Recommendations on Public Health Strategies for Sexually Transmitted Infections in China

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Abstract

Sexually Transmitted Infections (STIs) is a major public health challenge globally, affecting the health, well-being and quality of life of millions of people. Despite efforts to contain these infections through education, preventive measures, and treatment, the prevalence is still high. Although China has actively responded to the global health sector strategy on HIV, viral hepatitis and sexually transmitted Infections 2022-2030 proposed by the World Health Organization, STis in China are still a public health issue that needs attention due to the combined impact of rapid economic development, rich ethnic diversity, vast geographical range, and institutional changes. This paper highlights the importance of a comprehensive strategy that includes sex education, provision of safety tools, vaccination, and improved testing and surveillance to address the epidemic of STIs in China. According to the current situation STIs, including HIV/AIDS, in China, the differences in prevalence by gender, age and region were analyzed. From a public health perspective, this paper will propose improvements that can be made in the control of STIs in China.

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1.0 Introduction

1.1 Background of Sexually Transmitted Infections

Sexually transmitted infections (STIs) are currently one of the major global public health challenges, affecting the health, well-being and quality of life of millions of people. The widespread prevalence of STIs not only burdens the health care system, but is also closely associated with multiple socioeconomic problems.

STIs is primarily transmitted through sexual contact. More than 30 different bacteria, viruses and parasites are known to be transmitted through sexual contact, including vaginal, anal and oral sex. Some STIs can also be transmitted from mother to child during pregnancy, childbirth and breastfeeding. Eight pathogens and STIs are the most common. Of these, four are currently curable: syphilis, gonorrhea, chlamydia and trichomoniasis. The other four are incurable viral infections: hepatitis B, herpes simplex virus (HSV), human immuodeficiency virus (HIV) and human papillomavirus (HPV)(WHO, 2023).

In addition, new infections that can be acquired through sexual contact, such as monkeypox, *Shigella Sonnei*, *Neisseria meningitidis*, Ebola and Zika, as well as neglected STIs, such as lymphogranuloma venereum, are re-emerging. These are indicative of the growing challenge of providing adequate services for the prevention and control of STIs (WHO,2023).

Globally, the widespread transmission of STIs remains a significant public health challenge. According to data from the World Health Organization (WHO), HIV, viral hepatitis, and STIs together cause 2.3 million deaths and 1.2 million cancer cases annually. More than one

million people contract a STI every day, with 4.5 million new infections of HIV, Hepatitis B, and Hepatitis C occurring each year (WHO, 2022).

STIs can be transmitted in a variety of ways, including through sexual intercourse (vaginal, oral, or anal), blood transmission (especially HIV and syphilis), and from mother to baby (vertical transmission) (WHO, 2023). Although many STIs may not show obvious symptoms in the early stages, untreated infections can lead to long-term health problems and disease transmission. It may cause the following symptoms: abnormal discharge from the vagina, penis or anus, painful burning sensation when urinating, lumps around the genitals or anus, sores, ulcers, warts or blisters, unusual vaginal bleeding, pain around the pelvis, genital itching, pain during sex, warts in the mouth or throat, etc. But STIs can have serious consequences beyond the direct impact of the infection itself. STIs such as herpes, gonorrhea and syphilis increase the risk of contracting HIV. Mother-to-child transmission of STIs can lead to stillbirth, neonatal death, low birth weight and premature delivery, septicaemia, neonatal conjunctivitis and congenital malformations. HPV infection can lead to cervical cancer and other cancers. Therefore, prevention, early diagnosis and treatment of STIs are essential (WHO,2023).

1.2 Major Sexually Transmitted Infections

1.2.1 HIV

Human immunodeficiency virus (HIV) is a virus that attacks the body's immune system. If HIV is not treated, it can lead to Acquired immunodeficiency syndrome (AIDS). HIV is

transmitted through sexual contact, blood contact and from mother to baby. However, HIV is not transmitted by kissing, holding hands, or touching hard surfaces such as doorknobs and toilet seats.

AIDS is caused by the retrovirus HIV-1, which is spread through body fluids and secretions. HIV is divided into HIV-1 and HIV-2 and is transmitted through the same routes. HIV-1 is currently more common worldwide, and HIV-2 is found but less common in West Africa, Mozambique, and Angola. Compared to HIV-1, HIV-2 is less pathogenic, less transmissible and has a shorter duration of infection. HIV-1 is made up of four distinct lineages called groups M, N, O, and P. Each lineage is thought to be the result of an independent cross-species transmission event in west-central Africa. M, N, and O were identified in the early 20th century, while P has only been identified in the last three decades (Bekker et al., 2023).

The human immunodeficiency virus is a retrovirus with an RNA-based genome. This type of retroviruses spreads from one person to another person through contact with the infected individual's bodily fluids, such as blood or semen, and uses the CD4 receptor on the surface of the host cell as well as other co-receptors (such as CCR5 or CXCR4) to enter the host cell. These host cells are usually CD4+ T cells, a type of lymphocyte, which are subsequently destroyed by viral replication. Without timely treatment, over time, from months to years, the depletion of CD4+ T cells will lead HIV symptoms, making the infected individual extremely vulnerable to opportunistic infections and certain types of cancer. Typically, this results in the death of the infected adult within 2 to 10 years after infection (Bekker et al., 2023).

The progression of HIV infection goes through several stages: acute HIV infection, clinical latency, and AIDS (acquired immune deficiency syndrome). Acute HIV infection is the earliest stage of HIV infection and usually occurs within 2 to 4 weeks after infection. People have large amounts of virus in their blood, which is highly contagious. Many people have flu-like symptoms

such as fever, headache and rash. The clinical latency stage is also known as asymptomatic HIV infection. HIV is still active and continues to multiply in the body. During this stage, people may not have any symptoms or be sick, but can transmit HIV. People who receive HIV treatment as prescribed may never progress to stage 3 (AIDS). Without HIV treatment, this stage can last a decade or more, or progress much faster. At the end of this stage, the amount of HIV in the blood (viral load) rises and the patient may enter stage 3 (AIDS). AIDS is the most severe stage of HIV infection. People with HIV have a high viral load and can easily transmit virus to others. AIDS patients have severely compromised immune systems. They may get more and more opportunistic infections or other serious diseases. Without treatment, people with AIDS usually survive for about three years (CDC,2022). Without treatment, people living with HIV can also develop serious diseases such as tuberculosis, cryptococcal meningitis, severe bacterial infections, and cancers such as lymphoma and Kaposi's sarcoma. HIV can also worsen other infections, such as hepatitis C, hepatitis B, and measles. (WHO,2023)

There are three types of HIV testing: antibody testing, antigen/antibody testing, and nucleic acid testing (CDC,2022). HIV testing is usually done in blood or oral fluids. Urine can also be tested. Progression of HIV is measured by CD4 + count and viral load (WHO). A reduced CD4+ cell count indicates weakened immune function. Normally, the number of CD4+ cells range from 500 to 1500 cells /mm^3. For people with HIV, a CD4 count of less than 200 cells /mm^3 is described as having advanced HIV disease. Viral load is a measure of the amount of HIV virus in the blood, and a higher viral load means more immunosuppression. The main goal of treatment is to reduce the amount of HIV virus in the blood to undetectable levels (i.e. below 50 copies/ml). For people living with HIV on antiretroviral therapy (ART), if the viral load is consistently detectable and

exceeds 1000 copies/ml, this may indicate that treatment is not working well and a change or adjustment of treatment regimen needs to be considered.

There is currently no cure for HIV and no effective vaccine. Current HIV vaccine development is an important challenge because it is not easy to produce neutralizing antibodies, HIV is able to form latent proviral DNA, and the virus is highly variable (Robinson, 2002). But it can currently be treated with anti-HIV drugs (called antiretroviral therapy). Antiretroviral therapy (ART) can slow or stop the progression of HIV from one stage to another. HIV drugs can help people with HIV live longer, healthier lives (U.S. Department of Health and Human Services, 2023).

HIV infection can be prevented through various measures. Pre-exposure prophylaxis (PrEP) is medicine that reduces your chances of getting HIV from sex or injection drug use. When taken as prescribed, PrEP is highly effective for preventing HIV (CDC,2022). In addition to PrEP, HIV prevention can also be achieved through PEP (post-exposure prophylaxis), which involves taking medicine after a potential exposure to prevent HIV. PEP is intended for emergency situations and must be initiated within 72 hours following a possible exposure to HIV (CDC,2021). As research into HIV deepens, both PrEP and PEP have become crucial in the fight against HIV transmission.

1.2.2 Human Papillomavirus (HPV)

Human papillomavirus (HPV) is the most common sexually transmitted virus. Although HPV infections do not cause symptoms in most cases and can resolve on their own, if the infection persists, it is possible to develop cervical, vulvar, vaginal, penile, and anal cancers, as well as some head and neck cancers. HPV infection is associated with almost 100% of cervical cancers, 90% to

93% of anal canal cancers, 12% to 63% of oropharyngeal cancers, 40% to 64% of vaginal cancers, 40% to 51% of vulvar cancers, and 36% to 40% of penile cancers (Soheili et al., 2021). In particular, cervical cancer is one of the most common types of cancer that poses a threat to women's health and is the fourth most common type of cancer among women globally (Forman et al., 2012).

HPV is divided into two broad categories: low risk and high risk. Currently, there are 15 types of HPV that are considered high-risk, including types 16, 18, 31, 33, 35, 39, 45, 51, 52, 56, 58, 59, 68, 73, and 82, and these high-risk types of HPV are considered to be the main pathogens of reproductive tract cancers (Mo et al., 2022). The 12 low-risk HPV types included 6, 11, 40, 42, 43, 44, 54, 61, 70, 72, 81 and CP 6108 (Munoz et al., 2003). These types rarely cause cancer, but some low-risk types of HPV can cause warts around the genitals, anus, mouth, or throat. When these warts form in the throat or respiratory tract, a condition called respiratory papillomatosis may develop, causing difficulty breathing.

HPV16 and HPV18 are the two most common high-risk HPV types, and they are associated with approximately 70% of cervical cancer cases and 80%—90% of other HPV-related tumors (McCormack, 2014).

HPV is a small circular DNA virus belonging to the papillomavirus family whose genome contains approximately 8,000 base pairs and encodes six early regulatory proteins (E1, E2, E4, E5, E6, and E7) and two late structural proteins (L1 and L2) (Wang et al., 2020). HPV-induced lesions are caused by uncontrolled proliferation and mutation of cells, which may eventually develop into cancer.

There is currently no test to determine an individual's HPV status. And, there are currently no approved HPV tests to identify HPV infections in the mouth or throat. The HPV test is an important means of cervical cancer screening, which is usually only used to screen women 30

years of age and older. Many people who are infected with HPV may be completely unaware of it, as most people with HPV do not develop any symptoms or health problems. Some people may not realize they are infected with HPV until they develop symptoms such as genital warts. During cervical cancer screening, a woman may also be found to have HPV if her Pap test results are abnormal. Some people do not know they have HPV until they are diagnosed with serious health problems caused by HPV, such as cancer (CDC, 2022).

There is currently no treatment for the virus itself, but some of the health problems caused by HPV can be treated. For example, genital warts can be treated with medication prescribed by a doctor. Without treatment, condyloma acuminatum may disappear on its own, remain the same, or increase in volume and quantity. Precervical cancer can be cured, and women who have regular Pap tests and follow up as recommended can catch and treat cancer before it forms. Other HPV-related cancers that are diagnosed and treated early are also more curable. Prevention is more important than treatment, and the HPV vaccine offers an effective way to prevent the types of HPV that are most likely to cause cancer.

1.2.3 Syphilis

Syphilis is a globally common STI caused by *Treponema pallidum.* This is a chronic bacterial infection with multiple stages. Humans are the only natural host for this bacterial. Syphilis is mainly transmitted through sexual contact, including vaginal, anal and oral sex, as well as vertical transmission, such as mother-to-child transmission and, in rare cases through blood transfusions. Syphilis is not transmitted through everyday contact, such as using public health facilities, swimming pools, clothing or utensils (CDC,2022).

Treponema pallidum is a spiral-shaped bacterium that can penetrate mucous membranes or damage the skin and enter the body. Early in infection, it forms a hard chancre at the site of invasion, marking the first stage of syphilis. Over time, the disease may progress to a second stage with rash and mucosal lesions. Untreated syphilis can enter the latent period and eventually develop to the third stage, affecting the cardiovascular system and nervous system (CDC, 2022).

Due to the varied symptoms of syphilis, it has been dubbed the "great imitator," and can be categorized into acquired and congenital syphilis. There are several stages of syphilis (first, second, latent and third stages), each with different signs and symptoms. The typical painless lesions of primary syphilis may be missed, especially in hidden exposed sites such as the cervix or rectum. The rash and other symptoms of secondary syphilis may be subtle or mistaken for other conditions (Peeling et al., 2017).

Syphilis is an ancient disease that has significantly impacted public health throughout history. Today, despite the availability of effective treatment, cases of syphilis are increasing worldwide, particularly among certain high-risk groups (WHO,2023).

Penicillin remains an effective treatment, and *Treponema pallidum* has not yet shown resistance to it. However, the emergence of allergic reactions to penicillin in some populations and resistance to second-line therapeutic agents such as macrolide antibiotics justify the importance of developing alternative therapeutic measures. Development of protective vaccines is one approach that could be considered.

Some studies have explored potential syphilis vaccine candidates that could inhibit the spread of *Treponema pallidum* (Tien et al., 2020). However, due to the difficulty of culturing the bacteria in vitro, limited research into the virulence factors of *Treponema pallidum*, and an

incomplete understanding of protective immunity against it, no viable vaccine has yet been developed (Peeling et al., 2017).

1.2.4 Chlamydia

Chlamydia is a common STI that can occur in both men and women. It is caused by a bacterium called *Chlamydia trachomatis* (WHO,2023).

Chlamydia usually has no symptoms, but even when there are no symptoms, it can cause serious health problems. If symptoms develop, they may not appear until several weeks after sex with a partner with chlamydia. If left untreated, chlamydia can cause serious problems, including infertility and ectopic pregnancy. In pregnant women, it can cause babies to be born prematurely (preterm) (CDC, 2022). Young people who are sexually active are at a higher risk of contracting chlamydia, due to common behavioral and biological factors among young people.

Treatment of chlamydial infection is generally simple and effective and relies mainly on antibiotic therapy. Tetracyclines and macrolides are highly effective in treating uncomplicated chlamydial infections. There are a few case reports of in vitro antibiotic resistance in Chlamydia trachomatis isolates. However, significant antibiotic resistance has not yet emerged in human pathogenic chlamydophila species, but these organisms can exhibit significant resistant phenotypes (Tien et al., 2020). No vaccine has been developed to prevent chlamydia infection now. Therefore, performing regular sexual health examinations and ensuring transparent communication between sexual partners remain key measures to prevent the spread of chlamydial infection.

1.2.5 Trichomoniasis

Trichomoniasis is a STI caused by *Trichomonas vaginalis*, which is a common non-viral STI worldwide. *Trichomonas vaginalis* is a preventable and curable sexually transmitted protozoan that infects the urogenital tract. The parasite is transmitted through oral, vaginal and anal sex and, in rare cases, during childbirth.

Most infections in both men and women are asymptomatic. But more than 50% of women with *Trichomonas vaginalis* infection have leucorrhea, and about 10% of men have urethritis. In symptomatic women, vaginal discharge (yellow) may occur, which may be purulent. Other symptoms include vaginal redness and pain. Infected people also experience pain during sexual intercourse and urination. When *Trichomonas vaginalis* is present, health care providers may observe a yellow or green, possibly foamy discharge in the vagina during speculum examination. Men are usually asymptomatic, but some develop penile irritation and urethritis (WHO,2023). Clinical resistance to metronidazole was first reported in 1962, and thereafter it was estimated that at least 5% of isolates had some level of resistance. In addition, there have been reports of clinical failure of typical course of metronidazole. However, as routine drug susceptibility testing is often not available, information on the prevalence of antimicrobial resistance among *T. vaginalis* isolates is limited and updated data are lacking (Tien et al., 2020). Prevention measures mainly rely on the use of protective measures such as condoms and open communication between sexual partners. Regular sexual health checkups are also an important strategy to prevent transmission of trichomonas infection.

1.2.6 Gonorrhoea

Gonorrhoea is a preventable and curable STI caused by Neisseria gonorrhoeae. The infection is mainly transmitted through vaginal, oral and anal sex and can be transmitted from a pregnant woman to her baby in mother-to-child transmission.

Gonorrhoea causes different symptoms in women and men. In women, gonorrhoea is often asymptomatic, or symptoms are mild and non-specific and can easily be misdiagnosed as a bladder or vaginal infection. Initial symptoms may include painful urination, abnormal vaginal discharge, or abnormal bleeding during menstruation. If left untreated, the infection can lead to infertility and complications during pregnancy. In men, gonorrhoea may cause pain or burning when urinating, abnormal penile discharge, and occasional testicular pain (WHO, 2023).

Antibiotic resistance in gonorrhoea is a serious and growing problem and is resistant to almost all related antibiotics previously and currently widely used, including sulfonamides, penicillins, tetracyclines, macrolides and quinolones. The rapid development of resistance has prompted global public health agencies to intensify surveillance and research efforts. In the face of the multi-drug resistance of gonococcal infections, the search for alternative treatment methods and the development of gonococcal vaccines have become particularly critical. At present, the development of gonococcal vaccines is still in the preclinical discovery stage. Challenges include characteristics inherent to pathogens, such as antigenic variability and manipulation of immune responses (Tien et al., 2020). Therefore, the transmission of gonorrhea can be effectively reduced through condom use and regular sexual health examinations. Ensuring transparent communication with sexual partners is also a key measure to prevent the spread of gonorrhoea.

1.2.7 Hepatitis B

Hepatitis B (HBV) is a viral infection that attacks the liver and can be either acute (short-term and severe) or chronic (long-term). HBV can cause a chronic infection and puts people at high risk of death from cirrhosis and liver cancer. In severe cases, acute hepatitis can lead to liver failure, which can lead to death (WHO,2023).

In regions with high prevalence of HBV, transmission is most common from mother to child at birth (perinatal transmission) or through horizontal transmission (contact with infected blood), particularly from an infected child to an uninfected child during the first 5 years of life. The development of chronic infection is common in infants infected by the mother or before the age of 5 years. In addition, HBV can also be transmitted through needle stick accidents, tattooing, piercing procedures, and contact with infected blood and other body fluids such as saliva, menstrual blood, vaginal discharge and semen. The reuse of contaminated needles, syringes or other sharp objects in health care settings, the community, or among injecting drug users is also a route of transmission. Sexual transmission is also more common among unvaccinated people who have multiple sexual partners (WHO, 2023).

Less than 5% of adults infected with HBV develop chronic hepatitis, whereas about 95% of individuals infected in infancy and early childhood develop chronic hepatitis. This underscores the importance of vaccinating infants and children. The HBV can survive outside the body for at least 7 days. During this time, infection may still occur if the virus enters an unvaccinated person. The virus, which has an incubation period of 30 to 180 days, may be detected within 30 to 60 days of infection and has the potential to persist and develop chronic HBV, especially if infected during infancy and early childhood. There is currently no specific treatment for acute HBV. Chronic HBV can be treated with antiviral drugs such as tenofovir or entecavir. Management of acute HBV is

focused on relieving the patient's discomfort and advising a healthy diet and plenty of water to prevent dehydration from vomiting and diarrhoea. Currently, prevention of HBV can be achieved by vaccination (WHO, 2023).

1.3 Worldwide Epidemiology of Sexually Transmitted Diseases

STIs have a profound impact on sexual and reproductive health worldwide. STIs continue to pose a major public health challenge globally, according to World Health Organization (WHO) data and reports.

It is estimated that more than one million people are infected with STIs every day. WHO estimates that in 2020 there were 374 million new infections with 1 of 4 STIs: chlamydia infection (129 million), gonorrhoea (82 million), syphilis (7.1 million) and trichomoniasis (156 million). In 2016, more than 490 million people were estimated to have genital herpes and an estimated 300 million women were infected with HPV, which is also the leading cause of cervical and anal cancer. An estimated 296 million people are living with chronic HBV, with 1.5 million new infections occurring each year globally. HBV caused an estimated 820 000 deaths in 2019, mostly from cirrhosis and hepatocellular carcinoma (primary liver cancer) (WHO,2023).

At present, the incidence of STIs is showing an increasing trend worldwide. Inadequate coverage of services to prevent, test and treat STIs in many countries, particularly during the COVID-19 pandemic, has led to re-outbreaks of these infections. Even in countries with strict surveillance of STIs, such as the United States and the United Kingdom, cases of STIs are still rising. Emerging infections, such as MPOX, and the reemergence of neglected cases of sexual transmission pose challenges to prevention and control measures. At the same time, the

increasingly frequent reports of gonorrhea resistance have also aroused widespread public health concern (WHO,2023).

While these statistics highlight the prevalence and rapid spread of STIs, they also point to the urgency with which more prevention and treatment efforts need to be made. Worldwide, progress has been made in the prevention and control of STIs, but the incidence of STIs varies significantly in different regions. Infection rates are often higher in developing and low-income countries due to a lack of adequate health resources, inadequate sex education, and cultural and social factors. This information shows that despite some progress in prevention and control, the global burden of STIs is still high.

1.4 Current Preventive Interventions and Treatments

Globally, prevention and control of STIs is an important component of public health efforts. Over time, countries and international organizations have undertaken a range of preventive measures aimed at reducing the spread and impact of STIs. These include sex education, public awareness campaigns, vaccination, and provision of safer sex tools such as condoms.

1.4.1 Public Promotion of Sex Education

Sexuality education and public information campaigns play a vital role in preventing the spread of STIs. A review of randomized controlled trials and studies evaluating comprehensive education programs using quasi-experimental designs has shown that these are effective not only

in delaying adolescents' sexual debut, but also in reducing their sexual risk behaviors, thereby reducing the risk of STIs, including HIV, and teenage pregnancy (Craig-Kuhn et al., 2021).

The public information campaign aims to increase public awareness of STIs and awareness of prevention. Through a variety of channels, such as advertising, social media and public lectures, public information actives can provide reliable information and encourage the public to screen for STIs, thereby helping to reduce the infection rate.

Especially social media, has emerged as a promising platform to disseminate information and positively influence perceptions, knowledge and behaviour related to sexual health (Engel, 2023).

However, there are a number of barriers and challenges. The lack of effective public information campaigns in socially conservative and resource-limited areas limits the dissemination of STIs prevention messages. In addition, certain behaviors, beliefs, and attitudes may increase the risk of STIs, which similarly affects the effectiveness of prevention efforts (Craig-Kuhn et al., 2021). And the main challenges of social media in sexual health promotion, including privacy concerns, lack of control, the unsuitability of social media for sexual health issues, rapid changes in technology, and finding the right balance between education and entertainment. In particular, privacy concerns emerged as a significant challenge, and study participants also expressed concerns about judgment and discrimination when interacting with sexual health content (Engel, 2023). These findings and challenges point out that although sex education and public information campaigns play a key role in preventing STIs transmission, various sociocultural and technical factors need to be considered when implementing these strategies to ensure that these campaigns are effective in reaching target groups and having the desired impact.

1.4.2 Providing Tools for Safer Sex

Providing tools for safer sex, such as condoms, is a key strategy to prevent STIs. Studies have shown that consistent and correct use of male condoms significantly reduces the risk of transmission of HIV and other STIs, including chlamydia, gonorrhoea, syphilis, human papillomavirus (HPV) and trichomoniasis. Condom use also helps reduce a woman's likelihood of developing pelvic inflammatory disease by limiting infection of the lower reproductive tract (Marrazzo & Cates, 2011).

Nonetheless, condom use faces multiple barriers, including privacy concerns at purchase, social stigma surrounding condom use, non-acceptance by sexual partners, doubts about condom effectiveness, comfort issues, reduced sexual satisfaction, partner alcohol abuse, depression and anxiety problems, and lack of immediate access to condoms. In addition, women are more vulnerable to STIs due to biological and socioeconomic factors and face difficulties negotiating safer sex, such as using male condoms. Therefore, female-led protection measures are needed now. However, female condoms face difficulties in access, high cost, and low acceptability (Marfatia et al., 2015).

To increase condom availability and acceptance, governments and NGOs in many countries have begun to provide free or low-cost condoms through schools, community centers, and health facilities. However, cultural and social barriers still limit widespread condom acceptance and use, particularly in communities where levels of sex education are low, and discussion of sexual topics is still considered taboo.

1.4.3 Vaccination

Preventive vaccination, particularly HPV and HBV, is considered the most effective methods of preventing these diseases. These vaccines have made remarkable progress in preventing STIs. By the end of 2020, 111 mainly high and middle-income countries had introduced HPV vaccine as part of routine immunization strategies (WHO, 2023).

The HPV vaccine has shown up to 96% effectiveness in preventing pre-cervical cancer and has also been shown to be effective in preventing anal and genital warts and precancerous lesions in men (Markowitz & Unger, 2023). Prevent vertical transmission of the virus is highly effective through a regimen of 3 or 4 doses of hepatitis B vaccine administered at birth and in early infancy. In addition, vaccination during late childhood and adulthood helps stop further spread of the virus and can prevent the development of cirrhosis and hepatocellular carcinoma. The decline in the incidence of hepatitis B-related hepatocellular carcinoma has been largely attributed to widespread vaccination against hepatitis B (Gokengin et al, 2023).

Nevertheless, an effective vaccine for HIV is still a long way off. Similarly, vaccines against other STIs are still under research and development.

1.4.4 Testing, Monitoring, and Surveillance

The monitoring and testing of STIs are crucial for controlling their spread, especially since these infections often present with no symptoms or with non-specific symptoms in their initial stages.

Laboratory diagnoses mainly rely on blood, urine, or tissue samples, and considering that STIs can affect multiple anatomical parts of the body, this adds further complexity to diagnosis.

This complexity is influenced by individual factors such as gender, sexual orientation, and risk behaviors associated with sexual activity, leading to potential underdiagnosis of STIs. In addition, individuals may be affected by two or more stis simultaneously, exacerbating treatment and management challenges (WHO, 2023).

During pregnancy, prenatal screening is particularly important for preventing vertical transmission—that is, transmission from mother to fetus. This screening aims to identify and treat STIs that may pose risks to the mother and the unborn child. Timely interventions can significantly reduce the impact of the disease on pregnant women and infants, protecting maternal and child health (CDC,2023).

Testing and surveillance of specific populations are also crucial, especially for groups that are at higher risk due to biological, socioeconomic, or behavioral factors. This includes adolescents, sex workers, sexual minorities, and individuals with multiple sexual partners. Providing these groups with regular and accessible testing services not only facilitates timely detection and treatment of STIs but can also help reduce future infection risks through education and the provision of resources.

2.0 Objective

The main objective of this paper was to provide an in-depth analysis and review of the current policies, strategies and programmes in response to STIs in China. Specifically, the study aims to: 1) review the current policies, strategies and programs on STIs in China to understand their development history, implementation status and effectiveness; 2) Discuss the barriers and challenges of STIS prevention and treatment programs in China, with the aim of revealing the problems and shortcomings of the current system; 3) Based on the analysis results, targeted strategies and policy recommendations are proposed to improve the effectiveness of China's STIs prevention and control program.

3.0 Method

In order to achieve the above goals, this paper adopts the method of literature review, and uses the electronic databases PubMed, Web of Science, CNKI and WanFang Data for literature search. Keywords used in searches include various combinations of "STD," "STI," "HIV," "HPV," "chlamydia," "syphilis," "gonorrhea," "trichomoniasis," "hepatitis B," "program," "policy," "prevention," "China" and "epidemiology." The selection of these keywords aims to cover the major types of STIs, as well as aspects related to China's national conditions and epidemiological studies. The literature included original research articles, reviews, policy analyses and official health data. The literature was selected to be included in the study. The collected data were collated and analyzed, with a focus on China's STIs policy, implementation challenges, achievements and shortcomings.

Some key documents were published in Chinese, and the author translated and interpreted the relevant documents.

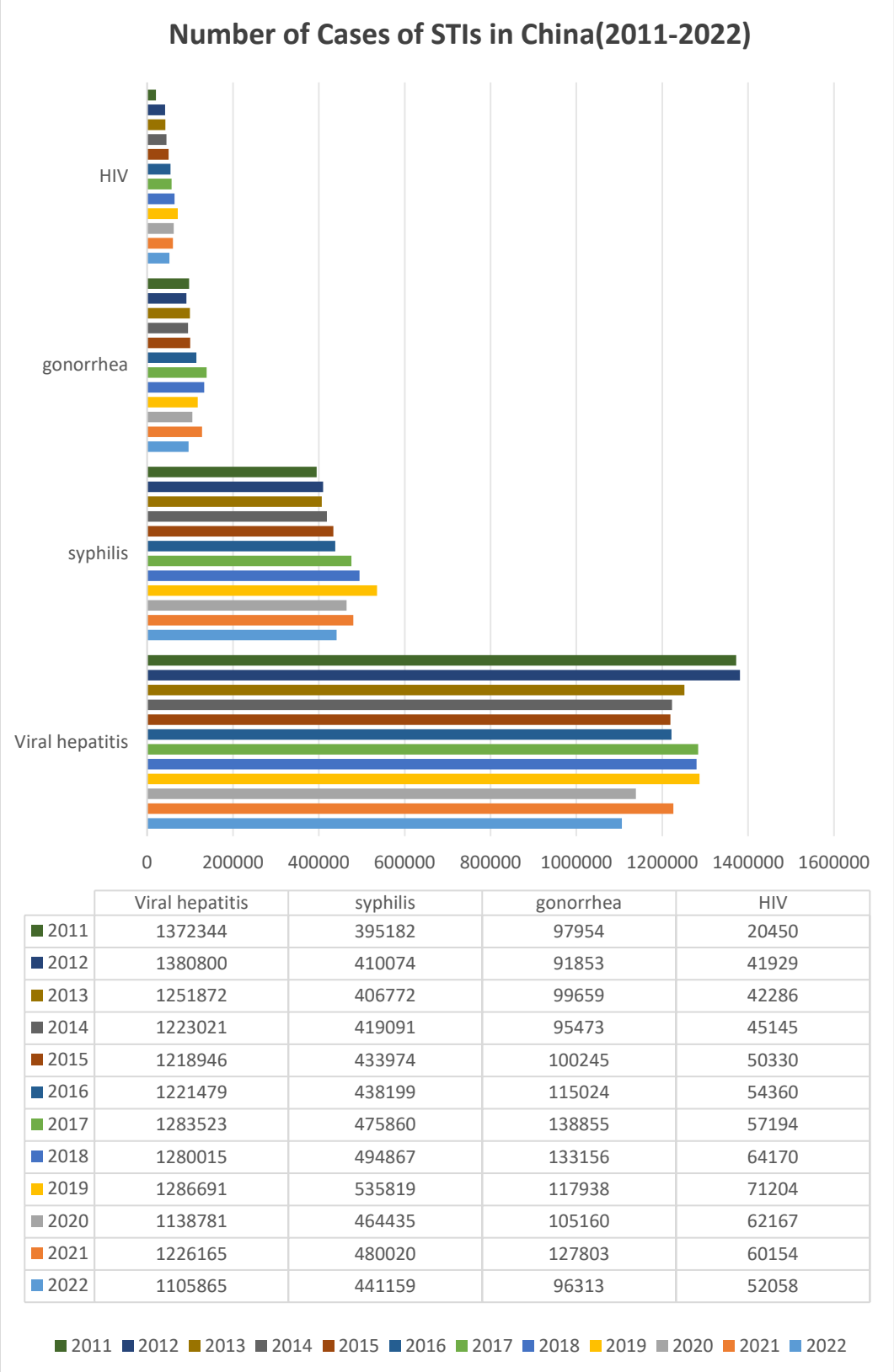
4.0 Current Status of Sexually Transmitted Infections in China

Accurate STI surveillance data are essential to develop prevention and control plans and to provide valuable measures to assess the impact of behavioural interventions and measure the likelihood of sexual transmission. Since 2004, China has been using an online direct reporting system called the China Infectious Disease Reporting Information System. According to the Law of the People's Republic of China on the Prevention and Control of Infectious Diseases, the Implementation Measures of the Law of the People's Republic of China on the Prevention and Control of Infectious Diseases, and the Law of the People's Republic of China on the Promotion of Basic Medical Care and Health, the legal infectious diseases monitored by health laws and regulations are divided into categories A, B and C according to severity. There are 40 diseases in total, among which the STIs include HIV, HBV, gonorrhea, and syphilis. These four diseases all belong to category B.

(Data on confirmed cases and deaths from 2011 to 2022 were obtained from the National Bureau of Statistics of the People's Republic of China.)

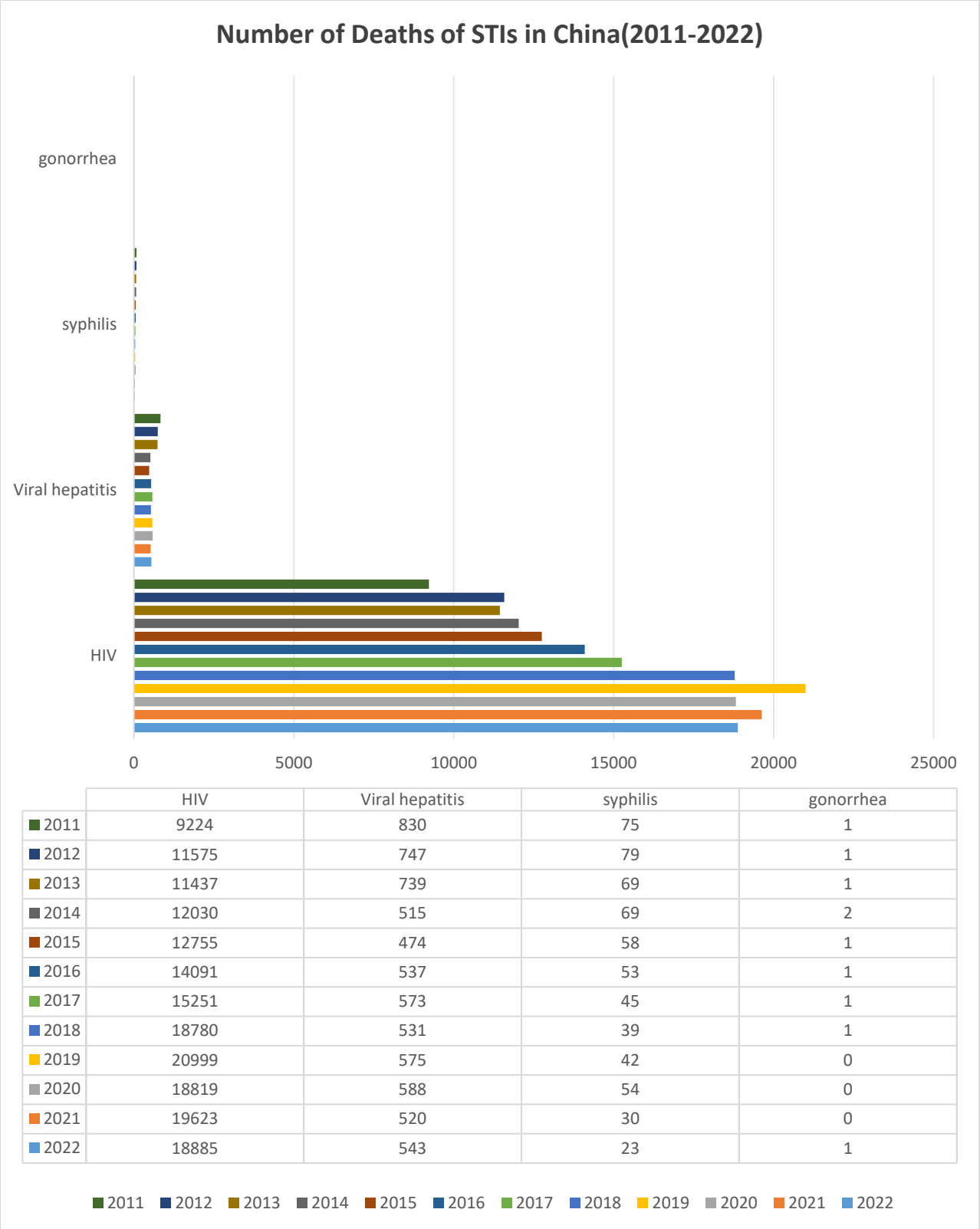
Between 2011 and 2020, the cases of HIV/AIDS infections showed fluctuations but increased overall, from 20,450 cases in 2011 to 62,167 cases in 2020. Although the number of infections has been increasing annually, the rate of increase has shown a trend of deceleration. Currently, the prevalence trend of HIV/AIDS is on a decline. Deaths caused by the HIV first increased, reaching a peak of 20,999 people in 2019, before slightly decreasing to 18,885 people in 2020. Cases of viral hepatitis have shown a declining trend during this period, from 1,372,344 cases in 2011 to 1,105,865 cases in 2020, and the number of deaths caused by it has also decreased annually. Syphilis cases have been on an upward trend since 2011, starting to decrease after 2019,

with the overall number of related deaths also showing a declining trend. Gonorrhea cases have experienced fluctuations and, although currently increasing, the rate of increase is slowing and tending to decline. The mortality rate associated with gonorrhea remains extremely low, with only single or zero death cases recorded annually(Figure 1, Figure 2).



	Viral hepatitis	syphilis	gonorrhea	HIV
2011	1372344	395182	97954	20450
2012	1380800	410074	91853	41929
2013	1251872	406772	99659	42286
2014	1223021	419091	95473	45145
2015	1218946	433974	100245	50330
2016	1221479	438199	115024	54360
2017	1283523	475860	138855	57194
2018	1280015	494867	133156	64170
2019	1286691	535819	117938	71204
2020	1138781	464435	105160	62167
2021	1226165	480020	127803	60154
2022	1105865	441159	96313	52058

Figure 1 Number of Cases of STIs in China (2014-2022)



	HIV	Viral hepatitis	syphilis	gonorrhea
2011	9224	830	75	1
2012	11575	747	79	1
2013	11437	739	69	1
2014	12030	515	69	2
2015	12755	474	58	1
2016	14091	537	53	1
2017	15251	573	45	1
2018	18780	531	39	1
2019	20999	575	42	0
2020	18819	588	54	0
2021	19623	520	30	0
2022	18885	543	23	1

Figure 2 Number of Deaths of STIs in China (2014-2022)

4.1 Statistics and Trends in the Prevalence of STI in China - HIV as an Example

The HIV epidemic in China has undergone significant changes, evolving from initial transmission among people who inject drugs (PWID) to an outbreak due to contaminated blood plasma collections in the mid-1990s. From 2004 to 2005, the Ministry of Health initiated a national HIV testing campaign targeting former commercial blood plasma donors who had donated blood or plasma in the mid-1990s. By 2015, no cases had been reported as a result of blood or plasma contamination. In 2004, China introduced methadone maintenance therapy (MMT) and needle and syringe exchange programs (NSP), which significantly reduced the transmission among drug users. By 2018, there were fewer than 4000 new HIV diagnoses annually among drug users. Currently, 95% of HIV cases in China are transmitted sexually (Wu et al., 2019). Therefore, in this paper, HIV is chosen as an example.

HIV is a special concern in China. Faced with the task of reducing the rate of new HIV infections, China has encountered many challenges, and the number of HIV infections continues to rise. This trend has been influenced by the combination of China's rapid economic development, rich ethnic diversity, vast geographical scope, and institutional changes, which together shape the epidemiological characteristics of HIV in China.

4.1.1 Gender Differences in the Incidence of HIV

Gender differences exist in biological characteristics, social roles, behavioral habits and access to health services, and these differences are particularly evident in the incidence of STIs, modes of transmission and effectiveness of preventive measures.

According to the research by Liu et al., during the study period, the prevalence rate of HIV/AIDS among men was higher than that among women, and the rate of increase was greater for men. From 1990 to 2017, men were a higher-risk group for AIDS compared to women. In 1990, the prevalence rate, incidence rate, and mortality rate for men were 8.52 per 100,000, 1.24 per 100,000, and 0.36 per 100,000, respectively, while for women, these rates were 4.05 per 100,000, 0.62 per 100,000, and 0.19 per 100,000. By 2017, the prevalence rate, incidence rate, and mortality rate for men were 65.05 per 100,000, 3.67 per 100,000, and 3.63 per 100,000, respectively, whereas for women, these rates were 23.84 per 100,000, 0.99 per 100,000, and 1.25 per 100,000 (Liu et al., 2021). It is evident from the comparison that whether it is the prevalence rate, incidence rate, or mortality rate, men had higher rates than women (Figure 3).

The research by Liu et al. also specifically focused on the unique care barriers experienced by different subgroups of Chinese men, such as men who have sex with men (MSM), men who identify as heterosexual, older men, transgender men, and male migrant workers (Liu et al., 2021). These different male subgroups face their own unique challenges and obstacles due to social, cultural, and economic factors when dealing with STIs. Particularly among the MSM group, the rates of syphilis and HIV infection are higher, which is closely related not only to sexual behavior patterns but also to the socio-cultural background and the extent of adoption of protective measures. Generally, men are weaker than women in terms of sexual health education and awareness of protection, especially in certain cultural contexts where men may increase their risk of STIs by being reluctant to use protective measures such as condoms (Liu et al., 2021).

The socio-cultural construction of gender roles also impacts the transmission and prevention of STIs. In many societies, there are different expectations and standards of judgment for male and female sexual behavior, which influence individuals' choices of sexual behavior and

the use of protective measures. For example, some societies are more tolerant of multi-partner sex male while holding stricter moral standards for women. The interaction of gender roles with the socio-cultural background not only shapes individual sexual behavior patterns but also indirectly affects the dynamics of STI transmission and the formulation and implementation of prevention and control strategies.

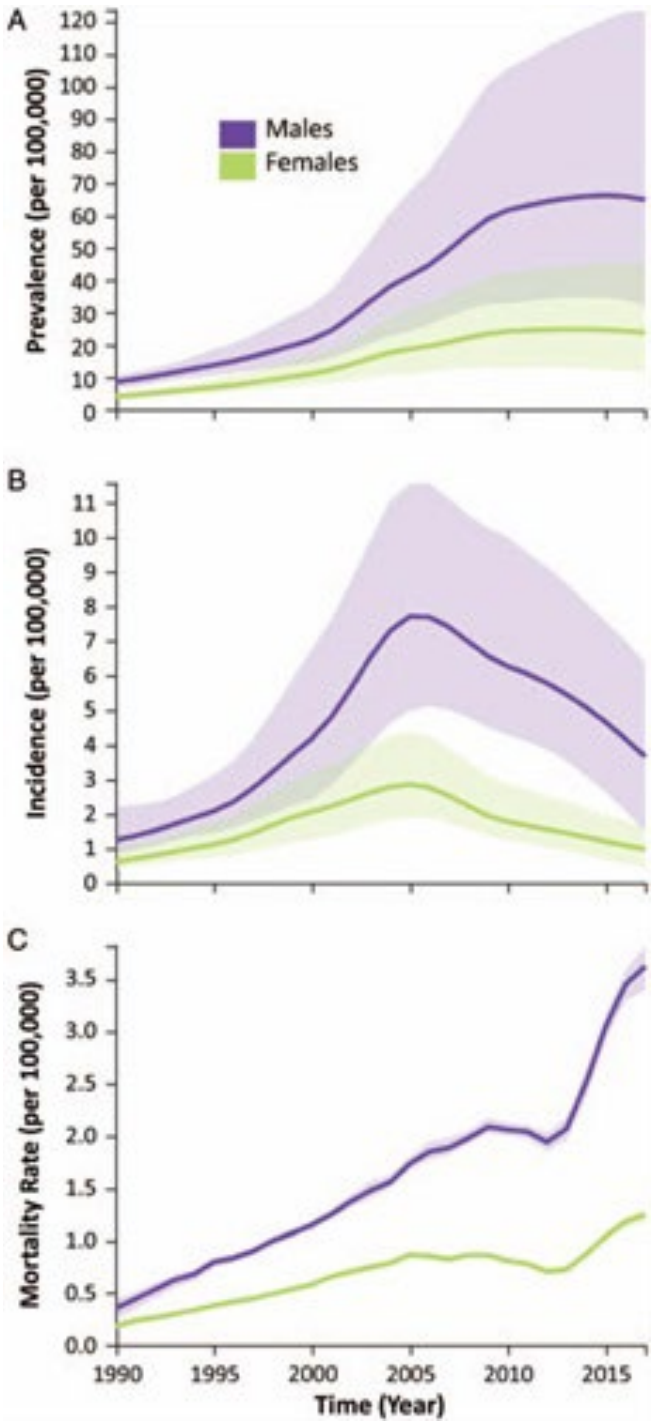


Figure 3 HIV/AIDS Prevalence (A), Incidence (B), and Mortality rate (C) by Sex, for All Ages, in China, 1990 to 2017, from the GBD, Injuries, and Risk Factors Study 2017 data. Estimated Values are Shown as Solid lines, while 95% CIs are Indicated by the Shaded Regions. CIs: Confidence Intervals; GBD: Global

Burden of Diseases; HIV/AIDS: Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome.(Liu et al., 2021)

4.1.2 Age Differences in the Incidence of HIV

In the study by Qiao et al., HIV cases were divided into three age groups: 0-20 years, 20-50 years, and over 50 years. The study found that among people aged 20 to 50, the number of HIV cases, the number of deaths related to HIV, and the number of new HIV infections were significantly higher than in the other age groups (Figure 4). Further analysis divided the 20 to 50 age range into decades, with the 20 to 30 age group showing the highest incidence rates (Figure 5) (Qiao et al., 2019).

The reason behind this finding may be that young adults are more sexually active and likely to engage in high-risk behaviors, such as not using condoms and having multiple sexual partners. At the same time, they may lack adequate knowledge and protective measures against STIs, not fully understanding how to prevent STIs or underestimating their severity. The absence or insufficiency of sexual education, especially in societies and communities where sexual education is neglected or hampered by cultural taboos, is another significant reason for the high incidence of STIs among young people.

For the middle-aged population, although the incidence of STIs is relatively lower, it should not be overlooked. Individuals in this age group may maintain relatively consistent sexual behavior patterns within stable relationships but are still at risk due to factors such as marital infidelity and establishing new relationships after divorce. Moreover, they might have insufficient knowledge and protective measures against STIs, especially if they did not receive adequate sexual education when younger.

As for the elderly population, although often overlooked in the past, recent studies have shown that the incidence of STIs is also increasing in this group. With improvements in quality of life and health awareness, the sexual activity of older adults does not significantly decrease with age. However, older adults may be more susceptible to STIs, partly because of societal and healthcare providers' biases and neglect towards senior sexual activity, leading to their lesser likelihood of seeking sexual health information and services.

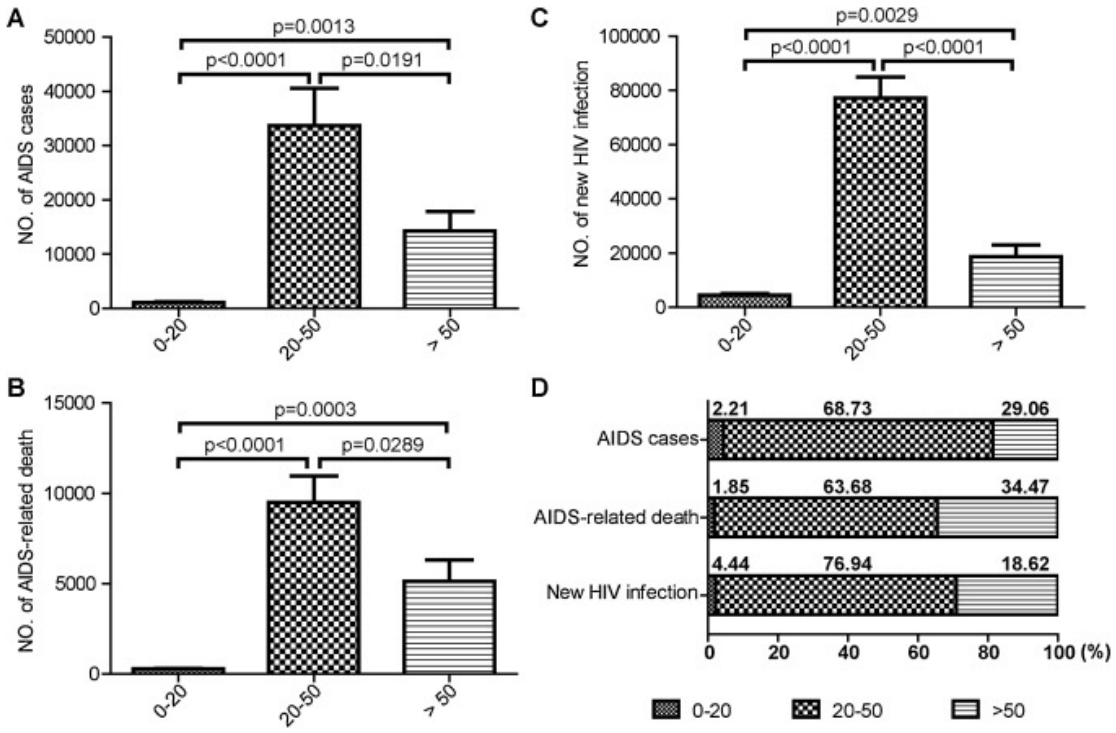


Figure 4 The Averaged Number (year) by Age Difference of AIDS Cases (A), AIDS-related Death (B), New HIV Infection (C) and Percent Distribution (D) in Chinese Populations, 2004–2016 (Qiao et al., 2019)

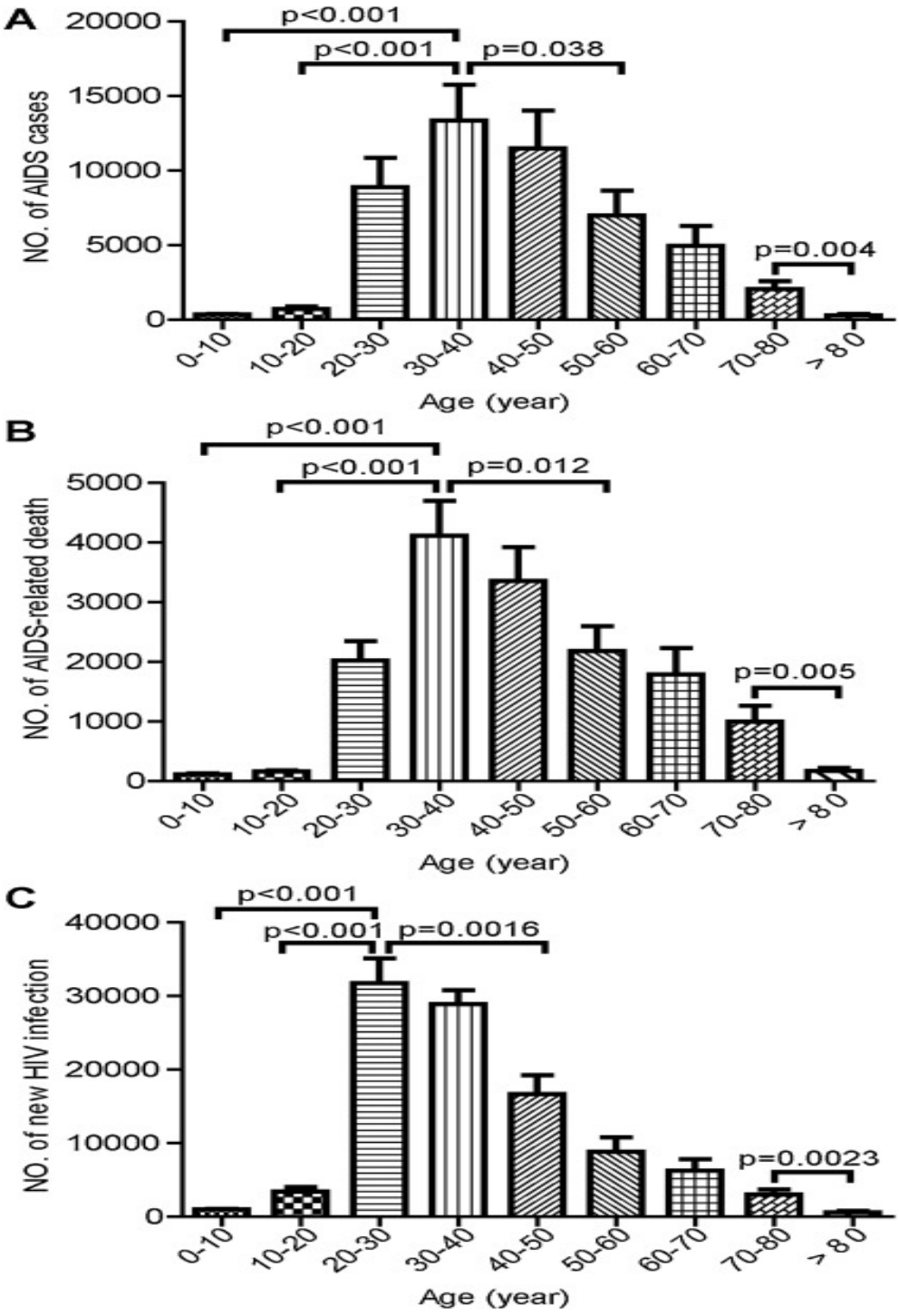


Figure 5 The Averaged Number (year) by Age Difference of AIDS Cases (A), AIDS-related Death (B) and New HIV Infection (C) in Chinese Populations, 2004–2016. (Qiao et al., 2019)

4.1.3 Regional Differences in the Incidence of HIV

In Qiao's study covering 31 regions in China, the research examined the annual growth of AIDS cases, AIDS-related deaths, and new HIV infections from 2004 to 2016. An analysis of the geographical distribution of AIDS across various regions in China (Figure 6) revealed significant regional differences, particularly higher AIDS incidence rates in provinces such as Henan, Yunnan, Guangxi, and Xinjiang, revealing a pattern of "heavier in the south and lighter in the north, higher in the west and lower in the east." Over the past 12 years, the provinces with the highest number of AIDS-related deaths were Yunnan, Guangxi, and Sichuan, especially Yunnan and Guangxi. This situation is likely linked to the relatively underdeveloped economic levels in these areas (Qiao et al., 2019).

Economic poverty directly limits opportunities for education and access to health services, particularly for low-income families who may struggle to afford sexual health education and protective measures due to financial pressure. Although the Chinese government has made significant achievements in improving public health in recent years, the low economic conditions in remote rural areas and urban slums are major barriers to the dissemination of sexual health education and the prevention of STIs. Low levels of education and lack of sexual health knowledge exacerbate these issues, making it difficult for these groups to understand the transmission and prevention of STIs.

Socioeconomic status not only affects education and health behaviors but also impacts access to medical services. Despite recent strengthening of China's public health system, medical resources are unevenly distributed, with high-quality medical resources tending to be concentrated in urban and economically developed areas. Low-income groups face difficulties in accessing medical services, affecting their ability to undergo STI screenings and receive treatment.

Individuals with low socioeconomic status may focus more on day-to-day living and neglect sexual health, especially rural residents who have limited resources and access to information about STIs. Furthermore, the high stigma and social discrimination associated with STIs may cause them to fear exclusion and hesitate to seek help and treatment.

Cultural perceptions and socioeconomic status play significant roles in the prevention, recognition, and treatment of STIs. In China, traditional sexual attitudes influence people's sexual health behaviors. Chinese society has long held conservative sexual views, and in many communities, sex remains a taboo subject. Families and schools often ignore to provide sexual education to adolescents and are reluctant for them to receive such knowledge, believing it could negatively influence them. This hinders discussions about sexual health and sexual education, further entrenching the stigmatization and misunderstanding of STIs.

With rapid economic development and urbanization, rising socioeconomic status has brought greater access to education and information for certain groups of people, changing their sexual attitudes and behaviors, raising the level of sex education and awareness of STIs, thus increasing the likelihood that they will take preventive measures and seek medical help if necessary. However, this positive change is not universal, as increased economic and social status may also lead people to adopt riskier sexual behaviors in some cases, increasing the risk of transmission of STIs. At the same time, with a large number of rural residents entering the city to seek job opportunities, a huge floating population has been formed. This high level of social mobility provides more opportunities for the spread of STIs and exacerbates the challenges of public health management.

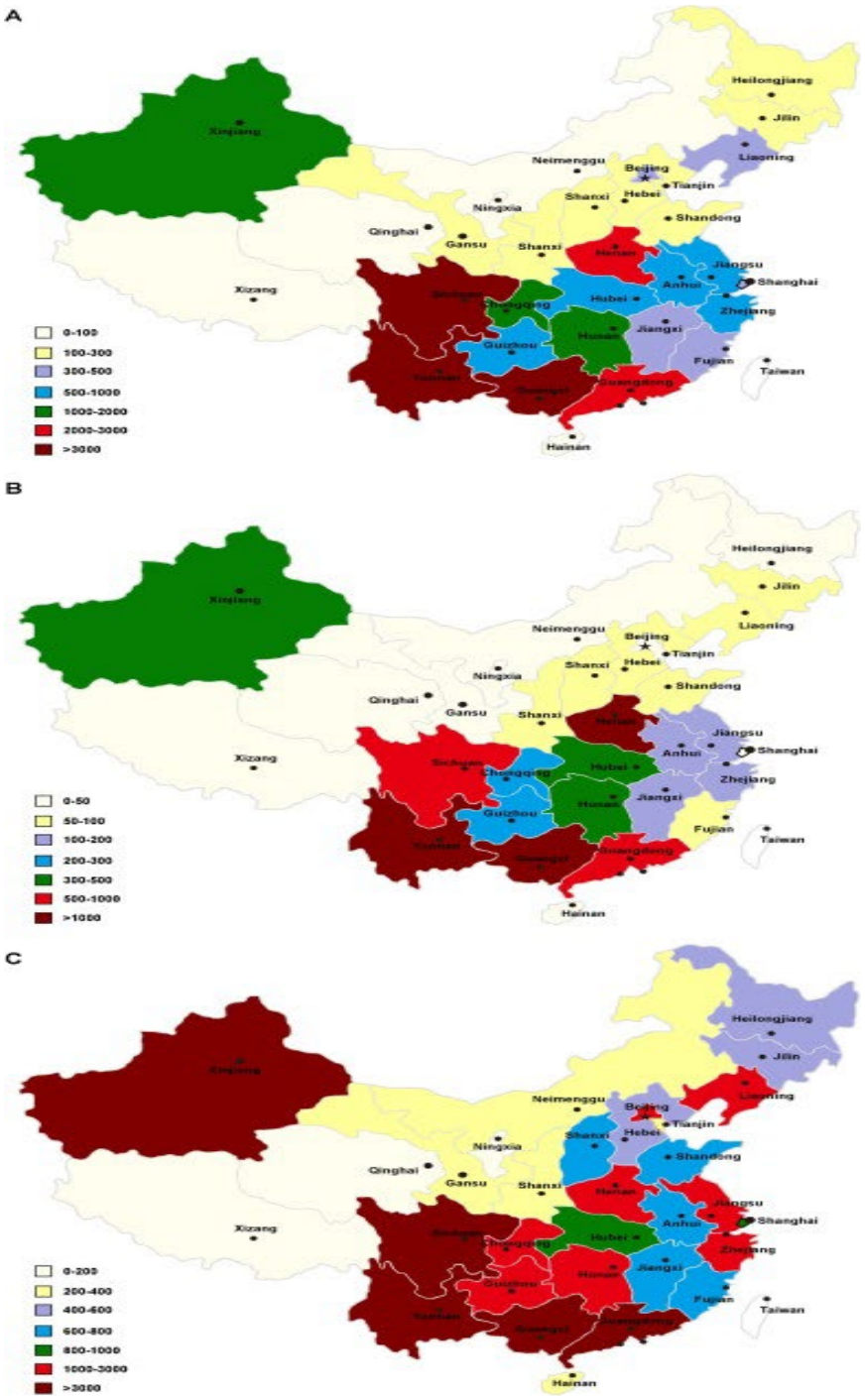


Figure 6 The Average Number (year) by Regional Distribution of AIDS cases (A), AIDS-related Death (B) and New HIV Infection (C) in Chinese Populations, 2004–2016. (Qiao et al., 2019)

4.2 Policies and Programs Related to STIs in China

With the global epidemic of STIs, the Chinese government has adopted a series of policies and programs to address this challenge, with the goal of reducing the spread of STIs and raising public awareness of these diseases. It aims to reduce the health burden of STIs through education, prevention, screening and treatment.

4.2.1 Vaccine

Vaccination programs play an important role in China's prevention and control strategy against STIs, especially against human papillomavirus (HPV) and hepatitis B virus (HBV).

4.2.1.1 HBV vaccine

China's immunization strategy began in 1985, when the plasma-derived HBV vaccine(HepB) was first approved. Subsequently, in 1992, the recombinant HBV vaccine was approved and began to be rolled out across the country. The main objective of the strategy is to cut off perinatal transmission of HBV and provide lifelong immune protection against HBV for newborns. This is done by giving newborns a birth dose of HepB vaccine, followed by two additional doses during infancy. Until 2002, the HepB vaccine was considered a Class II vaccine, which requires parents or adults to pay for. Since 2002, China has included hepatitis B in the National Immunization Program (EPI), providing free vaccines to children aged 14 and below. Between 2009 and 2011, China also carried out an additional hepatitis B vaccination campaign for children born between 1994 and 2001 who were not yet 15 years old, providing hepatitis B vaccine to about 68 million children. In 2011, China began implementing a comprehensive program for

the prevention and control of mother-to-child transmission of HIV, syphilis and hepatitis B in 1,156 counties (covering 44 percent of pregnant women), and expanded the program nationwide to cover all pregnancy in 2015 (Cui et al., 2017).

Through these measures, China has made remarkable progress in reducing the spread and chronic infection rate of hepatitis B. The implementation of these policies has greatly reduced the prevalence of hepatitis B.

4.2.1.2 HPV vaccine

In China, the first locally developed HPV vaccine was launched nearly a decade later than in some advanced countries, resulting in an estimated 114 million girls aged 9 to 14 missing out on the golden opportunity to be vaccinated against cervical cancer and its precancerous stages (Zhao et al., 2023).

Between 2016 and 2018, China successively approved three imported HPV vaccines, and the HPV vaccine was officially launched in the Chinese market. Still, the high price of these imported vaccines (about $80 to $180 per dose) and a shortage of supply have made it difficult for many Chinese women to receive them, limiting their popularity in the country. In December 2019, China approved the first domestic HPV vaccine Cecolin™ and was prequalified by the World Health Organization in October 2021, and the second domestic HPV vaccine Walrinvax™ was also approved in 2022 (Zhao et al., 2023).

At present, there are five types of HPV vaccines approved by the China Food and Drug Administration, including the bivalent domestic vaccine Cervarix, the bivalent imported vaccine Cecolin and Walrinvax, the quadvalent HPV vaccine Gardasil 4, and the nine-valent HPV vaccine Gardasil 9. These vaccines between $140 and $580 (Wang et al., 2023).

However, according to 2020 data, only 3% of Chinese women aged 9 to 45 have been fully vaccinated against HPV, and awareness of HPV vaccine is only 17% (Wang et al., 2021).

The main challenges facing HPV vaccination in China include the high price of the vaccine, the insufficient supply of domestic vaccines, the lack of awareness and willingness of the target population to vaccinate, and the lack of professional staff and high-quality and convenient services. In addition, due to the late launch and slow progress of vaccination programmes, service systems are not yet complete (Wang et al., 2023). At present, the supply of HPV vaccine is not enough to meet the short-term demand of the country, resulting in people needing to make appointments and queue for vaccination, and in addition to large cities such as Beijing and Shanghai, other small cities are especially difficult to make vaccine appointments and wait for a long time.

The HPV vaccine is not included in the national immunization program, which means that individuals have to pay for the vaccination, which costs about $254 to $576 for three doses. For young Chinese women, this cost is a big afford, often need support from their parents. In China's traditional family structure, parents usually make most of the decisions, so their attitudes and understanding are crucial to improving vaccination rates. However, many Chinese parents are currently hesitant about the HPV vaccine, lacking the necessary understanding and confidence that vaccination is not necessary.

Special attention should be given to women and girls living in areas with fewer resources, especially in rural areas. About 60 percent of cervical cancer cases in China occur in rural areas, where awareness of cervical cancer prevention and control is weak and women are less likely to proactively seek screening services.

4.2.2 Maternal Screening Policy

In China, the screening policy for pregnant women is an important part of the prevention and control strategy of STIs, which aims to detect and treat STIs in pregnant women as early as possible, so as to reduce the risk of transmission of the disease to mother and baby, and ensure the health of both.

From 2011 to 2020, the National Health Commission of China issued three versions of the Program for the Prevention of Mother-to-child Transmission of HIV, Syphilis and Hepatitis B, which includes the government's response strategies, intervention measures and organizational management requirements (Wang et al., 2021). The focus of the 2020 guideline update compared to the previous version is the resetting of goals and the addition of health education and promotion, HIV testing procedures for pregnant women, HIV infected pregnant women and antiretroviral treatment programs for pregnant women.

In addition, the Chinese Government has made significant financial investments in pre-pregnancy health services and launched a nationwide programme of free pre-pregnancy health check-ups. The plan was proposed by The State Council in 2010 and is jointly implemented by the National Health and Family Planning Commission and the Ministry of Finance. Many perinatal health experts from representative hospitals across the country agreed and co-designed the project through a series of meetings. This well-planned program provides 19 pre-pregnancy health services, including but not limited to health education, health check-ups, risk assessments and medical consultations (Xu et al., 2022). The programme also covers genital swabs (for candida, mycoplasma, chlamydia and gonorrhoea), microbiological tests for TORCH (Toxoplasma, cytomegalovirus and rubella virus), and serological tests for hepatitis B and syphilis, providing further diagnosis and treatment services for pregnant women who are found to be positive by

screening. Through these measures, the diagnosis and prevention of maternal STIs have been further strengthened.

4.2.3 Sex Education

Since China's reform and opening up, adolescents' sexual values and behaviors have undergone significant changes, triggering widespread concern about the possible public health risks caused by the mismatch between their inadequate knowledge of sex and their sexual behaviors. The report shows that the use of contraception among Chinese youth is relatively low (32.3% of unmarried women), leading to a high rate of unmarried pregnancy and induced abortion (28.13%) (Shi et al., 2022).

Although there is an urgent need for sex education, there is still a lack of consensus and constructive views on how to promote sex education in China. The Program of Action for Child Development of China (2021-2030) sets out the goal of including sexual and reproductive health education in the compulsory education system, but in practice, systematic sex education in the education system remains a challenge. Due to the traditional conservative culture, Chinese authorities also avoid using the term "sex education" directly in many official documents, preferring phrases such as "adolescent education", "health education" and "health education".

Within the education system, the inadequacy of sex education is obvious. Many schools lack specialized curricula, and teachers often avoid discussing sex education topics with parents for fear of embarrassment or misunderstanding. Even in higher education institutions, sex education teachers often lack professional training, and some even teach according to traditional Chinese sexual culture and values, which emphasize not falling in love before the age of 18 and prohibit premarital sex.

Due to the lack of sex education, most students have very limited knowledge about STIs, especially non-medical students. Understanding of infectious diseases is often limited to their severity and lethality, leading to significant stigma and discrimination against all carriers of infectious diseases, including hepatitis B and people living with HIV.

The second way for teenagers to have sex education is their parents. But Chinese parents are often not well prepared to provide their children with complete sex education. Many parents often avoid talking about it until their children are adults. As a result, many parents are completely unaware of their children's changing sexual attitudes and behaviors.

Adolescents have a natural curiosity about sex knowledge, but in the absence of proper guidance from school and home, they may turn to the Internet for information. These teenagers may get relevant knowledge from the Internet. But in an age of advanced information, the Internet is flooded with a large amount of information of varying quality, making it difficult for teenagers to distinguish between true and false, which may further affect their sexual attitudes and behaviors.

In today's China, the degree of sexual liberation of teenagers is getting higher and higher, and the trend of sexual behavior is becoming more and more similar to that of Western countries. Premarital sex and unwanted pregnancies among teenagers are on the rise. STIs, including HIV are also spreading rapidly. However, young people lack basic information about HIV/STI, how to protect themselves from these diseases, and how to avoid unwanted pregnancies.

China's lagging sex education not only affects teenagers' awareness of sexual health, but also affects their responsible attitude towards sexual behavior. Effective sex education can help young people establish healthy sexual values and increase their awareness of sexual health and STIs, thereby enabling them to make informed decisions to protect their own health and the health of others.

4.2.4 Treatment

ART can effectively provide long-term suppressive treatment against HIV and is the most effective method of treating HIV infection currently available.

The fact that people infected with HIV who are virally suppressed cannot sexually transmit the virus to others is now accepted in the HIV/AIDS community as a result of accumulating evidence since the early 2000s. In early 2016, the Undetectable=Untransmissable (U=U) slogan was launched by the Prevention Access Campaign to promote the finding (The Lancet Hiv, 2017).

In 2003, the Chinese government announced its “Four Frees and One Care”policy, which provided free ART to all PLWH, free voluntary counseling and testing, free prevention of mother-to-child transmission (PMTCT) services, free schooling for children orphaned or otherwise affected by HIV or AIDS, and economic assistance to households of PLWH (Tang et al., 2022)

Although the enactment of the "Four Frees and One Care" policy and the relaxed guidelines on the timing of treatment allow all HIV-positive individuals with a desire for treatment to receive free ART at designated hospitals, the types of free drugs provided by the state are relatively limited. If patients do not adhere well to their medication regimen, it may lead to the spread of resistant strains within the population (Tang et al., 2022).

Currently, there are several policies that provide subsidies for HBV patients. However, other sexually transmitted diseases, such as gonorrhea and syphilis, require pay the fee by themselves.

5.0 Discussion

China's lagging sex education not only affects teenagers' awareness of sexual health, but also affects their responsible attitude towards sexual behavior. Effective sex education can help young people establish healthy sexual values and increase their awareness of sexual health and STIs, thereby enabling them to make informed decisions to protect their own health and the health of others.

5.1 Increasing and Expanding Sex Education and Awareness

In China, strengthening sex education and raising sexual awareness are crucial to the prevention and control of STIs. In the face of the growing challenges of STIs, a comprehensive, science-based and open sex education system is of great significance to enhance individuals' ability to protect themselves, promote public health, and reduce the burden of healthcare in society.

At present, there are obvious deficiencies in sex education in China. According to the 2017 Adolescent Sexual and Reproductive Health Knowledge Survey, the average correct answer rate of participants was only 53% (Zhao et al., 2019). In addition, a study of college students with sexual experiences found that 18% of respondents did not know how to properly use condoms, while 44% had questions about contraceptive use (Liu et al., 2016). These data reflect that there is still much room for improvement in the popularization of sexual knowledge in China. As for the popularity and acceptance of LGBTQ+ related knowledge, it is a new field that has only begun to

be concerned by the society in recent years, and relevant research and public attitudes are insufficient.

At the same time, it is important to provide professional training on sexual health education for teachers and health workers to ensure that they are equipped to provide accurate information and support to students and the public, and can deliver sex education more confidently and effectively. In addition, the involvement of parents, teachers and other adults is also essential to building a comprehensive sex education network, through lectures, seminars and interactive workshops, which can effectively upgrade their knowledge and skills in sexual health education and provide an open and honest discussion environment.

Considering the development of information technology in today's society, the Internet has become the main channel for people to obtain information. In some Western countries, many reliable websites provide scientific information about sex, sexuality, or STIs. However, in China, the quality of information on many Chinese websites is uneven and often mixed with pornographic information, which cannot effectively provide useful popular knowledge about sexual health (Lyu et al., 2020).

Therefore, when using various platforms such as television, Internet and social media to carry out public publicity activities, attention should be paid to the scientific and targeted information, while ensuring that the way and language of information dissemination can be easily understood and accepted by different groups. Through these diversified and high-quality education strategies, public awareness of sexual health can be effectively raised, thus promoting the overall progress of Chinese society in the field of sex education and sexual health.

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5.2 Increasing Screening and Services

In China, strengthening screening for STIs and improving service quality are crucial strategies to curb the spread of STIs. Although the government has implemented several measures, such as the free provision of condoms in areas with high population movement, the addition of vending machines and the widespread placement of condoms in public places, to raise public awareness of the importance of preventing STIs and to encourage safe sex, these efforts still face challenges. Especially in some areas, such as Yunnan, Xinjiang, Henan, Shanghai, and Shenzhen, condom use is low, with 75% of study subjects not using condoms in the three previous sexual encounters before infection and the last three sexual encounters after infection (Wu et al., 2020).

In addition, access to high-quality STIs care is difficult, especially in less developed regions, leading to an increased risk of undiagnosed and untreated STIs (Si et al., 2024). Unequal distribution of medical resources and economic differences between regions further aggravate this problem (Li et al., 2018). Therefore, increased investment in public health, especially in screening, treatment services and training of health personnel, is essential to improve the quality and coverage of services, especially for high-risk groups and residents in remote areas.

According to the guidance of the NHC, China is currently working to improve the testing strategy, expand the scope of testing, and strengthen the promotion of condom use. Additionally,

in China, free widespread testing is currently available only for HIV, and there are subsidies for HBV testing. However, for sexually transmitted diseases such as syphilis, gonorrhea, and chlamydia, free counseling and testing services are available only at the Voluntary Counseling and Testing (VCT) clinics at local Centers for Disease Control and Prevention. In hospitals and clinics, individuals must pay for these services themselves. Therefore, it is necessary to expand and improve testing, as well as to provide a broader range of free counseling and testing services, in order to increase screening coverage.

Governments and NGOs are strengthening the capacity of health workers through professional training, while using digital health platforms such as online counselling, Internet appointment testing services and self-testing tools to increase screening coverage and accessibility, and reduce the psychological barriers to STIs screening among the public. These measures are designed to ensure that the public can easily access professional medical services in conditions that guarantee privacy.

Further, for China, the exploration of new mechanisms to effectively integrate telemedicine platforms and traditional face-to-face care may provide more convenient and efficient services for patients, while having a profound positive impact on the overall health system (Si et al., 2024).

5.3 Technology and Innovation

In China, technological innovation and scientific advances have played a central role in the strategy to address STIs, greatly enhancing the effectiveness of STIs prevention and treatment, while making prevention and treatment services more accessible and efficient for the public.

National vaccination programmes are one of the most cost-effective ways to prevent and control STIs. China now includes hepatitis B vaccine in the national immunization program and provides free vaccination for children 14 years of age and younger, a policy that has significantly reduced HBV transmission and chronic infection rates, demonstrating remarkable achievements in controlling the spread of HBV in China (Gokengin et al., 2023).

However, at present, HPV vaccination has not been included in the national immunization program, and future governments should consider including HPV vaccines and explore innovative pricing and financing mechanisms to address the high cost of vaccines (Wang et al., 2021). For domestic HPV vaccines, given their relatively low cost, increasing their production and improving the development process will make the vaccine affordable and safer for more people, especially in economically constrained situations.

The development and popularization of rapid diagnostic technologies, especially portable test kits designed for primary care facilities and resource-limited areas, can improve the early detection rate of STIs and ensure timely treatment. In addition, in view of the growing problem of antimicrobial resistance, it is particularly important to improve the awareness of antimicrobial resistance, strengthen surveillance research and optimize antimicrobial use (Tien et al., 2020).

At the same time, the use of the Internet and new media platforms provides a new way for the prevention and treatment of STIs. The development of a professional online consultation platform enables the public to obtain accurate information directly from medical experts, solving the accuracy problem that people may encounter when looking for health information on the Internet. Healthcare workers spread sexual health knowledge through platforms such as TikTok, wechat public accounts and Weibo, which are easily accessible and have become effective

channels for delivering health information. However, the information control of the platform also needs more attention and control.

5.4 Address Stigma and Discrimination

One of the keys to challenging transmitted diseases (STIs) in China is overcoming the stigma and discrimination associated with them. The social stigmatization of STIs not only harms the mental health of patients, it also greatly reduces the public's willingness to undergo screening, treatment, and preventive measures.

HIV and STIs are highly stigmatized diseases in China. It is reported that 60%—80% of adults living with HIV have made at least one statement about HIV-related stigma. People living with HIV (PLWH) face internal or public stigma, such as shame for having HIV, being the target of malicious gossip, and discrimination in their living environment (Zhang et al., 2022).

The nature of China's social and ecological environment contributes to the fear that HIV/STI will have a negative impact on one's social status and relationships. Expected attitudes and behaviours towards people with HIV/STI and their close partners have a powerful and significant impact on related health-seeking behaviours. Therefore, individuals will go to great lengths and accept serious risks and/or consequences to avoid exposing themselves to others engaging in risky sexual behavior (Lieber et al., 2006).

To address these issues, China governments need to strengthen and enforce anti-discrimination laws and regulations to protect people with STIs from discrimination and stigma. At the same time, policies should encourage and support public education programs and community initiatives to create a more supportive and understanding social environment. In

medical schools and public health training, education of future medical and public health professionals should be strengthened, focusing on the medical knowledge, humanistic care and communication skills of STIs to make them advocates against stigma and discrimination.

In addition, it is essential to change society's negative perceptions of STIs by disseminating positive messages through multiple channels such as education, culture and entertainment. This includes strengthening sexual health education in schools and accurately presenting STIs knowledge and contexts in film and television productions. At the same time, the advantages of digital technology and social media should be exploited to develop interactive and engaging educational tools and platforms that make sexual health knowledge more accessible to the public, especially young people.

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