



A Review of the Factors for the Elimination of Poliomyelitis and the Remain of Hepatitis B

Xin Ran Tian^(✉)

Faculty of Arts and Science, University of Toronto St. George, 27 King's College Circle,
Toronto, ON M5S 1A1, Canada
amyxr.tian@mail.utoronto.ca

Abstract. Both poliomyelitis and hepatitis B are preventable through vaccination but cannot be treated once infected. Poliomyelitis was eliminated in China in 2000, while hepatitis B remains an epidemiological problem. The objective of this research is to understand what factors aside from medical treatment caused the elimination of one disease but not the other in China. A number of literature reviews and studies were gathered to understand the factors. The results are that the low awareness and social factors like the vaccine incident caused the arising case of hepatitis B. In comparison, people pay more attention to poliomyelitis and are willing to get vaccinated at a young age.

Keywords: factors · poliomyelitis · hepatitis B · awareness · vaccination · prevention · elimination

1 Introduction

Poliomyelitis is a highly infectious disease caused by poliovirus, and hepatitis B is caused by the hepatitis B virus [1]. Both diseases cannot be cured but can be prevented effectively by vaccination at a young age [2]. Current studies have identified numerous medical perspectives on the two diseases, immunization, and potential side effects and improvement. However, comparison studies of the two diseases are lacking. Therefore, the objective is to understand what factors caused the elimination of poliomyelitis while the rising cases of Hepatitis B in China. For methodology, various literature and document were gathered to identify the elements of the two diseases. It is essential to understand why poliomyelitis, one of the preventable diseases, is eliminated. In contrast, hepatitis B, a preventable disease, is not eradicated and is still prevalent in China.

2 Analysis

2.1 Poliomyelitis

Poliomyelitis is a life-threatening disease caused by poliovirus, a type of neurophilic virus that attacks the motor central nervous system [1]. The virus develops in the intestine [3] and is transmitted by person-to-person contacts, such as the fecal-oral route [1]. Most people affected are under the age of 5 [2]. Symptoms including sore throat, fever, tiredness, nausea, and headache are mild and may not be visible. However, about one out of 100 cases develop severe symptoms such as paresthesia, meningitis, and paralysis. These symptoms cause lifelong physical disabilities and cannot be treated. In the most severe cases, the paralysis of breathing muscles can cause death [1]. Children who seem to be fully recovered might develop post-polio syndrome in adulthood, which involves muscle pain, weakness, or paralysis. Once infected, the disease cannot be treated. Vaccination at a young age can effectively prevent poliomyelitis [2].

2.2 Elimination of Poliomyelitis in China

In September 1955, the first case of poliomyelitis appeared in Nantong, Jiangsu province. One thousand six hundred eighty people in the city were paralyzed, primarily children, and 466 people lost their lives. The case fatality rate was as high as 27.75%. It quickly spread to other provinces and cities. Most poliomyelitis happens around summer and autumn, and the primary victims are children between six months to seven years old. The inactivated vaccine was not possible because, at that time, China could not mass-produce after the Japanese invasion and civil wars. The only option was to develop the live attenuated vaccine. The research team led by Gu Fangzhou successfully passed the phase I clinical trials on rhesus, and in 1960, the phase II clinical trial began. Two thousand doses of oral vaccine were delivered in Beijing, and children under the age of 7 in the city became subjects of phase II clinical trials. The data collected showed a positive conversion rate of vaccines with mild or no symptoms. Phase III clinical trial began in most large provinces and cities, and 4 million 500 thousand children took the vaccination. One drawback was that the oral vaccine was bitter and had to take together with other food. To solve this, in 1962, Gu Fangzhou and others finally successfully developed the sugar pill vaccine and passed the clinical test. In 1978, China began to implement planned immunization, and in 1988, only 667 cases were reported in the country. In 1990, the national polio eradication plan began to be implemented. For the following years, the number continued to decline drastically. Since the last case occurred in Xiangyang County, Hubei Province, in September 1994, no polio cases caused by native wild virus have been found. In July 2000, the World Health Organization confirmed that China had successfully blocked the transmission of wild poliovirus and achieved the goal of being polio-free [3].

2.3 Current Vaccination of Poliomyelitis

According to the Law of the People's Republic of China on the Prevention and Treatment of Infections Diseases Article 15, the State implements a planned vaccination system

[4]. This means that getting a vaccination for poliomyelitis starts from the child's birth and becomes a must. Oral polio vaccine (OPV) is free under government cover, and inactivated polio vaccine (IPV) is at one's expense. Parents can choose which type of vaccination they want. If the child has completed four doses of vaccine containing IPV according to the immunization procedure, it can no longer be vaccinated with OPV at the age of four [5]. Babies who are two months old need to be vaccinated with the first dose of polio vaccine and complete the rest of the doses at the age of three months, four-month, and four years old [6].

2.4 Reasons for Eliminating Poliomyelitis

2.4.1 Policy

According to the Regulations on the Administration of Vaccine Circulation and Vaccination Article 27, schools and educational institutions must check the vaccination certificate before a child enters school. If the child is not fully vaccinated, the school authority shall report to the local county-level disease prevention and control institution or vaccination unit and guide the child to vaccinate as soon as possible [7]. This policy reinforced the importance of vaccination and lowered the risk of spreading poliomyelitis. In addition, the POV is completely free and places no burden on disadvantaged families [5].

2.4.2 Effectiveness of Vaccination

From 1961 to 1962, the isolation rate of poliovirus in Shanghai was 18% before taking the sugar pill vaccine. After taking the sugar pill vaccine, the isolation rate was only 0.4%. At the same time, there was no significant difference in the isolation rate of non-poliovirus before and after taking the sugar pill vaccine. The sharp decline in the isolation rate fully shows that the sugar pill vaccine can block the spread of wild poliovirus [3]. With the improvement of technology and medical advancement, there is an improvement in polio vaccination. One example is OPV, a live attenuated polio vaccine designed from the wild poliovirus strain. OPV contains a live attenuated virus, activating the immune response to produce protective antibodies and would not cause pathogenic. IPV is another option. IPV is a trivalent vaccine made by inactivating the selected wild virus strain after cell culture. It can be used with other antigens like Diptheria, tetanus toxoids, and pertussis (DPT) vaccine and will not cause a vaccine-derived poliovirus (VDPV) [8].

2.4.3 High Awareness

The symptoms of poliomyelitis are apparent and can cause permanent physical disabilities. The symptoms were immediate and could occur within hours of infection [2]. Most parents cannot bear the risk of watching their children never able to move again, given the option to prevent it from an early stage. According to the study conducted by Yang et al., most parents are highly aware of poliomyelitis. The study aims to understand the risk perception of parents and pregnant women on polio and the evaluation criteria for the polio vaccine. The study used a convenient sampling method, and group interviews were conducted with 133 parents and 40 pregnant women in 5 provinces and eight cities.

Out of the valid responses, the results showed that most parents and pregnant women believed poliomyelitis is highly infectious and paid attention to polio [9]. They worried about the risk of their children getting poliomyelitis. With this high awareness, more parents are willing to let their children get vaccinated and help prevent the spread of poliomyelitis.

2.5 Hepatitis B

Hepatitis B is a liver infection caused by the hepatitis B virus. No effective cure is found but can be prevented by vaccination at a young age. There are two types of hepatitis B. Acute hepatitis B mainly occurs in adults and can be fully recovered in six months. However, suppose the infection lasts more than six months. In that case, it becomes chronic hepatitis B. Chronic hepatitis B may last a lifetime and be undetected for decades until serious illnesses such as liver cancer and liver cirrhosis occur [10]. According to statistics from the Centers for Disease Control and Prevention, about 90% of infants infected by hepatitis B will develop chronic infection compared to only 2–6% of adults [11].

2.6 Current Hepatitis B Vaccination

Hepatitis B vaccination is free under the cost of the government. It is the first vaccination that a baby gets. According to China's Immunization Technology Management Regulations and Vaccination Standard, the first shot of the three hepatitis B vaccination must be completed within 24 hours after birth. The second and third shots should be completed by one month old and between five to eight months old. The basic immunization requirements should be completed within 12 months after birth [12].

2.7 Increase in Hepatitis B Cases

2.7.1 Symptoms

Acute infection happens when a person is first diagnosed with Hepatitis B. After six months, if the person still has the disease, it is a chronic infection. The younger the person is exposed to the virus, the greater the chance of a chronic infection. There are differences between acute and chronic hepatitis B. For acute infection, it may last less than six months. Symptoms may or may not exist. General symptoms include loss of appetite, low-grade fever, and possible stomach pain. There are no apparent physical symptoms. The person can transmit the disease even though there are no symptoms. The acute infection has few lasting effects. Recovery from acute illness means that no virus is in the blood and is not capable of transmission. However, the virus is inactivated in the liver and may become activated when the immune system is suppressed. It becomes a chronic infection when the infection lasts more than six months. This means that the immune system cannot eliminate the virus, and it remains in the blood and the liver. People who do not have any symptoms may be diagnosed decades after their initial exposure to the infection. The condition becomes progressively worse over the years and significantly increases the risk of liver diseases such as cancer and cirrhosis. Chronic infection does not have apparent physical symptoms and may go unnoticed until a severe liver condition [13].

2.7.2 Social Factors

In 1992, the Ministry of Health assigned the hepatitis B vaccine to the immunization program, and all newborns need to be vaccinated. After that, about 92 million people in China are free from hepatitis B virus infection, and the number of hepatitis B carriers has decreased by about 30 million cases [14]. However, in southern China, from November to December 2013, numerous infants death happened after receiving the hepatitis B vaccine. This refers to the vaccine incident. The mass media reported the incident and caused widespread public debate and panic about hepatitis B vaccination. After the incident, the number of hepatitis B vaccine injections decreased significantly. To determine whether the vaccine incident affected hepatitis B vaccine injection, the study conducted by Chen Lihua tested the impact. A random sampling survey was conducted in Yancheng City, and a total of 150 parents were investigated, all of whom were parents of children between the aged of 0-23 months. Out of 150 parents, 46 parents expressed hesitation about the next vaccination or did not vaccinate temporarily, accounting for 34.8%; 52 parents, accounting for 39.4%, made it clear that they were unwilling to receive such vaccines. From the results, the incident has a more significant negative impact on public trust in vaccination [15]. Since children are not vaccinated, this increases their chance of getting hepatitis B as an adult and transmission of the disease.

2.7.3 Low Public Awareness

Many people are not aware of the consequences of hepatitis B since most symptoms are not apparent, and the condition takes a long time to affect the liver severely. A study by Shi Ji-ling discussed the relationship between unawareness of hepatitis B and vaccination rate. A total of 300 adults who received hepatitis B vaccination in the out-patient clinic in January 2019 were randomly selected as the subjects. Questionnaires were assigned. Among the respondents, 170 cases had been vaccinated against hepatitis B before, 130 had not been vaccinated before, or did not remember whether they had been vaccinated. The vaccination rate was only 56.67%. The subjects also scored poor on the general knowledge of hepatitis B, and the correct rate of all the answers of 300 respondents was 28.33% [16]. The study showed that people have low awareness of vaccination and its potential consequences.

3 Results

The above studies show two reasons why poliomyelitis is eliminated while hepatitis B is not. First, the severity of the symptoms and awareness are different. Poliomyelitis can cause permanent physical disabilities at a very young age and cannot be recovered. The physical symptoms of the children are a great shock to their parents and other people. Most parents cannot bear to see their children, with endless possibilities in the future, are paralyzed. Therefore, they have a high awareness of poliomyelitis and are willing to let their children get vaccinated. This is supported by the study conducted by Yang et al., where most parents believe poliomyelitis is highly infectious and pay attention to polio [9].

In comparison, parents lack awareness of Hepatitis B. Unlike poliomyelitis, hepatitis B symptoms may not exist. Even though there are symptoms, they are not as severe as poliomyelitis because they do not involve paresthesia, meningitis, or paralysis. In addition, the chronic infection takes decades before severe illnesses such as liver cancer appear and often go unnoticed [1]. As a result, parents are less aware of hepatitis B because the consequences take a long time to appear, and there are no obvious physical symptoms. The study conducted by Shi Ji-ling supports the argument by showing that many people are unfamiliar with hepatitis B, and some are not vaccinated [16]. Moreover, some people are unaware that vaccination can effectively prevent hepatitis B. According to a study conducted by Zhou et al. on Yuexiu residents, only 74.3% of residents know that the best way to prevent hepatitis B is to get vaccinated [17].

The second reason is that the social factors of the two diseases are different. The vaccine incident of hepatitis B caused many people to panic about vaccination, as shown in the study conducted by Chen Lihua [15]. Parents were concerned about the safety of the vaccination and were reluctant to let their children get vaccinated. As a result, these children are at a higher risk of contracting hepatitis B than vaccinated children. The trouble is more severe for children whose mothers are diagnosed before pregnancy. In comparison, similar vaccine incidents did not happen to poliomyelitis, and parents are more inclined to let their children get the polio vaccine.

To further increase the awareness of hepatitis B, there are specific methods. First, the promotion of vaccination is of vital importance. The main reason for people unwilling to inoculate hepatitis B vaccine is the low awareness and lack of knowledge. According to the study conducted by Zhou et al., television, newspapers, books, mass media, and leaflets can provide intuitive contact about the disease and are readily accepted by community residents. In addition, the internet is crucial because it is the primary source of information, regardless of a person's educational background [17].

Secondly, implementing different education content for different people can increase awareness. For high school and university students, schools are the best place to learn about hepatitis B. Schools could provide various lectures such as guest lectures and vocational education lecture halls to educate students about hepatitis B. School newspapers and social media platforms such as WeChat can be applied and to promote knowledge about hepatitis B [18]. For elementary students, educating both the parents and children is equally important. Young students can learn more about hepatitis B through interaction with teachers, fun activities, and easily understandable videos. Students can also get involved in discussing why it is essential to get vaccinated. Educating young children could help them gradually understand and become aware of the importance of health, which would benefit them lifelong [19].

Lastly, the content and source of education contribute to awareness. According to a study by Shi et al. in Yunnan province, most parents believe the information they get from doctors and vaccination sites' publicity materials is trustworthy [20]. Therefore, by letting doctors and the vaccination site provide more promotion materials, parents can better understand both hepatitis B infection and vaccination. Besides, the education materials should be easily understandable and cover critical information. For example, the ways of transmission and the free cost of hepatitis B vaccination should be included in the education material [21].

4 Conclusion

Overall, the severity of symptoms is different for the two diseases, and parents exhibit diverse awareness. Poliomyelitis can cause severe physical disabilities, while hepatitis causes more damage to the internal organs and takes longer. As a result, most parents are highly aware of poliomyelitis but not hepatitis B. Moreover, social factors are contrasting. Parents are worried about the safety of the hepatitis B vaccination due to vaccine incidents, while similar events did not happen to poliomyelitis vaccination.

The paper has some limitations. First, the literature reviews and data were gathered from plentiful periodical magazines and journals. However, no first-hand data is collected, and no experimentation is being conducted. Secondly, although most literature reviews are published in authoritative national journals, some are not. A small amount of information is gathered from websites, but the data comes from medical agencies such as World Health Organization. Finally, a small number of literature reviews are limited to local areas and might cause some threat to the validity of the paper.

In summary, to improve the awareness of hepatitis B, authority institutions and government can do more promotions to the public, vary the content based on age and educational level, and make the content easy to read and understandable.

References

1. (2021, September 28). Centers for Disease Control and Prevention. What is polio? <https://www.cdc.gov/polio/what-is-polio/index.htm>
2. (2019, July 22). World Health Organization. Poliomyelitis. <https://www.who.int/news-room/fact-sheets/detail/poliomyelitis>
3. Xu Yuan (2021). One thing in one's life - "sugar pill" Gu Fangzhou legend. Selected journal of biographical literature (02), 5-26
4. (2020, January 22). The National People's Congress of the People's Republic of China. Law of the People's Republic of China on the Prevention and Treatment of Infectious Disease. <http://www.npc.gov.cn/npc/c238/202001/099a493d03774811b058f0f0ece38078.shtml>
5. (2022, March 17). Huiqui Government. Interpretation of Immunization Procedures and Instructions of National Immunization Program Vaccine for Children. <https://www.huoqiu.gov.cn/public/6618291/31632541.html>
6. Mother's Encyclopedia. Polio Vaccination Time. <https://www.mama.cn/z/art/3947448/>
7. (2016, April 25). Central People's Government of the People's Republic of China. Regulations on the Administration of Vaccine Circulation and Vaccination. http://www.gov.cn/zhengce/content/2016-04/25/content_5067597.htm
8. Liu Yueyue, Zhao Rongrong & Li Changgui (2021). Research progress of polio vaccine Chinese Journal of biological products (12), 1506-1510. doi:<https://doi.org/10.13200/j.cnki.cjb.003499>.
9. Zhan Jianli, Zhan Jianli (2016). Qualitative study on polio risk cognition and vaccine evaluation of parents and pregnant women. China Health Education (02), 111-115. doi:<https://doi.org/10.16168/j.cnki.issn.1002-9982.2016.02.004>.
10. (2022.) Mayo Clinic. Hepatitis B. <https://www.mayoclinic.org/diseases-conditions/hepatitis-b/symptoms-causes/syc-20366802>
11. (2021, October 12). Centers for Disease Control and Prevention. Viral Hepatitis. <https://www.cdc.gov/hepatitis/hbv/index.htm>

12. Chen Ruohan (2016). Equity analysis of timely vaccination of hepatitis B vaccine for rural children in China (Master's thesis, Shandong University). <https://kns.cnki.net/KCMS/detail/detail.aspx?dbname=CMFD201701&filename=1016207224.nh>
13. (2022.) Hepatitis B Foundation. Acute V.S. Chronic Hepatitis B. <https://www.hepb.org/what-is-hepatitis-b/what-is-hepb/acute-vs-chronic/>
14. Wenbo (2015). Hepatitis B vaccination can not be less. Everyone's health (02), 10[15] Shen Lihua (2018). To analyze the impact of hepatitis B vaccine incident on public vaccination trust. World's latest medical information digest (95), 202. doi:<https://doi.org/10.19613/j.cnki.1671-3141.2018.95.164>.
15. Shi Jichen (2021). Investigation and analysis of cognition and health education needs of hepatitis B vaccination population. Smart health (36), 131-133+174. doi:<https://doi.org/10.19335/j.cnki.2096-1219.2021.36.044>.
16. Zhou Deqian, Zhan Lihua, Xiao Xiaoling, Zhou Wen & Yu Dandan (2016). Study on hepatitis B cognition and propaganda mode of residents in Yuexiu District, Guangzhou. Henan Journal of preventive medicine (11), 801-803. doi:<https://doi.org/10.13515/j.cnki.hnjpm.1006-8414.2016.11.001>
17. Zhang Jia (2018). Analysis of the five test results of hepatitis B in Vocational Colleges and the importance of education and publicity. New West (17), 40 + 29
18. Jia Xiuyan, Liu Dan, Wang Jixue, Gao Xueqian, sun Xiangming, Zhang yuanqiang & Shao Yan (2006). Primary school students hepatitis B prevention and control knowledge publicity and education research. Journal of disease control (02), 198-200
19. Shi Haoyu, Zhong Zhilei, Wang Jingdong, Li Ying, Li Jiaxuan, Chen Qiuyu & Yang Jingsi (2021). Investigation on polio and its vaccination awareness of parents of infants under 6 years old in Yunnan Province Chinese Journal of biological products (11), 1334-1339+1351. doi:<https://doi.org/10.13200/j.cnki.cjb.003471>.
20. (2006). Knowledge of prevention and control of hepatitis B publicity and education. China Health Education (12), 914.

Open Access This chapter is licensed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits any noncommercial use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.

