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Rebound in sexually transmitted infections after the COVID-19 pandemic

Vicente Soriano[1], Hilario Blasco-Fontecilla[2], Lucía Gallego[3], José V. Fernández-Montero[4], Carmen de Mendoza[5], and Pablo Barreiro[6]*

[1]UNIR Health Sciences School and Medical Center, Universidad Internacional de La Rioja, Madrid; [2]Department of Psychiatry, Puerta de Hierro Research Institute and University Hospital, Majadahonda, Madrid; [3]Department of Psychiatry, San Carlos University Hospital, Madrid; [4]Internal Medicine Department, Complexo Hospitalario Universitario de Santiago, Santiago de Compostela; [5]Department of Internal Medicine, Puerta de Hierro Research Institute and University Hospital, Majadahonda, Madrid; [6]Regional Public Health Laboratory, Emergency Hospital Isabel Zendal, Madrid. Spain

Abstract

Sexually transmitted infections (STIs) have become the second in the global rating of infectious diseases after respiratory infections. Globally, over 1 million, new STI is diagnosed every day. Although four conditions are the most representative and of obligatory declaration (gonorrhea, syphilis, chlamydia, and human immunodeficiency virus [HIV]), there are many other prevalent STI, including trichomona, herpes simplex, papillomavirus, and viral hepatitis. Herein, we perform a narrative and retrospective review, analyzing information from public databases from distinct Spanish government institutions. STI significantly declined in Spain during 2020 as a result of lockdown and social isolation measures dictated in response to the COVID-19 pandemic. After releasing restrictions, a major STI rebound occurred in 2021. Increases were 49% for gonorrhea, 45% for HIV, 39% for chlamydia, and 32% for syphilis. Based on nationwide statistics, we build a narrative review of the recent STI surge after COVID-19. In summary, we propose a holistic approach to confront the current re-emergence of STI. On one hand, new innovative medical advances must be implemented, including new rapid tests, novel vaccines, pre-exposure prophylaxis beyond HIV, and long-acting antivirals. On the other hand, information to citizens needs to be reformulated with interventions aimed to build a healthier society, alike it has been undertaken with tobacco, alcohol, diet, and lifestyle. STI determines important sexual, reproductive, and maternal-child health consequences. To promote human well-being or flourishing, the education of adolescents and young adults should be aligned with human ecology. Therefore, it is urgent to address new approaches in sexual health that represent a clear benefit for individual persons and society. In this way, favoring a cultural evolution aimed to delay the age of first sexual intercourse and the avoidance of multiple sex partners should be prioritized.

Keywords

Sexually transmitted infections. Monkeypox. Pelvic inflammatory disease. Infertility. Human ecology. Cultural evolution. Flourishing. HIV. Gonorrhea. Syphilis. Papillomavirus. Chlamydia. Trichomona. Hepatitis B. Men having sex with men. Pre-exposure prophylaxis.

***Correspondence to:**
Vicente Soriano
E-mail: vicente.soriano@unir.net

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Introduction

The 21st century has seen a global resurgence of sexually transmitted infections (STI). Since the lowest rate achieved in the late 1990s, yearly cases of gonorrhea, syphilis, and chlamydia infections have increased substantially in high-income countries[1-3]. The World Health Organization (WHO) reports that over one million people become infected every day with any of the four main curable STI, namely, trichomoniasis, chlamydia, gonorrhea, and syphilis[4].

The rising of STI has important sexual, reproductive, and maternal-child health consequences. Both acute and long-term complications account for a large health burden (Table 1) that goes from genital lesions or discomfort to pregnancy complications, infertility, fetal malformations, enhanced risk of human immunodeficiency virus (HIV) transmission, psychological/psychiatric symptoms, and social harm, including family disruption and jobless[5-8].

More than 30 different bacteria, viruses, parasites, and fungi are known to be transmitted through sexual contact (Table 2). The list of STI agents is growing as diagnostic tools improve and new epidemiological scenarios appear. The recent outbreaks of acute hepatitis A[9], hepatitis C[10], and human monkeypox[11,12] in men who have sex with men (MSM) are good examples. Emergence of drug resistance is another troublesome issue, especially for gonorrhea[13] and *Mycoplasma genitalium* infection[14].

Since the majority of STI does not cause immediate symptoms or only mildly, they often go unrecognized. This is particularly true for women, in whom STI is initially more often asymptomatic. However, STI may be associated with serious reproductive consequences, as a result of pelvic inflammatory disease, including infertility, ectopic pregnancies, or spontaneous abortion[5,15].

During pregnancy, STI can cause fetal or neonatal death, premature delivery, neonatal encephalitis, eye infections, and pneumonia. The WHO estimates that over one million pregnant women are yearly infected with syphilis resulting in roughly 350,000 adverse birth outcomes[4].

In adults, the prevalence of STI extends to nearly one-third of the whole population[16]. While bacteria and parasites generally produce acute clinical syndromes, most STI viruses produce chronic infections. Moreover, whereas all four major STI bacteria/protozoa produce curable conditions, most viral STI cannot be eliminated. Finally, while reinfections may occur with all bacteria following repeated new sexual exposures, recurrences for viruses are only seen with herpes simplex virus or more rarely as flare-ups in chronic hepatitis B carriers. Another two prevalent STI viruses, namely, HIV and human papillomavirus (HPV), in the absence of any therapeutic intervention, may progress to immunodeficiency (AIDS) or anogenital cancer, respectively.

Current STI rebound

At the beginning of the new millennium, the WHO and UNAIDS recommended the ABC strategy to confront the alarming advance of the HIV pandemic. These international organizations highlighted that abstinence (A), be faithful (B), and condom use (C), in a stepwise model, should be implemented to curve down the AIDS pandemic[17]. Changes in behavior were successful in some African countries, such as Uganda, mostly as a result of reducing sex partners[18]. However, in places where prevention was only focused on condom use, a compensatory risk phenomenon occurred. Ultimately, the false sense of security using condoms precluded to gain the benefit on HIV prevention derived from reducing sexual promiscuity[19,20].

Around 2010, another major breakthrough occurred in HIV prevention. Antiretrovirals given to uninfected persons engaged in high-risk practices were shown to drastically reduce HIV acquisition[21]. Since then, HIV pre-exposure prophylaxis has scaled up globally, especially among MSM and sexual workers[22].

During the last decades, significant declines in new HIV infections have been noticed, as a result of pre-exposure prophylaxis and the wider use of antiretroviral therapy by HIV-infected persons. Since suppression of viral replication is associated to lack of infectiousness (U = U, undetectable = untransmittable)[23], nowadays, the medication is given to all diagnosed individuals as soon as possible[24]. New HIV infections have declined from almost 3 million yearly by 2000-1.5 million in 2021. This reduction has been accompanied by a large increase in access to antiretroviral treatment from 560,000 to 28.7 million[23]. However, we and others have stressed that declines in new HIV infections are slowing down[25]. Hence, new strategies are needed to push down further new incident HIV cases. In the absence of HIV vaccines, behavioral interventions seem to be the most valuable[26-28].

The major driver of the alarming STI rise during the new millennium has been paradoxically the awareness on the effectiveness of HIV therapy. The huge success of antiretroviral therapy as a treatment of HIV infection and as

Table 1. Major clinical manifestations of sexually transmitted infections

	Acute	Long-term
Bacteria	– Purulent genital exudate – Urethritis – Vulvovaginitis – Proctitis	– Pelvic inflammatory disease (infertility, ectopic pregnancy, etc.) – Tertiary syphilis: neurosyphilis, aortitis
Viruses	– Ulcers – Vesicles – Rash – Lymphadenopaties	– AIDS – Cirrhosis, liver cancer – Cervical cancer, anorectal cancer, oropharyngeal cancer

Table 2. Main sexually transmitted agents

Viruses	Bacteria	Parasites	Fungi
– HIV – HTLV-1 – Papillomavirus – Hepatitis A, B, C and D viruses – Herpes simplex 1 and 2 – MPXV	– Treponema pallidum (syphilis) – Neisseria gonorrheae – Chlamydia – Micoplasma	– Trichomona – Scabies – Pediculosis	– Candida

prevention for uninfected individuals at risk has resulted in a loss of fear to HIV, especially among the youth. HIV is no longer seen as a deadly illness for preventing HIV acquisition[29]. By risk compensation and especially among MSM, it has been associated with less condom use and sex with multiple partners[30,31]. Alike, adolescents and young adults are engaged nowadays more frequently in risky sexual behaviors than in the past[32].

Lack of proper attention to STI has been fueled more recently by new challenges, as shown in Table 3. The impact of internet as facilitator of sexual contacts by apps and websites is huge[33,34]. Alike, the massive access to pornography, especially by adolescents and young adults, has influenced sexual relationships, with increasing violence[35]. The use of recreational drugs (*chemsex*) for behavioral disinhibition and longer sexual encounters is another factor that has fueled STI spreading[35,36]. Substance abuse, including drugs and alcohol, also favors the engagement in sexually risker behaviors. Finally, large population movements associated with wars, refugees, and poor socioeconomic conditions favor sexual violence[37]; and commercial sex is nowadays on the rise as never before by frequent traveling and sexual tourism[38].

The rapid surge of COVID-19 in March 2020 was an unprecedented phenomenon. As a result of lockdown and social isolation measures dictated in 2020 to ameliorate the pandemic, STI significantly declined. After releasing restrictions and introducing COVID-19 vaccines, a major STI rebound occurred in 2021. We will discuss below the data from Spain, in an attempt to bring light about which factors contribute to the alarming STI surge and which could be the most appropriate responses.

Table 3. Current challenges for sexually transmitted infections

- Early onset of sexual activity
- Multiple sex partners
- Risker sexual behaviors (anal sex, etc.)
- Diagnosis delays, often associated to paucity/lack of symptoms
- Emergence of drug resistance
- Internet and sex-seeking websites (pornography, etc.)
- Chemsex and substance abuse

STI trends in Spain

Updated nationwide figures for STI have recently been released[39]. It is noteworthy that steadily increases

for almost all STI have been noticed during the last couple of years. However, a significant drop occurred in 2020 as a result of the COVID-19 pandemic. Abruptly, medical services were disrupted and lockdowns precluded that most individuals in need attended health services. On the other hand, social isolation reduced the chances of relationships.

In Spain, as in other high-income countries, the advent of SARS-CoV-2 vaccines in earlier 2021 transformed the pandemic scenario[40]. Soon thereafter social life was largely resumed. The release of restrictions was accompanied by a significant surge of STI in 2021 (Fig. 1). Increases were of 49% for gonorrhea, 45% for HIV, 39% for chlamydia, and 32% for syphilis.

The 2021 rates of STI for 100,000 persons in Spain, a 47 million country population, were as follows: 50 for chlamydia, 33 for gonorrhea, and 14 for syphilis. Estimates for HIV were 6 but are expected to rise to 7.4 after accounting for delays in reporting[41]. Moreover, since HIV causes a chronic lifelong infection, prevalence rates may be more informative than incidence cases. The estimated current prevalence of HIV infection in Spain approaches 0.4%, one of the highest at the European Union.

Before the summer of year 2022, the human monkeypox outbreak exploded from epicenters in Spain, UK, and Portugal[11,12]. Within 3 months, the virus extended overseas, affecting mostly MSM. Daily cases were over 1000 during a few weeks in August 2022. Out of 87,000 cases confirmed worldwide, 7550 had been reported in Spain. Thanks to rapid intervention with information and vaccination of individuals at risk, 8 months later, the pandemic has been abated (Fig. 2).

Sexual behaviors in Spain

The Spanish government releases periodically data on several attitudes and behavior of adolescents and young adults. In the latest report (INJUVE-2020), information on sexual orientation and behavior was recorded for presential interviews of 5000 individuals with ages between 15 and 29 years old[42]. Overall, 77.5% reported to be heterosexual, 8.6% bisexual, and 8% homosexual. The rest either did not respond (5.6%) or acknowledged that they had not sexual orientation (0.4%) (Fig. 3).

When the data were split out by biological sex, women reported to be bisexual significantly more frequently than men (12% vs. 5%). In contrast, homosexuality was acknowledged more frequently by male than female (10% vs. 6.1%). Finally, whereas 80% of male acknowledged to be heterosexual, it was 75% for women.

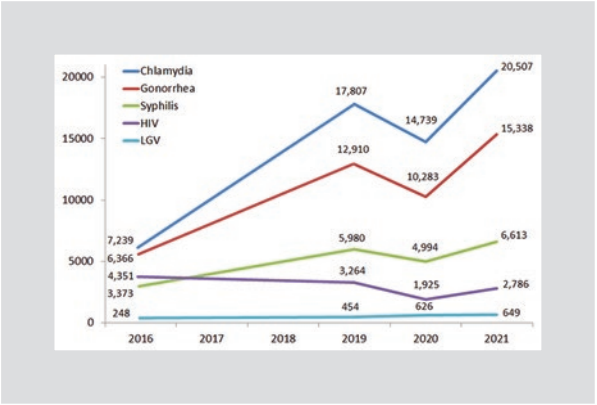

Figure 1. *Reported cases for major sexually transmitted infections in Spain.*

It is noteworthy that 72% reported having had sexual relations, being only 50% in the age group of 15-19 years. Among those who acknowledged having had sexual relationships, the mean age at first sexual intercourse was 16 years old, with no significant differences between male and female (Fig. 4). Overall, 73% of youth interviewed reported condom use.

Interventions to curve down STI

The WHO defines health as a "*state of complete physical, mental, and social well-being*"[43]. Hence, it refers to a broader conception of human being, where both physical and psychological aspects are taken into account. This definition is more aligned what is now understood as human flourishing[44-47]. There is no doubt that sexuality is a dimension of human being for which flourishing could be a good approach to deal with. Developments in this sense are similarly related to human ecology, as this discipline pursues the care of human being as a special part of nature[48]. Within this framework, individuals with mental disorders are particularly at risk for STI, as they more frequently have sexual partners for < 1 day and are more vulnerable to be pressed into unwanted sexual intercourse[49].

We propose a holistic approach to confront the current re-emergence of STI. Our recommendations are based on a renewed consideration of all factors that influence human sexuality. Interventions could be grouped into three major categories, reinforcement of classical strategies, introduction of new medical advances, and educational and behavioral strategies (Table 4).

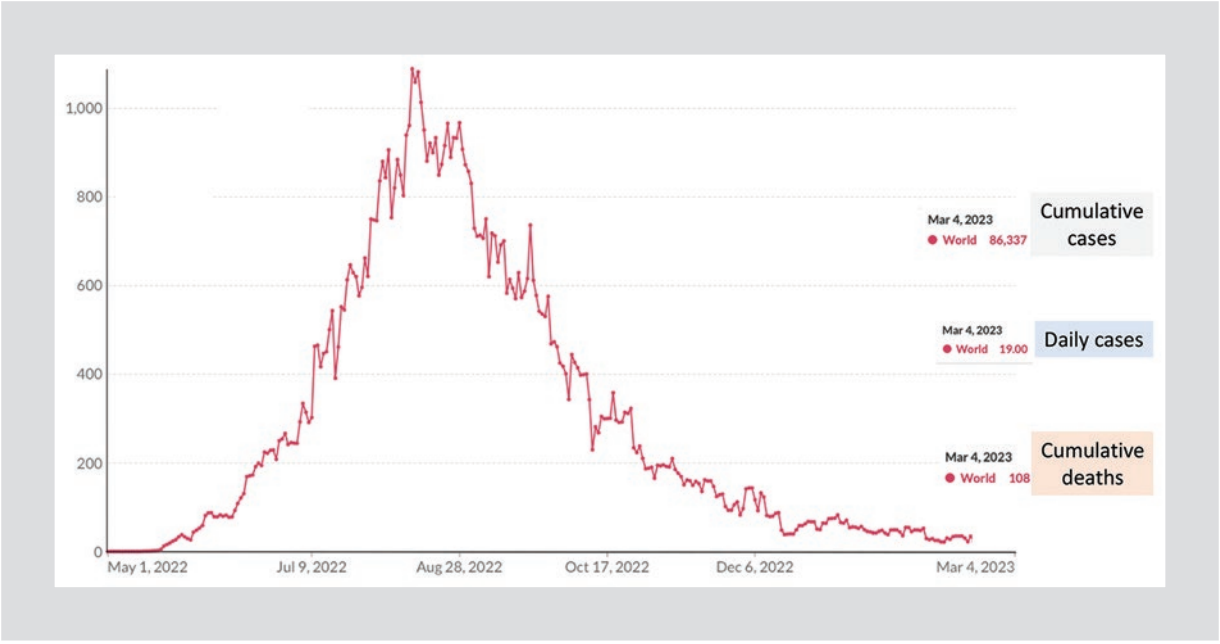

Figure 2. *Global outbreak of monkeypox (2022).*

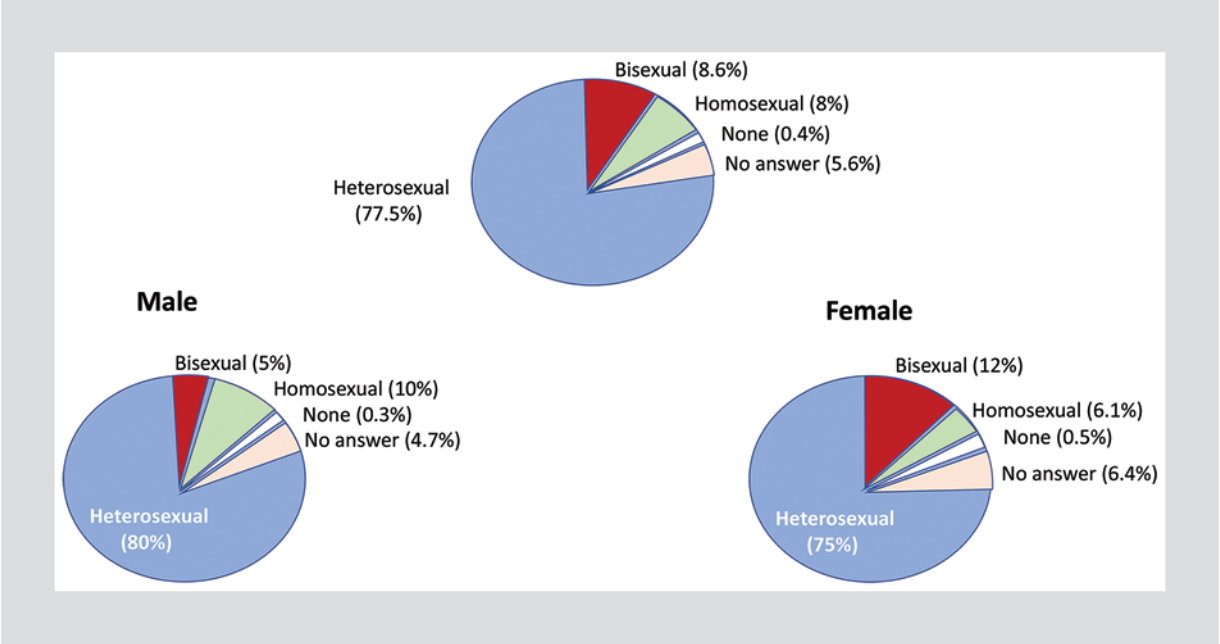

Figure 3. *Sexual orientation of adolescents and young adults in Spain.*

First, reinforce measures that already have demonstrated to work, including periodic STI screening[7], test-and-treat strategies, condom use, pre-exposure prophylaxis, and expand vaccination[3,29]. With respect to vaccine uptake, it is surprising the low rate of immunization for hepatitis B or papillomavirus noticed in recent surveys in at risk populations[50].

Second, new innovative medical advances must be assessed and, if efficacious, implemented. These include new rapid tests, novel vaccines (i.e., using mRNA technologies), pre- and post-exposure prophylaxis beyond HIV (i.e., using doxycycline)[51-53], and long-acting antivirals[54-56].

Finally, education and information to citizens need to be reformulated with interventions aimed to build a healthier

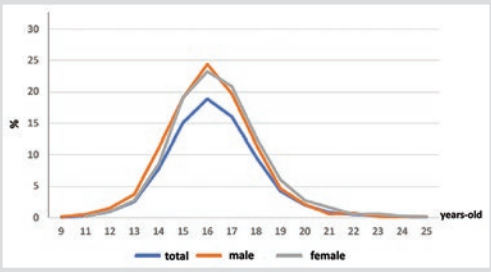

Figure 4. *Mean age at first sexual intercourse in Spain.*

Table 4. Interventions to curve down the re-emergence of sexually transmitted infections

- Reinforce classical messages
  - Test-and-treat
  - Universal vaccination
  - Condom use
  - Avoid chemsex, drugs, and alcohol abuse
- New medical approaches
  - Frequent periodic screening
  - Rapid tests (point-of-care)
  - New vaccines (mRNA, etc.)
  - Long-acting antivirals
- New educational strategies
  - Delay age for first sexual intercourse
  - Promote monogamy and avoid multiple sex partners
  - Avoid internet sex-seeking websites and pornography

society, alike it has been undertaken with tobacco, alcohol, diet, and lifestyle. Indeed, changes in lifestyle have a potential for reducing mortality by 43% whereas medical care improvements may contribute with only 11%. However, in countries such as the United States, only 1.5% of resources are invested for modifying lifestyle habits, being 90% used in providing medical services[57].

To promote well-being or "flourishing", the education of adolescents and young adults should be well aligned with human ecology, being the meaning of sex embraced within the respect to others and human love[58,59]. Therefore, it is urgent to address new approaches in sexual health that represent a clear benefit for individual persons and society. In this way, favoring a cultural evolution tended to delay the age of first sexual intercourses[60,61] and the avoidance of multiple sex partners must be prioritized.

Two new phenomena have fueled the recent increase in STI rates in unprecedented ways. The first is the wide use of internet and electronic devices. The consequences of the massive use of internet and social networks among young people are only beginning to emerge. Most likely we are seen only the tip of the iceberg[62].

The second phenomenon is substance abuse. There is no doubt that substance abuse and chemsex trigger sexual risk behaviors and STI rates[33]. Likewise, internet websites provide an easy way to find casual sex partners. Ultimately, the distortion in the meaning of sex by consumers of drugs and pornography frequently results in mental illnesses, especially among the youngest age groups[63,64].

Sexual addiction afflicts people having paraphilic or non-paraphilic behaviors associated with risk-taking sexual behaviors, loss of control, and significant adverse psychosocial consequences, such as unplanned pregnancy, pair-bond dysfunction, marital disruption, and STI[29]. Compulsive sexual behavior and dependence may impact on daily performance compromising job productivity and social skills, which in turn, may favor more depression, anxiety, and anti-social personality disorders[65]. This is particularly true among adolescents and young adults[66] and in MSM[67,68]. Ultimately, an increased risk of suicide is seen in adolescents in association with sexual addictive behaviors[69,70].

Modern evolutionists have distinguished two forms of evolution, referred as biological and cultural (Fig. 5). Major transitions over time, such as the emergence of multicellularity and of sex, are well established. The most recent major transition is the emergence of human culture. Cultural evolution refers to temporal changes in species populations that occur beyond biological determinants[71]. Social learning and the transmission of cultural traditions are much more widespread in the animal kingdom than earlier suspected, affecting numerous forms of functional behavior and creating a secondary form of evolution, built onto the better-known primary, genetically based form[72]. Social learning leads to the spread of a behavior to other individuals, which is what defines cultural transmission, and the establishment of traditions that come to characterize whole groups. Human culture is exceptional and by far extends biology[71].

In this postmodern era in which people are characterized by a lack of critical sense[73], and spread of misleading health information in social networks and unofficial communication channels is the rule[74], adolescents and individuals with mental disorders are more vulnerable and susceptible to exploitation and manipulation in any matter, including information about STI[75].

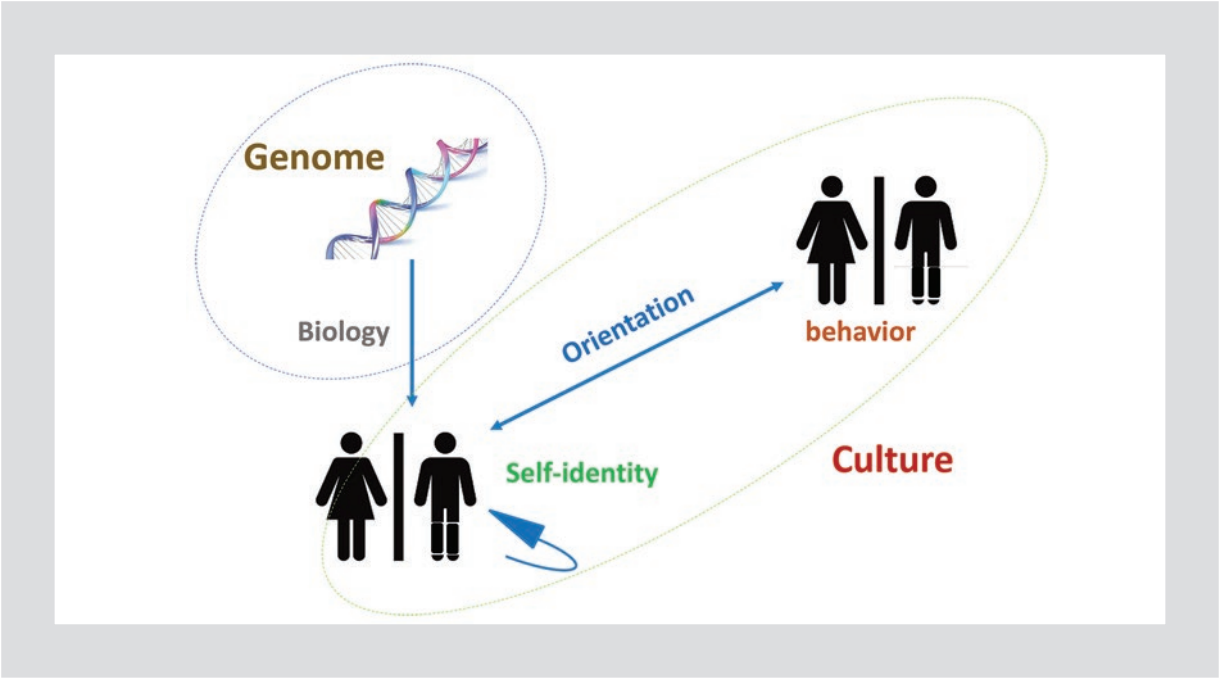

Figure 5. *Determinants of sexual behavior. "Nature" versus "Nurture".*

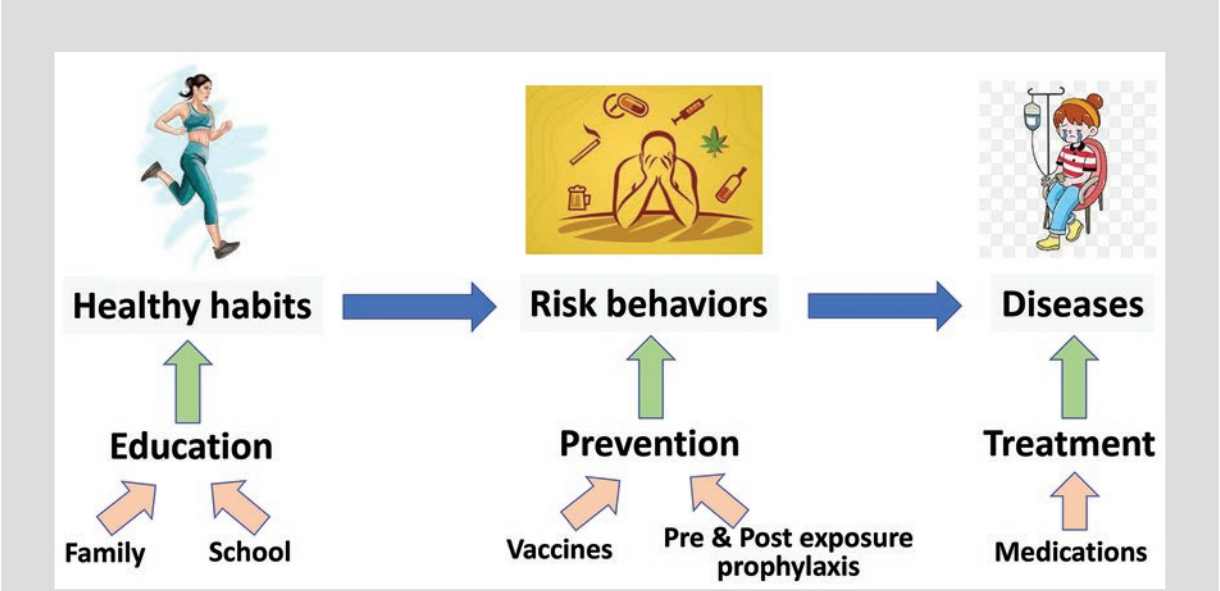

Figure 6. *Medical shift paradigm – moving from treatment to prevention and then to promote healthy lifestyles.*

The WHO has released recommendations for the achievement of global targets for controlling STI by 2030[4]. The following targets are specified: 90% reduction of *T. pallidum* incidence globally; 90% reduction in *N. gonorrhoeae* incidence globally; 50 or fewer cases of congenital syphilis per 100,000 live births in 80% of countries; and sustain 90% coverage in countries with the HPV vaccine in their national immunization program. Only a concerted effort to rapidly scale up effective interventions as the ones described above

could achieve the goal of ending the STI epidemics as public health concern by 2030.

We are convinced that our comprehensive and holistic approach to confront STI is in line with a paradigm shift currently seen in medicine, moving from being therapeutic alone to prioritizing prevention strategies, and especially encouraging education for health (Fig. 6). This vision has firstly matured and is being implemented for other more prevalent medical conditions, such as cardiovascular diseases, using the Life's Essential 8 call[76]. However, it largely remains to be considered for many other diseases, including STI.

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Conflicts of interest

No competing interests acknowledged by all authors signing this work.

Ethical disclosures

Protection of human and animal subjects. The authors declare that no experiments were performed on humans or animals for this study.

Confidentiality of data. The authors declare that no patient data appear in this article.

Right to privacy and informed consent. The authors declare that no patient data appear in this article.

Use of artificial intelligence for generating text. The authors declare that they have not used any type of generative artificial intelligence for the writing of this manuscript, nor for the creation of images, graphics, tables, or their corresponding captions.

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