local organisations and overall scuffle for child health rights. The arguments favoured SPHC as the resources (financial or human) for PHC are usually scarce in low-income settings. Its simplicity, cost-effectiveness and acceptable technology to save children's lives were appreciating and result oriented. From the above example, it was quite clear that such a strategy even being successful needs to be integrated into the comprehensive PHC programmes.<sup>[18]</sup>

Introspecting an example, the Middle East and Central Asian regions which were free from neglected tropical diseases, contracted leishmaniasis from Syria, while the “breakthrough diseases from Venezuela” are spreading from Latin America to the neighbouring parts of Brazil, Ecuador and the Colombian region. We are also witnessing the effects produced by the anti-vaccination campaigns, especially in Afghanistan, where there are Taliban-run anti-vaccination campaigns because of the threat of spying by invading nations like the US. Such campaigns have always encouraged parents to withhold and ignore public health recommendations and delay such vaccination initiatives.<sup>[19]</sup> The effects of anti-vaccine campaigns all over the globe are near to the truth where we have seen a record number of measles deaths in Europe in 2018 while declining reports of vaccination coverage from the US.<sup>[20,21]</sup> Just two decades ago, this modern anti-vaccine movement started, and by now, millions of websites are contaminated with

misinformation, spreading infodemic usually via multiple media platforms. The most worrying aspect is that the anti-vaccine movement of the developed countries might percolate down to the low- and middle-income countries (LMICs) and might thwart the introduction of the next generation of future vaccines.<sup>[1]</sup>

## Future Directions

As it is clear from the above discussion (i.e., the past and present global scenario), the steps for vaccine science and VD are at crossroads, and there is a possibility for getting a good direction if we make a piggyback policy approach of VD along with the foreign policy.<sup>[1]</sup> Establishing such an approach is useful not only in developed countries but also in LMICs. A similar dialogue was started by the former US President Obama (2009) and he extended a helping hand to the Organization of Islamic Cooperation(OIC).<sup>[1]</sup> Unfortunately, the Muslim countries especially Egypt, Indonesia, Iran and UAE, which have some potential for vaccine development, were not interested in this collaboration with the US because of unknown reasons—maybe their political ideology stopped them from adopting such a collaboration in the name of VSD.<sup>[1]</sup>

There are plenty of missed opportunities observed where VSD could have saved the lives of millions, like prevention of death from introducing the anti-leishmaniasis vaccine in the conflicting areas of the Middle East and North Africa. Similar opportunities were present in Cuba and North Korea where they have the basic infrastructure for the development of the vaccines.<sup>[1]</sup>

As a reference, the Sabin Vaccine Institute and Texas Children's Hospital Centre, which are capable of vaccine development (Sabin) and testing the Neglected Tropical Disease (NTD) vaccines (anti-poverty vaccines), could play a pivotal role and indirectly they could benefit poor countries where mortality and morbidity tolls are high because of NTDs. Even the OIC countries could be immensely benefitted by the US VD/NTD vaccines. As per data, schistosomiasis took the lives of hundreds of thousands of people in Syria and Syrian refugees as a leading killer disease during the war between northern and southern Sudan in 1980–1990.<sup>[1]</sup> During the present COVID-19 pandemic, we have also witnessed the dire need of VSD, globally. Again, it is evident that we are paying a heavy toll for not making any overarching policies on the VSD. Although we had plenty of opportunities for VSD, especially in the South-East Asian regions like China, India, Indonesia, Japan, and Vietnam where we have adequate technical expertise (maybe not advanced like the US) and infrastructure for vaccine development and testing at a large scale.<sup>[1]</sup> It could help us to mitigate this COVID-19 pandemic by smooth cooperation between those countries, but unfortunately, the Asian power has been fragmented, may due to differences in the political ideologies of the countries. If we had better diplomatic relations between our neighbouring countries, we could fight against the COVID-19 menace effectively and coherently.

Besides this, Brazil, which also has major vaccine capabilities, has started South-South partnerships with Lusophone Africa and could become an important player in VD.<sup>[1]</sup>

From the above discussion, one thing is clear that we have failed to exploit our collaborative potentials towards VD/vaccine development and sharing in the past (except smallpox and polio during the 1950s and 1960s) and in the present COVID-19 times. We feel that we never gave importance to VSD, and we indulged in our power game by giving undue importance to political diplomacy.

However, the power of vaccine and VSD can be re-explored as we have a noble track record of smallpox and polio eradication with the help of VSD. We must remember that science has no boundaries, and it should be used for the betterment of humanity only. The lessons learned from the past must be followed now and, in the future, to make a better world for all. The COVID-19 episode has highlighted again the dire need for VSD and we assume that not only COVID-19, in future, emerging and re-emerging diseases will take place so we must prepare ourselves for combatting those future emerging and re-emerging diseases.

We have also witnessed that ad hoc solutions have not controlled the past and present communicable diseases, and we assume that it will not control communicable diseases in the future. That is why long-term sustainable solutions are needed. Commitment by individuals, communities and countries as overarching policies like VSD and political diplomacy are also important. Public health specialists, primary care physicians/family physicians along with policymakers must play a leadership role here academically and through action! Last, though, we have won battles through science, the war on communicable disease is still on!

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