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Mémoire présenté par **Sarah DACO**

en vue de l'obtention du grade de

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List of abbreviations

AIDS: Acquired Immunodeficiency Syndrome

ART: Antiretroviral Therapy

CAI: Condomless Anal Intercourse

CDC: Centers for Disease Control and Prevention

FTC: Emtricitabine

HIV: Human Immunodeficiency Virus

HPV: Human Papillomavirus

HSV: Herpes Simplex Virus

MPOX: (formerly Monkeypox)

MSM: Men Who Have Sex with Men

PEP: Post-Exposure Prophylaxis

PrEP: Pre-Exposure Prophylaxis

STI: Sexually Transmitted Infection

TAF: Tenofovir Alafenamide

TDF: Tenofovir Disoproxil Fumarate

WHO: World Health Organization

Abstract (EN)

Background: Pre-exposure prophylaxis (PrEP) has substantially advanced HIV prevention. However, sexually transmitted infections (STIs) continue to represent a significant public health concern, particularly among PrEP users. Shifts in sexual behaviors accompanying PrEP usage may influence STI incidence, requiring a comprehensive understanding of associated risk factors to optimize prevention strategies. Who's most vulnerable in that population, and why? Our study dives into these questions, not just with numbers, but by exploring the human perspectives behind them.

Methods: This study analyzed data from a cohort of 644 PrEP users at the CHU of Liège, employing univariate and multivariate logistic regression models to explore and identify behavioral and sociodemographic factors linked to STI acquisition. Comparisons were made across models for three distinct STIs to elucidate common and unique determinants of infection risk.

Results: Findings reveal that younger PrEP users are disproportionately affected by STIs, a trend consistent with international data. Sexual practices such as chemsex and condomless anal intercourse (CAI) significantly elevate STI risk, underscoring the biological and contextual vulnerabilities inherent to these behaviors. Additionally, partner-related factors, including partner's drug use and multiple sexual partnerships contribute to indirect exposure risk. Notably, event-driven PrEP use emerged as a protective factor against STIs, suggesting a potential role for behavioral regulation and sexual health literacy in risk mitigation.

Conclusion: Despite advances in HIV prevention, STIs remain prevalent among PrEP users, shaped by complex interactions between individual behaviors, relational contexts, and broader social environments. These findings challenge traditional prevention approaches, advocating for tailored, non-stigmatizing interventions that address the lived realities of those most affected. Future efforts should prioritize community-based programs, inclusive health messaging, and enhanced training for healthcare providers to foster empathetic, informed care that effectively responds to evolving sexual health challenges.

Key words: PrEP ; STI ; Risk-Taking ; MSM ; Sexual Health

Résumé (FR)

Contexte : La prophylaxie pré-exposition (PrEP) a marqué une avancée majeure dans la prévention du VIH. Toutefois, les infections sexuellement transmissibles (IST) demeurent un enjeu majeur de santé publique, en particulier chez les usagers de la PrEP. Les changements de comportement sexuel associés à l'usage de la PrEP peuvent influencer l'incidence des IST, rendant nécessaire une compréhension approfondie des facteurs de risque pour adapter efficacement les stratégies de prévention. Qui, parmi ces usagers, est le plus vulnérable, et pourquoi ? Cette étude tente de répondre à ces questions, au-delà des chiffres, en explorant également les dimensions humaines qui les sous-tendent.

Méthodologie : Cette étude a analysé les données d'une cohorte de 644 usagers de la PrEP suivis au CHU de Liège, à l'aide de modèles de régression logistique univariée et multivariée afin d'identifier les facteurs comportementaux et sociodémographiques associés à l'acquisition d'IST. Trois IST distinctes ont été comparées dans des modèles séparés afin de mettre en évidence les facteurs communs ou spécifiques influençant le risque d'infection.

Résultats : Les résultats révèlent une vulnérabilité accrue aux IST chez les usagers les plus jeunes, tendance cohérente avec les données internationales. Certaines pratiques sexuelles, tels que le chemsex et les rapports anaux non protégés, augmentent significativement le risque d'IST, en raison de facteurs biologiques mais aussi contextuels. Des facteurs liés aux partenaires, comme la consommation de drogues ou la multiplicité des partenaires sexuels, contribuent également à une exposition indirecte accrue. De manière notable, l'utilisation de la PrEP à la demande apparaît comme un facteur protecteur contre les IST, suggérant un lien possible avec une meilleure anticipation des rapports sexuels et une littératie en santé sexuelle plus élevée.

Conclusion : Malgré les progrès réalisés dans la prévention du VIH, les IST restent fréquentes chez les usagers de la PrEP, en lien avec une interaction complexe entre comportements individuels, contextes relationnels et environnements sociaux. Ces résultats interrogent les approches classiques de prévention et plaident en faveur d'interventions adaptées, non stigmatisantes, fondées sur la réalité vécue des personnes concernées. Les actions futures devraient renforcer les programmes communautaires, co-construire des messages de santé inclusifs, et former les professionnels de santé à une écoute empathique et éclairée, à même de répondre efficacement aux enjeux actuels de santé sexuelle.

Preamble

This research project is deeply rooted in both personal experience and academic commitment. Having grown up with a close family member living with HIV, I was sensitized early on to the medical, emotional, and social complexities of the illness.

I studied dental hygiene as a bachelor's degree and during my clinical training, I found myself drawn to those moments: the quiet intensity in the eyes of HIV-positive patients seated in the dental chair, and the questions that lingered beyond the consultations. Those interactions strengthened my determination to better understand how risk, care, and prevention intersect in the lived experiences of patients.

This thesis, centered on STIs among PrEP users, extends that reflection. While PrEP has revolutionized HIV prevention, it also raises new public health questions. Who is now most vulnerable to STIs, and why? How do behavioral, social, and contextual factors shape health outcomes, even in the presence of biomedical tools? These are questions that go beyond the clinic and call for a multidisciplinary approach.

From a public health perspective, this work lies at the crossroads of epidemiology, health economics, and healthcare management. It uses statistical analysis to identify profiles at greater risk, informs resource allocation by pointing where interventions could be most impactful, and contributes to designing more responsive and inclusive care strategies.

Above all, it reflects a belief that research should be closely aligned with the realities of the field. Public health should not only treat diseases but anticipate them. Effective prevention must be not only evidence-based, but also community-centered, empathetic, and adaptable. And behind every data point lies a person, whose story deserves to be heard and explored.

Introduction

Sexual health is a growing public health concern, considering the increasing prevalence of sexually transmitted infections (STIs) in recent decades. These infections affect millions of people each year, particularly young adults. STIs are diseases caused by pathogenic microorganisms such as bacteria, viruses or parasites spread through sexual contact. Around thirty different STIs have been identified but eight are considered as the most common by the World Health Organization (WHO): syphilis, gonorrhea, chlamydia, trichomoniasis, hepatitis B, herpes simplex virus (HSV), human immunodeficiency virus (HIV), and human papillomavirus (HPV) (1). Some STIs like chlamydia, gonorrhea and syphilis are curable with appropriate antibiotics. Others, such as HIV, HSV and HPV are chronic conditions with no cure and require long-term medical treatment. Although many STIs are asymptomatic, they can still result in severe health complications such as infertility, various forms of cancer, pregnancy-related issues, and neonatal infections. The transmission of STIs occurs primarily through sexual contact (vaginal, anal, or oral), but some infections, like HIV and hepatitis B, can also be transmitted perinatally or through blood exposure (2). The impact of STIs extends beyond individual health. They impose a significant burden on healthcare systems due to the need of regular screening, prevention programs and care services (3). For instance, untreated HIV can progress to acquired immunodeficiency syndrome (AIDS), HPV can lead to cervical cancer, and hepatitis B may cause liver cirrhosis or hepatocellular carcinoma. These consequences highlight the urgent need for effective prevention and control strategies (4).

Understanding the biological and social impacts of STIs sets the stage for examining their current spread. According to the WHO, over one million new STI infections occur every day. In 2020, there were more than 374 million reported cases of the four most common curable STIs: chlamydia, gonorrhea, syphilis and trichomoniasis. These figures highlight the ongoing spread of STIs worldwide, despite medical progress and public health efforts (1). In Europe, and particularly in Belgium, the trend is not different. Like many other European Union countries, Belgium is experiencing a resurgence in STI diagnoses. Chlamydia continues to be the most prevalent STI overall, especially among women (5) (6) (7). However, recent data from the EPILABO laboratory network indicates a shift: in 2023, gonorrhea exceeded chlamydia to become the most diagnosed STI among men for the first time. (7).

The statistics are striking. Between 2019 and 2023, the rate of chlamydia diagnoses in Belgium increased by 21%, rising from 156 to 189 cases per 100 000 inhabitants. The growth of gonorrhea cases has been even more dramatic, nearly doubling in the same period with an increase of 99% from 66 to 130 diagnoses per 100 000 inhabitants. These trends suggest a rapid and widespread increase in STIs transmission across the population. This rise is not limited to men who have sex with men (MSM), a group traditionally considered high-risk. There is also a marked increase in transmission among heterosexual individuals. Moreover, these numbers likely underestimate the real burden of STIs, as underdiagnosis remains a significant challenge due to gaps in systematic screening and access to testing (8).

Among STI, HIV stands out as the most serious due to its long-term consequences on individual health and its broader public health implications. HIV firstly attacks the immune system by targeting the CD4+ lymphocytes, which play a crucial role in defending the body against infections. Without any treatment, HIV progressively weakens the immune system, increasing the vulnerability to opportunistic infections and certain cancers. In its most advanced stage, the infection develops into AIDS, a life-threatening condition (9). More than four decades after its identification in 1983, HIV remains a global health priority. Since the beginning of the HIV epidemic, 42.3 million people have died from HIV-related illnesses and 88.4 million have been infected. In 2023, 39.9 million people were living with HIV worldwide, with 1.3 million new infections and 630,000 deaths recorded that year. African countries are the most severely affected, with a prevalence rate of 3.4%, meaning that 1 in 30 people is infected. Among children, there were 1.4 million living with HIV in 2023, with 120,000 new infections and 76,000 deaths. Furthermore, 103 countries implemented prevention programs, resulting in a total of 230 million people being tested for HIV in 2023 (10). These figures underscore the persistent challenge imposed by HIV, even in the era of antiretroviral therapies and expanded prevention strategies.

In Belgium, the number of HIV diagnoses in 2023 showed a slight increase compared to 2022, marking the third consecutive year of rising cases (+13%). This trend ends the long-standing decline observed in previous years. In 2023, 665 new diagnoses of HIV infections were made in Belgium. Among the infected individuals, 70% were men with the majority falling within 20-49 age range. A notable rise in new cases was noticed among MSM, particularly Belgian MSM

aged 30-39 years old. Additionally, diagnoses among heterosexual individuals also increased, especially among women of Belgian and other European nationalities, as well as men from sub-Saharan Africa and Europe. Regional data indicate that the rate of new HIV diagnoses remains highest in Brussels, highlighting the concentration of HIV transmission in urban settings (11).

The prevention of STI, including HIV, relies on a comprehensive combination of biomedical, behavioral, and structural strategies. The 2022 guidelines from the Centers for Disease Control and Prevention (CDC) outline tailored approaches based on individual risk profiles and population specific vulnerabilities. Routine screening remains a cornerstone of STI prevention: annual testing is recommended for all sexually active women under 25, as well as older women at increased risk, such as those with new or multiple sexual partners. For MSM, more frequent testing, every 3 to 6 months, is advised for those with ongoing high-risk behaviors. Condom use remains a fundamental method of preventing many STIs (12). When used consistently and correctly, both male and female condoms are effective in reducing the transmission of infections such as chlamydia, gonorrhea, syphilis, and HIV. However, not all STIs are equally prevented by condom use alone, particularly those transmitted through skin-to-skin contact, such as HPV or herpes simplex virus. Vaccination plays a critical preventive role. Immunization against hepatitis B and HPV is widely recommended. These vaccines significantly reduce the risk of long-term complications such as liver cancer or cervical cancer. Comprehensive sexual education and access to sexual health services further support prevention efforts by equipping individuals with knowledge and tools. Education programs promoting safer sex, consent, and testing can reduce stigma and encourage more consistent protective behaviors (13) (5) (14).

Pre-exposure prophylaxis (PrEP) has become a cornerstone of HIV prevention for individuals at substantial risk of infection. It involves the regular use of antiretroviral medications by HIV-negative individuals to prevent seroconversion following exposure. When taken consistently, PrEP reduces the risk of HIV infection by more than 90% (15). The most prescribed PrEP scheme is a daily oral pill containing a combination of emtricitabine (FTC) and tenofovir disoproxil fumarate (TDF), marketed under the brand name Truvada ®. An alternative formulation, Descovy ® (emtricitabine and tenofovir alafenamide, or TAF) is approved in some

countries but is not yet widely used for receptive vaginal sex. Both drugs work by blocking the action of reverse transcriptase, an enzyme necessary for HIV replication (16) (17) (18). In addition to daily use scheme, on-demand (event-driven) PrEP is also an existing option. This scheme, known as “2+1+1”, involves taking two pills minimum 2 hours to maximum 24 hours before sex, followed by one pill 24 hours later and another 48 hours later (19).
Recently, long-acting injectable PrEP, such as cabotegravir, has been approved in some countries. Administered once every two months, this option may improve adherence for individuals who find daily oral pills burdensome or who prefer to remain discreet about their medication intake. However, access remains limited, and cost is a consideration (20) (21).

However, it is important to emphasize that PrEP is not a standalone solution. Its use must be supported by regular HIV and STI testing, behavioral counseling, and broader public health efforts. For instance, post-exposure prophylaxis (PEP) offers an emergency intervention for individuals who may have been exposed to HIV within the previous 72 hours. When initiated promptly and taken for 28 days, PEP can significantly reduce the chance of infection (22) (23). Additionally, for those already living with HIV, antiretroviral therapy (ART) remains essential, both to improve health outcomes and to eliminate transmission risk, thanks to viral suppression that renders the virus undetectable and untransmissible (24) (25). Together, these strategies reflect the need for a multi-layered approach to prevention: addressing both biological and behavioral factors and adapting to the needs of diverse populations.

In Belgium, PrEP was introduced in 2017 and is available for individuals aged 16 and over. Access requires an initial consultation and follow-up appointments every three months at a recognized HIV reference center. These visits include HIV testing and screening for other STIs, as well as monitoring for side effects, kidney function and adherence. To have access to a refund in Belgium, individuals must meet specific risk criteria. These include:

- MSM who have had unprotected anal sex with at least two partners in the past six months,
- Individuals with a history of multiple STIs within the year,
- Those who use drugs during sex (chemsex practice),
- Sex workers and people who inject drugs,
- Individuals with HIV-positive partners not yet virally suppressed.

Although side effects are generally mild, they may include gastrointestinal symptoms, headache, and in some cases renal toxicity or reduced bone density (26) . PrEP has proven to be a highly effective tool in reducing new HIV infections, but its implementation must be accompanied by continuous education, behavioral support and STI screening to ensure a comprehensive sexual health protection (27).

While PrEP has significantly reduced HIV transmission, its widespread adoption has raised important questions about its broader impact on sexual health (15). The focus is particularly on the incidence of other STIs because PrEP protects only against HIV and not against bacterial or viral STIs such as gonorrhea, syphilis, or chlamydia. Its use has coincided with notable shifts in sexual behavior and STI trends, especially in populations with high PrEP uptake (28). Studies have consistently shown higher rates of STI diagnoses among PrEP users compared to non-users. This increase is likely due to a combination of factors: first, behavioral changes, such as decreased use of condom have been observed among individuals using PrEP (29) (30). Many users report a reduced fear of HIV infection, which may influence their decision to engage in condomless sex or increase their number of sexual partners. Second, PrEP programs involve frequent STI testing. This increased screening often leads to more frequent detection of asymptomatic infections that might go undiagnosed (29).

PrEP use can contribute to better surveillance and faster treatment of STIs, even if the reported rates appear higher. Among MSM, this shift in sexual behavior is well documented. In several studies, PrEP users report a greater willingness to engage in condomless anal intercourse (CAI) and a perception that HIV is no longer a major concern. While PrEP offers substantial protection against HIV, this perceived invulnerability may inadvertently lead to the resurgence of STIs (23) (31). These trends highlight the need for complementary prevention efforts alongside PrEP use. Behavioral education, condom promotion, regular STI screening, and public health messaging remain critical. Additionally, researchers and policymakers must carefully monitor STI patterns and develop integrated prevention strategies addressing both HIV and non-HIV infections in a coordinated way (32).

Understanding the underlying factors that contribute to STI incidence among PrEP users, such as condom use, number of sexual partners, frequency of testing, and perceptions of risk, is

essential for developing effective and balanced prevention strategies. This study examines these dynamics to support the development of more comprehensive strategies for promoting sexual health. We will approach these themes with an open and curious mindset. Our work will be exploratory by nature, not aiming to confirm preconceived ideas but rather to follow where the inquiry leads us. We hope to be surprised, challenged, and even unsettled at times, because it is in those moments that the most meaningful questions often emerge.

Materials and methods

This leads to our research question, which will be addressed through an explanatory approach in this thesis: “What behaviors or risk factors can influence the incidence of STIs among PrEP users?”

Design of study and type of research

To achieve our objective, we used a quantitative retrospective study design, which allowed us to investigate behaviors and associated factors based on existing data. This design enabled the analysis of a large dataset without the need for additional data collection or patient follow-up.

Study objectives

Primary objective was to identify and analyze factors and behaviors potentially associated with STIs in the study population using quantitative data. Secondary objectives come with data analysis. Specifically, the study allows to describe the sociodemographic characteristics of individuals in the cohort and examine patterns such as condom use associated to sexual behaviors, number of sexual partners and types of sexual activity, etc. In addition, the study seeks to compare and understand shared or distinct results of the three STIs models analysis. Through this comprehensive data-driven approach, the study intends to generate evidence that could inform targeted prevention strategies.

Studied population characteristics

The population for this study consists of individuals of all ages and genders using pre-exposure prophylaxis (PrEP) and who attend PrEP consultations at the Centre Hospitalier Universitaire (CHU) of Liège. As a recognized HIV reference center in Belgium, the CHU provides specialized care and preventive services about HIV, including PrEP consultations (33) .

Here are the inclusion criteria chosen for this study:

- Attending at least 3 consultations between January 1, 2021, and December 31, 2023,
- Covered by health insurance.

The justification for these inclusion criteria is based on the hypothesis that three consultations represent the minimum threshold to define a regular PrEP use. Moreover, it allows the observation of behaviors over a sufficiently long period to detect relevant trends. Finally, by including only patients covered by health insurance, the study ensures a certain level of socioeconomic uniformity, which helps reducing any potential bias related to access to healthcare.

Sample size

For this study, no sample size was calculated in advance. The aim of the analysis was to enroll every patient from the database who meets the criteria. The number of patients included was determined by the inclusion criteria (cf. Fig.1). This approach enabled the selection of a sample based on the available relevant data, eliminating the need for a formal sample size calculation.

Data collection

This study was a retrospective analysis based on an existing database of PrEP users at the CHU of Liège. All patient records meeting the inclusion criteria described above were selected for analysis. Therefore, no formal sampling method was applied.

Study variables

The primary objective was to identify the risk factors and behaviors associated with contracting STIs while using PrEP. The clinical data analyzed in this study are based on existing scientific literature on the subject and the variables available in the consultations. These parameters can be divided in several classes:

Tab 1. Description of variables groups and studied parameters

Variables groups	Studied parameters
Patient's characteristics parameters	Gender, age, nationality, origin, sexual orientation.
PrEP related variables	Date of convention, total number of consultations, history of PrEP use scheme, current PrEP use scheme, reason for PrEP requirement (linked with behavioral parameters like having several sexual partners, high incidence of STIs, sexual worker, HIV infected partner, post-PEP, chemsex practice, etc.)
Behavioral parameters	History of chemsex practice, current chemsex, number of irregular/regular sexual partners, vaginal intercourse, anal intercourse, oral sex, sexual intercourse with HIV positive partner, sexual intercourse with a partner who takes drugs, MSM, sex with a prostitute, prostitution, having sex with a partner who has multiple sexual partners, sexual practice that includes bleeding and fisting, all the different drugs use, alcohol consumption.
STIs parameters	Four studied STI for three years (2021 to 2023): chlamydia, gonorrhea, syphilis, and Mpox.

Statistical plan and analyses

Treatment of the database

Raw extractions from patient's records were initially received in an Excel file. This initial dataset underwent a comprehensive cleaning process to identify and rectify inconsistencies, eliminate duplicates, and address any missing or erroneous entry. Following this step, variables and corresponding values were systematically recoded to standardize the dataset and ensure coherence across all entries. To facilitate future analyses and enhance reproducibility, a tailored codebook was created to provide detailed documentation about the

dataset structure including variables definitions and coding schemes. As a result, the database was fully prepared for subsequent statistical analyses.

Descriptive statistics and normality investigation

The dataset was first imported into R commander version 4.3.1. The initial step consisted of conducting descriptive statistics to summarize the dataset. This process began with the treatment of quantitative variables, including an assessment of their distribution. Normality was investigated for those variables: number of irregular sexual partners, number of regular sexual partners, number of consultations per patient, and the age. Specifically, tests of normality "Shapiro-Wilk test" were performed with graphical methods like histograms and Q-Q plots to determine whether the data followed a normal distribution. Details of this investigation are provided in the appendices. As a result, only the age variable was considered having a normal distribution. The three other variables were transformed by using a threshold to be used in regressions in the form of dichotomous variables. Other variables from the dataset were dichotomized to facilitate the interpretation of future analyses (e.g. nation and origin).

Univariate analyses

After the descriptive analysis, binary logistic regressions were executed to explore the research question. Binary logistic regressions were performed instead of correlation because the analysis involved predicting a binary outcome, considering multiple explanatory variables, and aiming for a more interpretable and controlled statistical model rather than an association. Moreover, logistic regression provides odds ratios giving an intuitive understanding of how different factors impact the probability of the outcome. Correlation coefficients describe the strength of a linear relationship without specifying the nature of the impact.

For the univariate regression analyses, the main outcome variable (Y) was the presence of at least one of the three selected STIs (chlamydia, gonorrhea, and syphilis) during the study period (2021 to 2023). The explanatory variables (X) included sociodemographic factor, risk behaviors and other relevant variables. All STIs were grouped together for the primary

analyses to increase statistical power and to identify general risk factors associated with acquiring any STI among PrEP users. This approach also reduces the risk of false positives due to multiple testing and allows to address the broader clinical question of overall STI risk. Detailed information regarding the frequency of protective methods was reported for most of the risk factors. This data originated from structured clinical consultation tools in which clinicians selected one of five predefined categories reflecting the frequency of protection: 1= Always, 2 = Often, 3 = Sometimes, 4 = Never, 5 = Except once. To maintain the full level of detail provided by this ordinal variable, the protection variables were initially binarized into five distinct variables per item. This approach allowed a flexible modeling strategy and helped to explore specific behavioral categories. First, univariate regressions were performed only on the "always" protected variable to compare it to the other. For interpretability and to analyze trends across varying levels of inconsistent protection, a new continuous variable was created. In this variable, participants who reported "always" using protection were recoded as "0" because they had already been analyzed separately in a dedicated univariate regression. The remaining categories (values from 2 to 5) were recoded to 1 to 4 (items were reordered from the most frequent protection to never protection, which therefore had the highest score). Thereby, this continuous scale reflected increasing levels of non-consistent protection. The continuous variable was used in univariate logistic regression to assess whether the decrease in protection increased the probability of contracting an STI. This dual approach allowed us to capture both extreme behaviors and more nuanced gradients of risk. Protection questions were considered relevant only for participants who reported engaging in the corresponding risk factors. Protection variables were not included in the multivariate models to avoid potential bias related to structurally missing data.

However, for the analyses describing reasons for requesting PrEP, we conducted separate logistic regression models for each specific STI (chlamydia, gonorrhea, and syphilis). This was done to explore whether certain factors were associated with specific infections, as different STIs may have distinct epidemiological profiles and risk factors. By using both grouped and specific models, we aimed to balance sensitivity (by grouping STIs) and specificity (by analyzing each infection separately), thus providing a comprehensive understanding of STI risk in this population.

Multivariate analyses

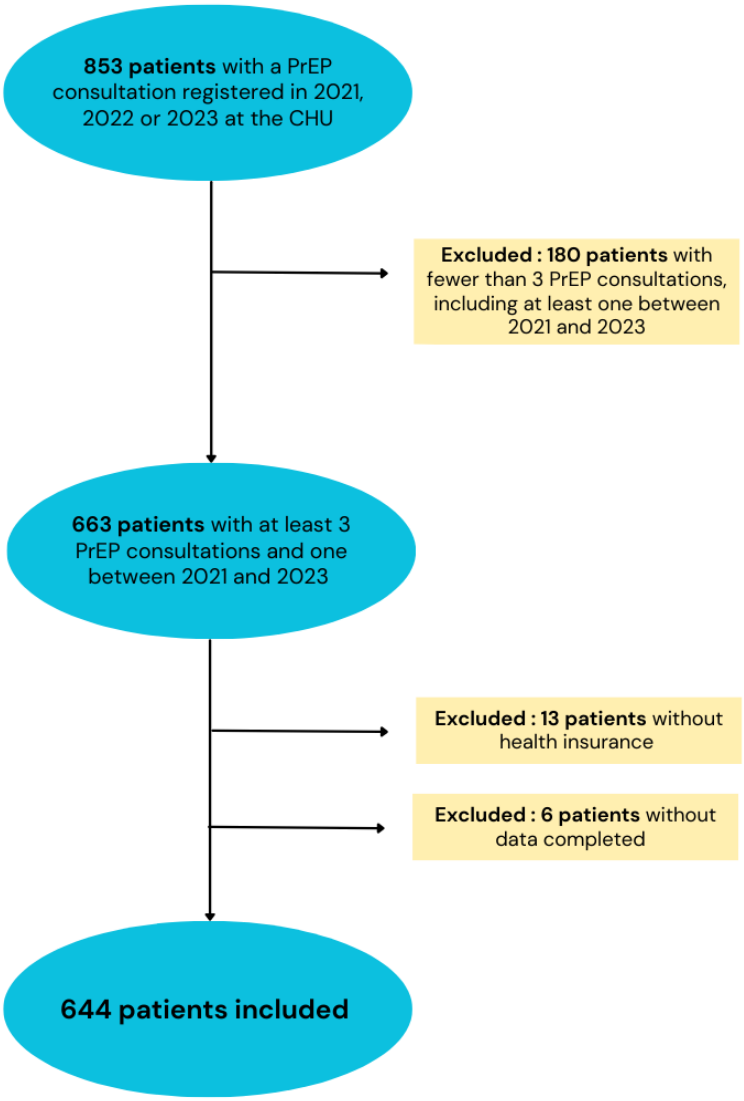
Multivariate logistic regression models were built to identify independent associations with STIs outcomes. Variables were selected based on the results of univariate analyses (those made on each STI separately), using a significance threshold of $p < 0.05$ and requiring that the 95% confidence intervals for odds ration did not include 1. Prior to modeling, potential multicollinearity among explanatory variables was explored. This was initially assessed using a Spearman correlation matrix. The threshold was set at 0.7 considering a strong correlation between the two variable (34). Additionally, Variance Inflation Factor (VIF) values were computed for each model. Following widely accepted guidelines, VIF values between 5 and 10 were interpreted as indicative of moderate multicollinearity while values above 10 were considered as problematic. This threshold aligns with established literature on multicollinearity diagnostics in regression modeling, including works by O'Brien (2007) and Salmerón et al. (2018) suggesting caution even for VIFs > 5 depending on the context of the data and the model complexity (35) (36). As a result of this assessment, a high collinearity was identified between the variables “chemsex history” and ‘current chemsex”. Given the clinical focus on present behaviors in relation to STI risk, “current chemsex” was retained in the final models to avoid redundancy and improve model interpretability. Final multivariate logistic regression models were constructed for each STI outcome based on the selected variables. For each model, the following statistical outputs were reported: odds ratio (OR), regression coefficients with standards errors (SE), p-values, and 95% confidence intervals (95% IC). Model fit and complexity were evaluated using Akaike Information Criterion (AIC). The number of observations excluded due to missing data was recorded and reported for each model. Likelihood ration (LR) tests were conducted to compare each full model to its null counterpart. This modeling strategy allowed for the identification of independent associations between behavioral factors and STI outcomes while addressing potential multicollinearity and ensuring robust model fit.

Results

Study population

The study includes 644 patients from a database at the “Centre Référence SIDA” of the CHU of Liège. Basically, 863 patients received a consultation on the set dates. Of these patients, 180 were excluded because they had fewer than 3 consultations in the years selected and fixed in the study's methodology. Of these 663 patients, 13 were excluded because they had no health insurance. Finally, 6 were excluded because their recorded data were incomplete.

Fig. 1: population flowchart



Characteristics of the study population and univariate associations with STI status

Table 2 shows the characteristics of participants (n=644), split by presence or absence of at least one STI. For each variable, the distribution in both groups is shown, along with univariate odds ratios (OR) and p-values comparing those with ≥1 STI to those without.

Tab.2 - Sociodemographic and exposure to PrEP according to the presence or absence of STI(s) (N=644)

Variable	≥ 1 STI (N (%) ; mean ± SD)	Absence of STI (N (%) ; mean ± SD)	OR (p) ≥1 STI vs 0 STI (ref)
Age (n= 644)	353 (55%) 40 ± 11	291 (45%) 43 ± 11	0.97 (<0.01)
Sex			
- **Male**	346 (54%)	283 (44%)	Ref
- **Female**	4 (1%)	6 (1%)	0.55 (0.35)
- **Female transgender**	3 (1%)	2 (0.3%)	1.23 (0.82)
Sexual orientation			
- **Homo/bisexual**	350 (54%)	285 (44%)	Ref
- **Heterosexual**	3 (<1%)	6 (<1%)	0.41 (0.21)
European origin (n=627)	310 (49%)	258 (41%)	0.82 (0.49)
Vs other	35 (6%)	24 (4%)	
African origin (n=627)	19 (3%)	13 (2%)	1.21 (0.61)
Vs other	326 (52%)	269 (43%)	
Number of consultations ≥ 7	212 (33%)	129 (20%)	1.89 (<0.01)
(vs <7)	141 (22%)	162 (25%)	

Among the 644 participants included in the analysis, 55% (353 individuals) had at least one STI, while 49% (291 individuals) did not. The mean age was slightly lower in the group with at least one STI (40 ± 11 years) compared to those without (43 ± 11 years). Younger age was significantly associated with the presence of an STI (OR=0.97, p<0.01). Most of participants were males (98%), with no significant difference in STI prevalence by sex or gender identify.

Regarding sexual orientation, the majority identified as homosexual or bisexual (99%), and heterosexual orientation was not significantly associated with STI status (OR=0.41, p=0.21). Neither European nor African origin showed a significant association with the presence of an STI. Finally, 212 participants attended at least seven consultations and were at higher risk to contract an STI (OR=1.89, p<0.01).

Table 3 presents the frequencies and percentages of risk behaviors, divided into two categories to allow for comparison: participants with at least one STI versus those without any STI diagnosis. The table also includes univariate regression analyses reporting odds ratio (OR) and p-values for associations between STI status and various risk behaviors, sexual practices, and vulnerability factors. Additionally, for each behavior listed, an associated line labeled "condom use" is included. This line provides information on the protective aspect of the behavior described above and includes two different ORs: the first compares individuals who not always protected versus those who were always protected, while the second reflects a protection score providing a more nuanced measure of condom use.

Among all participants analyzed in the table 3,59% (n=378) reported having more than ten irregular sexual partners, and this factor was strongly associated with the presence of at least one STI (OR=2.06, p<0.01). Anal sex was reported by 94% (n=604) of the sample and was significantly linked to a higher risk of STI (OR=4.5, p<0.01). Oral sex was also common, practiced by 97% (n=626), and was associated with an increased risk of STI (OR=2.7, p=0.03). Regarding condom use, significant associations were found for participants who did not always use protection while having more than ten irregular sexual partners (OR=1.7, p<0.01). Similarly, a higher risk was observed with protection score (OR=1.18, p=0.01), indicating that inconsistent condom use is linked to greater STI risk. Participants who were not always protected during sex work had also associated with reduced risk (OR=0.46, p=0.04), and the protection score also associated with a decreasing risk (OR=0.46, p=0.04). This suggest that consistent condom use is particularly effective in reducing STI risk in this context. Additionally, not always using protection versus always was associated with a twice increase of STI risk during bloody/fisting sexual activities (OR=2, p=0.04). Finally, among MSM, not always using protection compared to always was also significantly associated with higher STI risk (OR=1.67, p=0.01).

Sexual practices, condom use, and vulnerability factors

Tab 3. Univariate associations between risk factors according to STI status (N=644)

Variables	≥ 1 STI (N (%))	Absence of STI (N (%))	OR (p-value) ≥1 STI vs 0 STI (ref)	OR "Not always protected vs always)" (p-value)	OR "protection score" (p-value)
Number of regular partner(s) > 1	227 (38%)	187 (31%)	0.98 (0.92)		
Condom use				1 (0.99)	0.99 (0.85)
Number of irregular partner(s) > 10	243 (39%)	150 (24%)	2.06 (<0.01)		
Condom use				1.7 (<0.01)	1.18 (0.01)
Anal sex (Yes)	346 (54%)	269 (42%)	4.5 (<0.01)		
Condom use				1.37 (0.12)	1.1 (0.18)
Vaginal sex (Yes)	32 (5%)	38 (6%)	0.67 (0.11)		
Condom use				1.04 (0.94)	0.96 (0.81)
Oral sex (Yes)	346 (54%)	275 (43%)	2.7 (0.03)		
Condom use				1.95 (0.31)	1.15 (0.27)
Sex with a sex worker (Yes)	24 (4%)	26 (4%)	0.74 (0.31)		
Condom use				1.03 (0.96)	1.05 (0.83)
Prostitution (Yes)	17 (3%)	12 (2%)	1.15 (0.72)		
Condom use				0.14 (0.03)	0.46 (0.04)

Blood/fisting sexual practice (Yes)	81 (13%)	72 (12%)	0.89 (0.53)		
Condom use				2 (0.04)	1.14 (0.25)
PEP taken (Yes)	102 (16%)	84 (13%)	1 (0.99)		
Alcohol consumption (Yes)	33 (5%)	41 (6%)	0.63 (0.06)		
Drug use (Yes)	184 (29%)	137 (22%)	1.23 (0.2)		
Current chemsex practice (Yes)	76 (12%)	29 (5%)	2.46 (<0.01)		
Historic of chemsex practice (Yes)	89 (14%)	32 (5%)	2.73 (<0.01)		
HIV positive sexual partner (Yes)	71 (12%)	57 (9%)	1.03 (0.86)		
Condom use				1.19 (0.63)	1 (0.95)
Sexual partner who takes drugs (Yes)	103 (17%)	47 (8%)	2.17 (<0.01)		
Condom use				1.89 (0.11)	1.19 (0.19)
MSM (Yes)	340 (55%)	266 (45%)	15.34 (<0.01)		
Condom use				1.67 (0.01)	1.15 (0.05)
Sexual partner with multiple partners (Yes)	291 (47%)	211 (34%)	1.76 (<0.01)		
Condom use				1.35 (0.2)	1.05 (0.55)
Mpox (Yes)	13 (2%)	2 (<1%)	5.53 (0.02)		

Table 4 presents univariate logistic regression models examining three specific STIs individually: chlamydia, syphilis, and gonorrhea. This stratification was undertaken to explore whether distinct patterns of associations emerge when each STI is considered separately, rather than using a composite STI outcome as in the previous tables. The dependent variable varies across models to account for potential differences in behavioral or vulnerability correlates specific to each infection. These regressions assess associations between reasons for initiating PrEP and the presence of each STI. In addition, the table includes participant's PrEP use schemes, both historical and current, categorized into three distinct groups. All results are presented as odds ratios (OR) with corresponding p-values.

Tab 4: Univariate analysis of STI specific associations with PrEP use patterns

Variables	Gonorrhea OR (p)	Chlamydia OR (p)	Syphilis OR (p)
Reason for PrEP application:			
Multiple partners	3.61 (<0.01)	2.95 (0.01)	2.91 (0.08)
Multiple STIs	1.26 (0.5)	1.79 (0.08)	3.62 (<0.01)
Sexworker	0.7 (0.5)	0.71 (0.52)	2.48 (0.07)
HIV infected partner	0.51 (0.19)	0.82 (0.67)	0.73 (0.62)
Post PEP	1.1 (0.71)	0.76 (0.29)	0.69 (0.3)
Chemsex practice	2.3 (<0.01)	1.95 (0.03)	2.89 (<0.01)
Historic PrEP scheme:			
Continuous	Ref	Ref	Ref
Intermittent	0.59 (0.01)	0.47 (<0.01)	0.54 (0.02)
Mixed	1.01 (0.97)	0.76 (0.18)	0.73 (0.24)
Current PrEP scheme:			
Continuous	Ref	Ref	Ref
Intermittent	0.6 (<0.01)	0.48 (<0.01)	0.73 (0.15)
Mixed	1.48 (0.28)	0.92 (0.82)	0.55 (0.28)

Among the reasons for PrEP application, reporting multiple partners was strongly associated with an increased risk of all these three STIs: gonorrhea (OR=3.61, p<0.01), chlamydia (OR=2.95, p<0.01), and syphilis (OR=2.91, p<0.01). Similarly, having a history of multiple STIs was significantly associated with syphilis (OR=3.62, p<0.01). Chemsex practice was also linked

to higher risk for all three STIs, with significant odds ratios for gonorrhea (OR=2.3, p<0.01), chlamydia (OR=1.95, p=0.03), and syphilis (OR=2.89, p<0.01).
Regarding PrEP schemes, both historic and current intermittent event-driven use were associated with a lower risk of gonorrhea (historic: OR=0.59, p=0.01; current: OR=0.6, p<0.01) and chlamydia (historic: OR=0.47, p<0.01; current: OR=0.48, p< 0.01), compared to continuous use. Historic intermittent use was also associated with a lower risk of syphilis (OR=0.54, p=0.02), whereas mixed schemes did not show significant associations with any STI.

Multivariable logistic regression analyses identified several factors significantly associated with gonorrhea, chlamydia, and syphilis diagnoses among PrEP users. Regarding gonorrhea, increasing age was inversely associated with diagnosis (OR=0.96, 95%CI: 0.94-0.98, p<0.01). participants reporting more than ten irregular sexual partners (OR=2.02, 95%CI: 1.33-3.1, p=0.01) and those with more than seven PrEP consultations (OR=2.33, 95%CI: 1.54-3.55, p<0.01) showed significantly higher odds of gonorrhea. A previous diagnosis of chlamydia (OR=2.56, 95%CI: 1.73-3.81, p<0.01) was strongly associated with gonorrhea infection. Although a significant association was found between Mpox diagnosis and gonorrhea (OR=12.69), the wide confidence interval (95% CI: 2.48-101.6) suggests limited precision, it may be due to the low number of Mpox cases. This result should be interpreted with caution. For chlamydia, intermittent use of PrEP was associated with a decreased risk (OR=0.49, 95%IC: 0.24-0.97, p=0.04). Having sex with a partner known to have multiple sexual partners increased the odds of chlamydia (OR=1.71, 95%CI: 1.02-2.95, p=0.04). Additionally, a prior gonorrhea diagnosis was strongly associated with chlamydia infection (OR=2.46, 95%CI: 1.66-3.65, p<0.01). As for syphilis, requiring PrEP due to a history of multiple STI diagnoses significantly increase the risk (OR=2.9, 95%CI: 1.34-6.1, p<0.01). These findings highlight the importance of behavioral and clinical factors in predicting STI risk among individuals using PrEP, underlining the need for tailored prevention strategies based on solid statistics.

Tab 5: Factors independently associated with Gonorrhea, Chlamydia and Syphilis (multivariable logistic regression)

Variables	Gonorrhea OR (CI)	P	Chlamydia OR (CI)	P	Syphilis OR (CI)	P
Age	0.96 (0.94-0.98)	<0.01	-	-	-	-
More than 10 irregular partners	2.02 (1.33-3.1)	0.01	-	-	-	-
More than seven PrEP consultations	2.33 (1.54-3.55)	<0.01	-	-	-	-
Intermittent PrEP current scheme	-	-	0.49 (0.24-0.97)	0.04	-	-
Sex with a partner who has multiple sexual partners	-	-	1.71 (1.02-2.95)	0.04	-	-
Requiring PrEP because of multiple STIs diagnose	-	-	-	-	2.9 (1.34-6.1)	<0.01
Chlamydia diagnose	2.56 (1.73-3.81)	<0.01	-	-	-	-
Gonorrhea diagnose	-	-	2.46 (1.66-3.65)	<0.01	-	-
Mpox diagnose	12.69 (2.48-101.6)	<0.01	-	-	-	-

Discussion

STIs remain a significant public health concern, particularly among populations at higher risk such as individuals using PrEP. In recent years, the increased use of PrEP has been accompanied by shifts in sexual behaviors, which may influence the STI incidence and transmission dynamics. Understanding the associated factors with STIs in this population is therefore essential to adapt prevention strategies effectively. This study analyzed data from a cohort of PrEP users at the CHU of Liège to identify behavioral and sociodemographic risk factors associated with STIs incidence. Quantitative methods were used, including both univariate and multivariate logistic regressions. In addition, the study compared models for three different STIs to highlight shared or specific factors, contributing to a more nuanced understanding of risk profiles. This data-driven approach may inform more targeted and tailored public health interventions.

Why do younger PrEP users seem more exposed to STIs?

When comparing people who use PrEP a clear trend emerges: younger users are more likely to contract STIs than older ones. The age gap may seem small, but it reveals a broader dynamic: STIs disproportionately affect younger individuals within this population.

This isn't just a local observation. International research supports this finding. For example: in the United States, a large study over 5,000 young PrEP users showed that age alone was a significant factor in STI acquisition (37). Similarly, studies in Thailand among adolescents and young transgender women using PrEP reported high STI rates. These STI rates were linked to factors like inconsistent condom use and having multiple sexual partners (38). Although, they used different statistical methods from ours, it was nonetheless equally strong in statistical power.

Several explanations can help us understand this pattern. From a behavioral perspective, it is well established that younger adults tend to have a higher number of sexual partners, more diverse sexual practices, and are less consistent with using protection like condoms. These behaviors naturally increase their risk of contracting STIs (39) (40).

Psychological factors also play a role. Some studies have found that once on PrEP, many young users feel more protected, which can lower their perception of risk and influence their choices.

For example, a qualitative study conducted in San Francisco revealed that some participants reported using condoms less often, particularly when they trusted their partners or knew they were also on PrEP or HIV treatment (41).

Another explored perspective is what is called “the surveillance effect”. Younger users may have started PrEP earlier or be more connected with healthcare services. This can lead to more frequent check-ups and screenings. This increased medical monitoring raises the chance of detecting an STI, not necessarily because they are more at risk, but simply because they are tested more often (42).

Thus, age here may act as a marker for individual’s behavioral patterns, not as a direct risk factor. What we observed is one example of how personal choices and perceptions influence STI risk. Recognizing these patterns opens the door to more tailored public health responses: educational campaigns focused on risk perceptions, sexual health counseling specifically designed for young PrEP users, and interventions that promote consistent use of condoms (without undermining the confidence and autonomy that PrEP offers). It is by addressing these individual-level factors that broader population-level outcomes can improve.

What make some sexual practices more at risk than others?

We found that certain sexual practices are more commonly associated with an increased probability of STIs. Chemsex and anal sex are the two most statistically risky sexual practices and that did not surprise us because of the numerous scientific literatures existing on these subjects in PrEP users. Recent literature consistently demonstrates a strong association between chemsex practices, condomless anal sex, PrEP use, and increased risk of STIs among MSM. For example, a cross-sectional study cohort in Hong Kong found that MSM engaging in chemsex were significantly more likely to use PrEP and to report high-risk sexual behaviors, including group sex and condomless anal intercourse. These behaviors were directly linked to a higher prevalence of STIs in this population (43). Similarly, a national study from the United States reported that MSM who engaged in chemsex were also more likely to use PrEP and to be diagnosed with bacterial STIs within the past year. Notably, 43% of chemsex participants in this study had an STI diagnosis (44). These results underscore the strong interconnection between high-risk behaviors. Taken together, they point to chemsex and condomless anal sex among PrEP users as major contributors to the continued spread of STIs. Considering the well-

known health risks associated with these practices, their persistence may seem paradoxical. However, this phenomenon cannot be fully explained by individual risk-taking alone. It likely reflects a more complex interplay of psychological, social, and structural factors.

Anal sex for example, carries a higher biological risk of STI transmission due to the fragility of anal mucosa (45). But beyond biological explanations, these practices often take place in environments where access to effective prevention tools is limited, where sexual health messaging lacks inclusivity, and where open discussions about sexual behaviors are discouraged or stigmatized. (46)(47). This amplifies vulnerability, especially for individuals suffering from stigmatization or lack of tailored support.

Chemsex, similarly, is often framed as a high-risk behavior due to its association with prolonged and unprotected sex under the influence of drugs. However, this behavior is rarely just about sensation-seeking. For many, chemsex is tied to experiencing a sexual liberation, the pursuit of connection, and the management of psychological distress or anxiety (48). A recent study in Barcelona reported that these users are still scared of being judged, especially by health professional workers who might be not informed enough (49).
In this context, sexual risk is not simply about personal choices but also about the environments in which those choices are made. It reflects how people navigate identity, intimacy, exclusion, and mental health. This understanding calls for a shift in how we approach the related public health prevention strategies. Rather than relying solely on generic or moralizing messages about risk, interventions should be adapted to reflect the realities of those most affected. That includes offering non-stigmatizing, trauma-informed, and community-based health-services that support individuals holistically: socially, emotionally, and culturally.

Can your partner's behavior put you at risk? Understanding sexual networks and indirect exposure

While individual's behaviors are often the focus of STIs prevention, this study shows that who your partners are, and what they do, matters just as much. One study reported a particularly striking figure: each additional sexual partner was associated with a 4.2% increase in the risk

of contracting an STI (50). This finding supports the association observed in our own data, where having more than 10 irregular sexual partners significantly increased STI risk.

More strikingly, individuals whose partners use drugs, or have multiple other partners themselves, face elevated risk (even if the individual did nt engage in those behaviors). This underlines a key point: risk is not only about what you do, but it is also about the context you are part of. Through partners, people may be indirectly exposed to higher-risk environments. In this sense, the situation looks like secondhand smoke: even those who do not actively seek out risk can still be exposed to its consequences through the broader environment that surrounds them.

These indirect risk factors reveal a blind spot in individual-centered public health strategies. Prevention efforts must acknowledge the relational dimension of sexual health. This includes promoting couple-based STI testing together, encouraging open discussions about partner's histories and behaviors, and developing community-centered messages that support trust, negotiation, and shared responsibility (without stigma or blame).

Could event-driven PrEP also protect against STIs? A surprising observation

Surprisingly, our analysis revealed that event-driven PrEP use appears to be a protective factor again STIs. This finding holds consistently in both univariate and multivariate models. It is particularly striking given that, in the existing literature, event-driven PrEP is not commonly discussed as a protective factor for STI acquisition. While some studies have noted that individuals using intermittent PrEP report fewer sexual encounters compared to the daily users, the potential for this plan of use contribute directly to STI prevention (19).

Our findings raise the possibility that it could reflect more than just a pharmacological flexibility. A study from the Journal of the International AIDS Society supports this perspective by showing that individuals adapt their PrEP regimen daily or event-driven, based on their current life context and sexual activity. It may serve as a factor for behavioral regulation, indicating greater anticipation and planning of sexual activity, a higher degree of sexual health literacy, and a more intentional approach to risk management (51). Taken together, these insights challenge standardized public health messaging and suggest that personalized prevention strategies may be more effective than universal guidelines. Future research should

explore whether the observed protective association of event-driven PrEP reflects causal mechanisms or is indicative of specific user profiles, characterized by distinctive health-seeking behaviors and psychological determinants.

This geographic and institutional focus may limit the generalizability of the results to other regions or healthcare settings with different patient profiles or care practices. Therefore, caution is warranted when extrapolating these conclusions beyond the local context. This retrospective cohort study may be subject to selection bias, as it reflects only PrEP users followed at CHU Liège. Self-reported data may also introduce information bias due to recall errors or social desirability.

Conclusion

Despite major advances in the fight against HIV, STIs continue to spread, often silently and underestimated, particularly in a context where prevention behaviors are evolving. It is against this shifting backdrop that our study was conducted, among a cohort of PrEP users in Liège, with the aim of identifying those most at-risk and exploring new avenues for intervention.

Through a rigorous statistical analysis, several clear trends emerged: younger users face a higher risk, certain sexual practices such as chemsex or unprotected anal sex are particularly linked to transmission and the relational context plays just as central a role as individual behavior. One unexpected finding also stood out: the use of on-demand PrEP appears to be associated with a lower incidence of STIs, suggesting that this method may reflect more intentional or better-regulated sexual behavior.

But more than anything, the statistics reveal a deeper complexity. Behind every behavior lies a story, a context, a perception of risk. Age for example, is not a culprit in itself: it reflects the dynamics of pleasure, identity, confidence or sometimes vulnerability. These findings challenge conventional public health approaches. They call for prevention strategies that speak honestly, that do not moralize, and that support real practices instead of promoting abstract ideals. Prevention that acknowledges risk is not always a matter of personal choice, but often the product of environments, networks, and cultures of silence of stigma.

What are the next steps? Scaling up community-based interventions, co-creating health messages with those most affected, and training healthcare professionals to listen with more knowledge, more empathy, and more openness. Because preventing STIs is not just about distributing condoms and tests. It’s about understanding what bodies express when they take risks and offering responses that truly reflect their reality.

Bibliography

1. Sexually transmitted infections (STIs). Available from: https://www.who.int/news-room/fact-sheets/detail/sexually-transmitted-infections-(stis)

2. Hufstetler K, Llata E, Miele K, Quilter LAS. Clinical Updates in Sexually Transmitted Infections, 2024. J Womens Health (Larchmt). 2024 Jun;33(6):827–37.

3. Welford E, Martin TCS, Martin NK, Tilghman W, Little SJ. Relative Cost and Infectious Days Averted Associated With Rapid Gonorrhea and Chlamydia Testing Among Men Who Have Sex With Men. Sex Transm Dis. 2024 Jun 1;51(6):388–92.

4. What's on the rise in Sexually Transmitted Infections? - The Lancet Regional Health – Europe. Available from: https://www.thelancet.com/journals/lanepe/article/PIIS2666-7762(23)00183-7/fulltext

5. Gökengin D, Noori T, Alemany A, Bienkowski C, Liegon G, İnkaya AÇ, et al. Prevention strategies for sexually transmitted infections, HIV, and viral hepatitis in Europe. The Lancet Regional Health - Europe. 2023 Nov;34:100738.

6. STI cases on the rise across Europe. 2024. Available from: https://www.ecdc.europa.eu/en/news-events/sti-cases-rise-across-europe

7. Lecompte A, Serrien B, Bensemmane S, De Baetselier I, Van Den Bossche D, Deblonde J, et al. Surveillance des infections sexuellement transmissibles. Situation épidémiologique au 31 décembre 2023. Sciensano (Belgium); 2024. Available from: https://www.sciensano.be/fr/node/75743

8. Lecompte. sciensano.be. Bulletin épidémiologique intermédiaire sur les infections sexuellement transmissibles. Available from: https://www.sciensano.be/en/biblio/bulletin-epidemiologique-intermediaire-sur-les-infections-sexuellement-transmissibles

9. Swinkels HM, Nguyen AD, Gulick PG. HIV and AIDS. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025. Available from: http://www.ncbi.nlm.nih.gov/books/NBK534860/

10. HIV. Available from: https://www.who.int/data/gho/data/themes/hiv-aids

11. sciensano.be. Les diagnostics de VIH sont en hausse en Belgique. Available from: https://www.sciensano.be/fr/coin-presse/les-diagnostics-de-vih-sont-en-hausse-en-belgique

12. Workowski KA, Bachmann LH. Centers for Disease Control and Prevention's Sexually Transmitted Diseases Infection Guidelines. Clinical Infectious Diseases. 2022 Apr 13;74(Supplement_2):S89–94.

13. CDC. Sexually Transmitted Infections (STIs). How to Prevent STIs. Available from: https://www.cdc.gov/sti/prevention/index.html

14. Kenyon C, Herrmann B, Hughes G, de Vries HJC. Management of asymptomatic sexually transmitted infections in Europe: towards a differentiated, evidence-based approach. Lancet Reg Health Eur. 2023 Oct 26;34:100743.

15. Traeger MW, Schroeder SE, Wright EJ, Hellard ME, Cornelisse VJ, Doyle JS, et al. Effects of Pre-exposure Prophylaxis for the Prevention of Human Immunodeficiency Virus Infection on Sexual Risk Behavior in Men Who Have Sex With Men: A Systematic Review and Meta-analysis. Clinical Infectious Diseases. 2018 Aug 16;67(5):676–86.

16. Mayer KH, Molina JM, Thompson MA, Anderson PL, Mounzer KC, De Wet JJ, et al. Emtricitabine and tenofovir alafenamide vs emtricitabine and tenofovir disoproxil fumarate for HIV pre-exposure prophylaxis (DISCOVER): primary results from a randomised, double-blind, multicentre, active-controlled, phase 3, non-inferiority trial. Lancet. 2020 Jul 25;396(10246):239–54.

17. D'Angelo AB, Westmoreland DA, Carneiro PB, Johnson J, Grov C. Why Are Patients Switching from Tenofovir Disoproxil Fumarate/Emtricitabine (Truvada) to Tenofovir Alafenamide/Emtricitabine (Descovy) for Pre-Exposure Prophylaxis? AIDS Patient Care STDS. 2021 Aug 1;35(8):327–34.

18. Truvada | European Medicines Agency (EMA). Available from: https://www.ema.europa.eu/en/medicines/human/EPAR/truvada

19. Vuylsteke B, Reyniers T, De Baetselier I, Nöstlinger C, Crucitti C, Buyze J, et al. Daily and event-driven pre-exposure prophylaxis for men who have sex with men in Belgium: results of a prospective cohort measuring adherence, sexual behaviour and STI incidence - Vuylsteke - 2019 - Journal of the International AIDS Society - Wiley Online Library. Available from: https://onlinelibrary.wiley.com/doi/10.1002/jia2.25407

20. Clement ME, Kofron R, Landovitz RJ. Long-acting Injectable Cabotegravir for the Prevention of HIV Infection. Curr Opin HIV AIDS. 2020 Jan;15(1):19–26.

21. Taramasso L, Bonora S, Cingolani A, Di Biagio A, Gianotti N, Guaraldi G, et al. Question and answers on long-acting therapy with cabotegravir and rilpivirine in people with HIV. J Antimicrob Chemother. 2025 Mar 3;80(3):610–23.

22. WHO announces the 2023 update of the Guidelines for HIV post-exposure prophylaxis (PEP). Available from: https://www.who.int/news/item/22-09-2023-who-announces-the-2023-update-of-the-guidelines-for-hiv-post-exposure-prophylaxis-(pep)

23. Su R, Liu Y, Li P, Ge L, Liao M, Fu Y, et al. Usage of post-exposure prophylaxis and its impact on risk behaviors among men who have sex with men in Qingdao, China. BMC Infect Dis. 2025 Mar 27;25(1):421.

24. Rendina HJ, Cienfuegos-Szalay J, Talan A, Jones SS, Jimenez RH. Growing acceptability of Undetectable = Untransmittable but widespread misunderstanding of transmission risk: Findings from a very large sample of sexual minority men in the United States. J Acquir Immune Defic Syndr. 2020 Mar 1;83(3):215–22.

25. CBIP. CBIP | Antirétroviraux contre le VIH. Available from: https://www.cbip.be/fr/chapters/12?frag=10868

26. CBIP. Remboursement. Available from: https://www.cbip.be/fr/ampps/172197?cat=b

27. Fonner VA, Dalglish SL, Kennedy CE, Baggaley R, O'Reilly KR, Koechlin FM, et al. Effectiveness and safety of oral HIV preexposure prophylaxis for all populations. AIDS. 2016 Jul 31;30(12):1973–83.

28. Ong JJ, Fu H, Baggaley RC, Wi TE, Tucker JD, Smith MK, et al. Missed opportunities for sexually transmitted infections testing for HIV pre-exposure prophylaxis users: a systematic review. Journal of the International AIDS Society. 2021;24(2):e25673.

29. Jansen K, Steffen G, Potthoff A, Schuppe AK, Beer D, Jessen H, et al. STI in times of PrEP: high prevalence of chlamydia, gonorrhea, and mycoplasma at different anatomic sites in men who have sex with men in Germany. BMC Infectious Diseases. 2020 Feb 7;20(1):110.

30. Ramchandani MS, Golden MR. Confronting Rising STIs in the Era of PrEP and Treatment as Prevention. Curr HIV/AIDS Rep. 2019 Jun;16(3):244–56.

31. Protiere C, Sagaon-Teyssier L, Donadille C, Sow A, Gaubert G, Girard G, et al. Perception of PrEP-related stigma in PrEP users: Results from the ANRS-PREVENIR cohort. HIV Med. 2023 Aug;24(8):938–45.

32. Nguyen VK, Greenwald ZR, Trottier H, Cadieux M, Goyette A, Beauchemin M, et al. Incidence of sexually transmitted infections before and after preexposure prophylaxis for HIV. AIDS. 2018 Feb 20;32(4):523–30.

33. CHU de Liège. Centre de référence SIDA. Available from: https://www.chuliege.be/jcms/c2_17345654/fr/centre-de-reference-sida/accueil

34. Gomez RS, Garcia CBG, Sanchez AR, Garcia CG. Limitations in Detecting Multicollinearity due to Scaling Issues in the mcvis Package. The R Journal. 2023 Feb 10;14(4):264–79.

35. O'brien RM. A Caution Regarding Rules of Thumb for Variance Inflation Factors. Qual Quant. 2007 Oct 1;41(5):673–90.

36. Salmerón R, García ,C. B., and García J. Variance Inflation Factor and Condition Number in multiple linear regression. Journal of Statistical Computation and Simulation. 2018 Aug 13;88(12):2365–84.

37. Hechter RC, Bruxvoort KJ, Zhou H, Towner WJ, Contreras R, Schumacher CM, et al. Sexually Transmitted Infections Among Men and Transgender Women Using HIV Pre-exposure Prophylaxis in a Large Integrated Health System-A Cohort Study. J Acquir Immune Defic Syndr. 2022 Sep 1;91(1):1–8.

38. Songtaweesin WN, Pornpaisalsakul K, Kawichai S, Wacharachaisurapol N, Wongharn P, Yodkitudomying C, et al. Sexually transmitted infections incidence in young Thai men

who have sex with men and transgender women using HIV pre-exposure prophylaxis. Int J STD AIDS. 2022 Apr;33(5):447–55.

39. de Wit JBF, Adam PCG, den Daas C, Jonas K. Sexually transmitted infection prevention behaviours: health impact, prevalence, correlates, and interventions. Psychol Health. 2023 Jun;38(6):675–700.

40. Allison BA, Widman L, Stewart JL, Evans R, Perry M. Adherence to Pre-Exposure Prophylaxis in Adolescents and Young Adults: A Systematic Review and Meta-Analysis. J Adolesc Health. 2022 Jan;70(1):28–41.

41. Storholm ED, Volk JE, Marcus JL, Silverberg MJ, Satre DD. Risk Perception, Sexual Behaviors, and PrEP Adherence among Substance-Using Men Who Have Sex with Men: A Qualitative Study. Prev Sci. 2017 Aug;18(6):737–47.

42. Warzywoda S, Fowler JA, Dyda A, Fitzgerald L, Mullens AB, Dean JA. Pre-exposure prophylaxis access, uptake and usage by young people: a systematic review of barriers and facilitators. Ther Adv Infect Dis. 2024 Dec 7;11:20499361241303415.

43. Wong NS, Chung SL, Lee KCK, Lee SS. Interrelationship between chemsex engagement and PrEP (pre-exposure prophylaxis) experience in men who have sex with men: a community-based cross-sectional study. Sex Transm Infect. 2025 Jan 11;sextrans-2024-056331.

44. Ivey K, Bernstein KT, Kirkcaldy RD, Kissinger P, Edwards OW, Sanchez T, et al. Chemsex Drug Use among a National Sample of Sexually Active Men who have Sex with Men, – American Men's Internet Survey, 2017–2020. Subst Use Misuse. 2023;58(5):728–34.

45. Van Doren VE, Ackerley CG, Arthur RA, Murray PM, Smith SA, Hu YJ, et al. Rectal mucosal inflammation, microbiome, and wound healing in men who have sex with men who engage in receptive anal intercourse. Sci Rep. 2024 Dec 30;14(1):31598.

46. hiv-sti-prevention-among-men-who-have-sex-with-men-guidance.pdf. Available from: https://www.ecdc.europa.eu/sites/default/files/media/en/publications/Publications/hiv-sti-prevention-among-men-who-have-sex-with-men-guidance.pdf

47. Global Health Sector Strategies on, Respectively, HIV, Viral Hepatitis and Sexually Transmitted Infections for the Period 2022-2030. 1st ed. Geneva: World Health Organization; 2022. 1 p.

48. Lunchenkov N, Cherchenko N, Altynbekov K, Terlikbayeva A, Primbetova S, Gryazev D, et al. "A way to liberate myself": A qualitative study of perceived benefits and risks of chemsex among gay, bisexual, and other men who have sex with men in Almaty, Kazakhstan. Drug Alcohol Depend. 2024 Nov 1;264:112464.

49. Leyva-Moral JM, Aguayo-González M, Mora R, Villegas L, Gómez-Ibáñez R, Mestres-Soler O, et al. Chemsex in Barcelona: A qualitative study of factors associated with the practice, the perception of the impact on health and prevention needs. Adicciones. 2024 Jun 1;36(2):189–98.

50. Sleeman NA, Hoban C, Koutoubi S. Sexually Transmitted Infections in Pre-Exposure Prophylaxis Patients. Int J Transl Med Res Public Health. 2023 Mar 29;7(2):1–8.

51. Jongen VW, Reyniers T, Schim van der Loeff M, Smekens T, Hoornenborg E, van den Elshout M, et al. Trajectories of PrEP use among men who have sex with men: a pooled analysis of two prospective, observational cohort studies. J Int AIDS Soc. 2023 Jul;26(7):e26133.

Appendix

Descriptive statistics

The appendices under present the descriptive analyses conducted on the entire database collected for this study. While comprehensive, it is important to note that not all variables and data points have been used in the main body of this research. This selective approach was intentional to maintain a clear focus on the central research question and objectives, thereby avoiding potential distractions or dilution of the core analysis. The descriptive statistics provided in these annexes offer valuable context and background information, supporting the robustness of the study.

Tab A1. Participant 's characteristics (N=644)

Variable	N non missing	Mean (± SD) N (%)	Median	Quartiles P25-P75	Min	Max
Sex	644					
- Male		629 (97,7)				
- Female		10 (1,6)				
- Female transgender		5 (0,8)				
Age	644	41.67 (± 11.01)	40	33-48	21	78
- < 35		216 (33,5)				
- 36-50		293 (45,4)				
- 51-64		120 (18,6)				
- > 65		16 (2,5)				
Nationality	556					
- Europe		530 (94,8)				
- Africa		15 (2,5)				
- America		10 (1,8)				
- Asia		6 (0,9)				
Origin	627					
- Central Europe		557 (88,8)				

- Eastern Europe		11 (1,8)
- North Africa		16 (2,6)
- Sub-Saharan African		16 (2,6)
- Middle East		7 (1,1)
- South America		12 (1,9)
- Asia		8 (1,3)
Sexual orientation***	644	
- Homosexual/bisexual		641 (98,6)
- Heterosexual		9 (1,4)

Tab.A2 Sexual partners and protection (N=644)

Variables	N non missing	Mean (± SD) N (%)	Median	Quartiles P25-P75	Min	Max
Number of regular partner(s)	604	1.29 (± 3,6)	1	0-1	0	50
Condom use (Protection)	389					
- Always		47 (12,1)				
- Often		40 (10,3)				
- Sometimes		9 (2,3)				
- Never		291 (74,8)				
- Except once		2 (0,5)				
Number of irregular partner(s)	629	27.16 (± 52,84)	10	5-30	0	700
Condom use (Protection)	589					
- Always		191 (32,4)				
- Often		267 (45,3)				

- Sometimes	55 (9,3)
- Never	61 (10,4)
- Except once	15 (2,6)

Table A3. Types of sexual intercourse and frequency of protection

Variables	N non missing	N (%)
Anal sex	642	615 (95,8)
Condom use (Protection)	572	
- Always		125 (21,9)
- Often		311 (54,4)
- Sometimes		66 (11,5)
- Never		57 (10)
- Except once		13 (2,3)
Vaginal sex	644	70 (10,9)
Condom use (Protection)	65	
- Always		25 (38,5)
- Often		23 (35,4)
- Sometimes		3 (4,6)
- Never		14 (21,5)
Oral sex	643	621 (96,6)
Condom use (protection)	557	
- Always		10 (1,8)
- Often		22 (4)
- Sometimes		5 (1)
- Never		519 (93,2)

- Except once 1 (0,2)

Table A4. Vulnerability factors and protection (N=644)

Variables	N non missing	N (%)
HIV infected partner	617	128 (20,8)
Condom use (Protection)	123	
- Always		52 (42,3)
- Often		11 (8,9)
- Sometimes		13 (10,6)
- Never		45 (36,6)
- Except once		2 (1,6)
Drug user partner	608	150 (24,7)
Condom use (Protection)	148	
- Always		38 (26)
- Often		62 (42,5)
- Sometimes		15 (10,3)
- Never		29 (19,9)
- Except once		2 (1,4)
Prostitute partner	619	50 (8,1)
Condom use (protection)	50	
- Always		29 (58)
- Often		11 (22)
- Sometimes		10 (20)
Prostitution	618	29 (4,7)
Condom use (Protection)	26	

- Always		16 (61,5)
- Often		8 (30,8)
- Sometimes		1 (3,9)
- Never		1 (3,9)
Bloody/fist sex	615	153 (24,9)
Condom use (Protection)	142	
- Always		51 (35,9)
- Often		49 (34,5)
- Sometimes		16 (11,3)
- Never		25 (17,6)
- Except once		1 (0,7)
MSM	619	606 (97,9)
Condom use (Protection)	532	
- Always		120 (22,6)
- Often		282 (53)
- Sometimes		67 (12,6)
- Never		55 (10,3)
- Except once		8 (1,5)
Partner who has multiple partners	618	502 (81,2)
Condom use (Protection)	418	
- Always		97 (23,2)
- Often		197 (47,1)
- Sometimes		64 (15,3)

- Never		53 (12,7)
- Except once		7 (1,7)
Chemsex historic	644	121 (18,8)
Current chemsex practice	642	105 (16,4)
PEP taken at least once	644	186 (28,9)

Tab.A5 Drug consummation (N=644)

Variables	N non missing	N (%)
Drug consummation	637	321 (50,4)
Alcohol consummation	643	74 (11,5)
Cannabis	644	127 (19,7)
Tobacco	644	30 (4,7)
Viagra	644	26 (4)
Cocaine	644	82 (12,7)
Heroine	644	1 (0,2)
Amphetamine	644	37 (5,8)
Cathinone	644	33 (5,1)
LSD	644	22 (3,4)
Crystal	644	11 (1,7)
Poppers	644	143 (22,2)
Another drug	644	70 (10,9)
Syringe administration	644	9 (1,4)

Snif administration	644	103 (16)
Smoke administration	644	29 (4,5)
Sharing administration	644	51 (7,9)

Tab. A6 Reasons for PrEP application (N=644)

Variables	N non missing	N (%)
Multiple partners	644	598 (92,9)
Multiple STIs	644	39 (6,1)
Sexworker	644	19 (3)
HIV infected partner	644	24 (3,7)
Post PEP	65	82 (12,7)
Chemsex practice	644	48 (7,5)
Injection risk	644	0
Other reason	644	9 (1,4)

Tab A7. End of PrEP application (N=644)

Variables	N non missing	N (%)
End of the PrEP	644	49 (7,6)
Reason	50	
- No longer needed		42 (84)
- Side effects		2 (4)
- Death		2 (4)
- Other		4 (8)

Tab A8. STIs frequency (N=644)

Variables	N non missing	N (%)
Chlamydia infection in 2021	644	81 (12,6)
Chlamydia infection in 2022	644	96 (14,9)
Chlamydia infection in 2023	644	96 (14,9)
Chlamydia (2021-2023)	644	214 (33,2)
Gonorrhea infection in 2021	644	71 (11)
Gonorrhea infection in 2022	644	101 (15,7)
Gonorrhea infection in 2023	644	102 (15,8)
Gonorrhea (2021-2023)	644	216 (33,5)
Syphilis infection in 2021	644	33 (5,1)
Syphilis infection in 2022	644	45 (7)
Syphilis infection in 2023	644	48 (7,5)
Syphilis (2021-2023)	644	104 (16,2)
Hepatitis C infection	644	2 (0,3)
At least one STI from 2021 to 2023	644	355 (55,1)
Monkeypox diagnosed in 2022	644	15 (2,3)

Table. A9 Calculated score STI (N=644)

Variables	N non missing	Mean (± SD) N (%)	Median	Quartiles P25-P75	Min	Max
Score STI	644	1,05 (± 1,28)	1	0-2	0	9

Tab.A10 PrEP schema (N=644)

Variables	N non missing	N (%)
Historic PrEP schema	644	
- Continuous		171 (26,6)
- Intermittent		253 (39,3)
- Mixed		220 (34,2)
Current PrEP schema	643	
- Continuous		264 (41,1)
- Intermittent		344 (53,5)
- Mixed		35 (5,4)

Tab. A11 Binary calculated variables for regressions (N=644)

Variables	N non missing	N (%)
Nation (Europe)	560	527 (94,1)
Number of irregular partners </= to the median (10)	629	236 (37,5)
Number of regular partners </= to the median (1)	604	190 (31,5)
Origin (European)	627	568 (90,6)
Origin (African)	627	32 (5,1)

Table.A12 Specific PrEP consultation (N=644)

Variables	N non missing	Mean (± SD) N (%)	Median	Quartiles P25-P75	Min	Max
Number of consultation	644	7,03 (± 2,88)	7	4-10	3	14

Normality investigation

The assessment of normality in quantitative variables is a fundamental step in statistical analysis. Verifying the hypothesis that the variable follows a normal distribution ensures the reliability and validity. In cases where normality is not validated, data transformations may be required to ensure robust and accurate conclusions.

Variable: « IRRPART » which determine the number of irregular sexual partners

Descriptive statistics :

```
> numSummary(BDFUSION[,"IRRPART", drop=FALSE], statistics=c("mean", "sd", "quantiles", "CV", "skewness", "kurtosis"),
+   quantiles=c(0,.25,.5,.75,1), type="2")
     mean       sd IQR skewness kurtosis 0% 25% 50% 75% 100%   n NA
 27.16216 52.83886  25 6.863529 66.15594  0   5  10  30  700 629 16
```

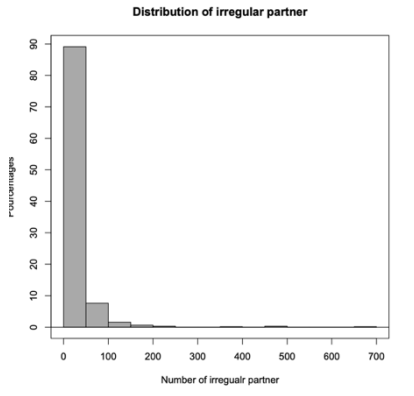
Commentaries :

- Mean and median distance (27 and 10)
- High standard deviation (52)
- Skewness coefficient at 6,8
- Kurtosis coefficient at 66,15
- P25 quartile = 5 et P75 quartile = 30 which means IQR = 25

In conclusion, the results of the descriptive statistics suggest that the distribution of the data for this variable is far from normal. The mean (27) and median (10) are far apart, indicating a marked asymmetry in the distribution. The high standard deviation (52) reflects a wide dispersion of values, reinforcing the idea of a broad distribution. The skewness coefficient of 6,8 indicates a strong right-wing skewness, while the kurtosis coefficient of 66,15 suggests a very sharp distribution. Finally, the quartiles P25 = 5 and P75 = 30, giving an interquartile range (IQR) of 25, confirm the presence of relatively dispersed values, with a notable concentration in the lower part of the distribution.

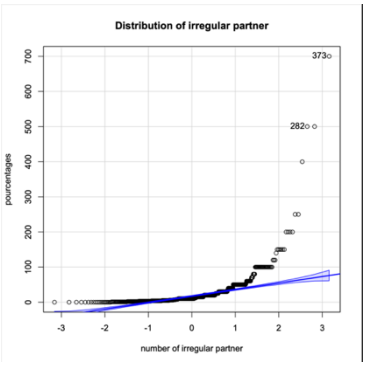
Graphics analysis:

Histogram :



The histogram is not normally distributed because it shows a strong asymmetry. There is a high bar on the left, indicating a concentration of values in the lower range. While the distribution gradually extends towards the right lower bars. This suggests a right-skewed distribution meaning that the most data points are clustered around the lower values with a. few higher values.

Q-Q plot :



The Q-Q plot suggests that the data do not follow a normal distribution. At the beginning, the points are approximately aligned with the reference line, indicating that the lower values follow the expected normal pattern. However, as the values increase, the points deviate significantly from the line, suggesting a departure from the normality.

Normality test Shapiro-Wilk :

```
> normalityTest(~IRRPART, test="shapiro.test", data=BDFUSION)

        Shapiro-Wilk normality test

data:  IRRPART
W = 0.43558, p-value < 2.2e-16
```

- W = 0.43558
  The W statistic measures the extent to which the data distribution aligns with a normal distribution. A value closer to 1 indicates a stronger adherence to normality. In this case, W = 0.43558 is significantly distant from 1, suggesting that the data distribution deviates considerably from normality.
- p-value < 2.2e-16
  The p-value is extremely small (well below the conventional threshold of 0.05). This indicates strong evidence against the null hypothesis, which assumes that the data follow a normal distribution. Consequently, the null hypothesis is rejected.

Conclusion :

The Shapiro-Wilk test confirms that the “IRRPART” variable does not follow a normal distribution, given the very low p-value and the small W statistic.

Variable: « REGPART » which determine the number of regular sexual partners

Descriptive statistics:

```
> numSummary(bdfusion[,"REGPART", drop=FALSE], statistics=c("mean", "sd", "quantiles", "CV", "skewness", "kurtosis"),
+   quantiles=c(0,.25,.5,.75,1), type="2")
     mean       sd IQR skewness kurtosis 0% 25% 50% 75% 100%   n NA
 1.288079 3.597464   1 8.974425 95.04119  0   0   1   1   50 604 41
```

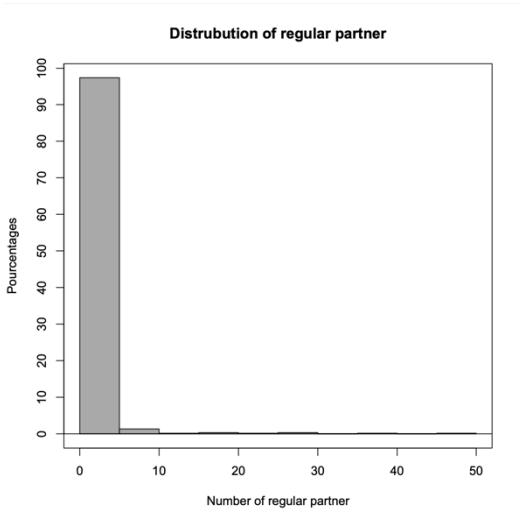
Commentaries :

- Mean and median close (1,29 and 1)
- Narrow standard deviation (3,6)
- Skewness coefficient at 8,97
- Kurtosis coefficient at 95,04
- P25 quartile = 0 et P75 quartile = 1 which means IQR = 1

The proximity of the mean and median values indicates that the distribution is broadly centred, with no strong asymmetry at the central values. The standard deviation indicates that the dispersion of the data around the mean is relatively small, suggesting that the values do not vary too much. The skewness coefficient indicates a distribution that is extremely skewed to the right. The kurtosis coefficient is very high, suggesting an extremely sharp distribution, with most observations concentrated around the median. As the interquartile range is very narrow, this confirms that most values are close to the median, with very little dispersion within the middle 50% of the data.

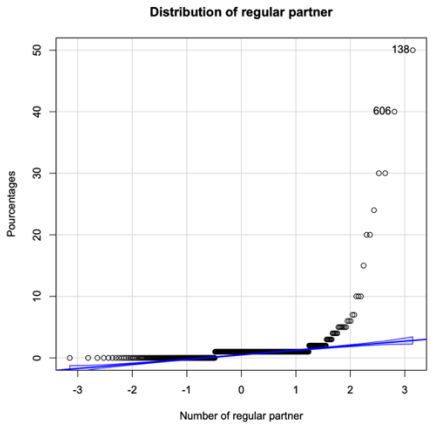
Graphics analysis:

Histogram :



The histogram is not normally distributed because it shows a strong asymmetry. There is a high bar on the left, indicating a concentration of values in the lower range. While the distribution gradually extends towards the right lower bars. This suggests a right-skewed distribution meaning that the most data points are clustered around the lower values with a. few higher values.

Q-Q plot :



The Q-Q plot suggests that the data do not follow a normal distribution. At the beginning, the points are approximately aligned with the reference line, indicating that the lower values follow the expected normal pattern. However, as the values increase, the points deviate significantly from the line, suggesting a departure from the normality.

Normality test of Shapiro-Wilk :

```
> normalityTest(~REGPART, test="shapiro.test", data=bdfusion)

        Shapiro-Wilk normality test

data:  REGPART
W = 0.2422, p-value < 2.2e-16
```

W is very low (0.2422), indicating that the distribution of the data is not normal. The highly significant p-value indicates that the null hypothesis of normality is rejected.

Variable: « NB_CLT » which determine the number of participant's consultation

Descriptive statistics:

```
> numSummary(bdfusion[,"NB_CLT", drop=FALSE], statistics=c("mean", "sd", "quantiles", "CV", "skewness", "kurtosis"),
+   quantiles=c(0,.25,.5,.75,1), type="2")
     mean       sd IQR  skewness  kurtosis 0% 25% 50% 75% 100%   n
 7.043411 2.890009   6 0.1656793 -1.167128  3   4   7  10   14 645
```

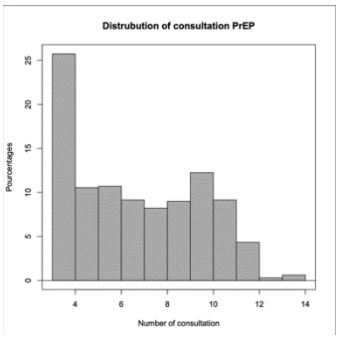
Commentaries :

- Mean and median very close (7.04 and 7)
- Narrow standard deviation (2.89)
- Skewness coefficient of 0.16
- Kurtosis coefficient of -1.16
- P 25 = 4 and P75 = 10 which gives IQR 6

The mean and median suggest a symmetrical distribution since they are close together. The standard deviation is narrow, which means that the dispersion of the data is low, with values clustered around the mean. The coefficient of asymmetry is low, meaning that the distribution is almost symmetrical with no strong deviation to the right or left. Finally, the IQR also indicates that the dispersion of the variables is "normal".

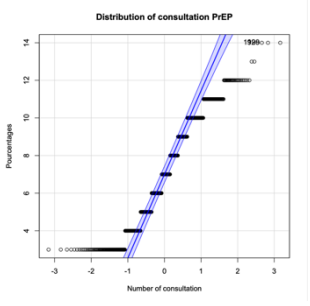
Graphics analysis:

Histogram:



The histogram is approximately symmetric, but with some notable deviations. The leftmost bar is higher than the others, indicating a concentration of lower values. After this initial peak, the distribution appears relatively balanced for several bars, with frequencies remaining consistent. Overall, while the distribution is not perfectly symmetric.

Q-Q plot :



The Q-Q plot indicates that the data follow a roughly normal distribution in the central range but deviate at the extremes. The blue reference line is nearly vertical. Most points remain close to the line, indicating a good fit with normality in the middle of the distribution. However, at the extremities, the points deviate from the line. These deviations indicate that the data may not perfectly follow a normal distribution.

Normality test Shapiro-Wilk:

```
> normalityTest(~NB_CLT, test="shapiro.test", data=bdfusion)

        Shapiro-Wilk normality test

data:  NB_CLT
W = 0.93481, p-value = 3.631e-16
```

W: close to 1, indicating that the distribution is close to normal.
The p-value is under than 0.05, the null hypothesis is rejected. The distribution is not normal.

Variable: « AGE » which refers to the age in years of the population

Descriptive statitics:

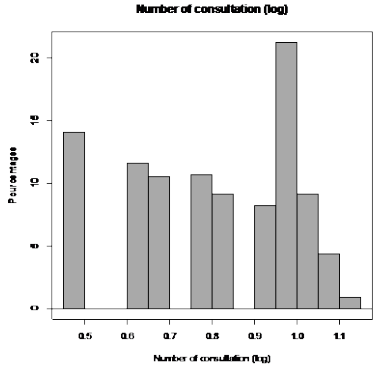
```
> numSummary(bdfusion[,"AGE", drop=FALSE], statistics=c("mean", "sd", "quantiles", "CV", "skewness", "kurtosis"),
+   quantiles=c(0,.25,.5,.75,1), type="2")
     mean       sd IQR  skewness   kurtosis 0% 25% 50% 75% 100%   n
 41.72248 11.08895  15 0.6427784 0.09546024 21  33  40  48   78 645
```

- Mean and median close (41,72 and 40)
- Moderate tandard deviation 11,08
- Asymmetry coefficient at 0,64
- Kurtosis coefficient 0,09
- P25 = 33 and P75 = 48, giving IQR 15

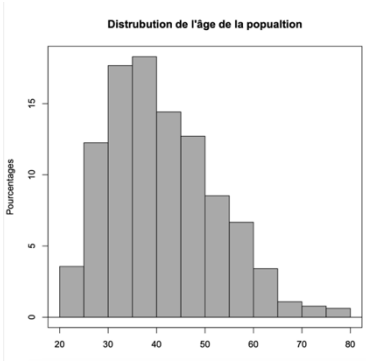
The proximity of the mean to the median suggests a relatively symmetrical distribution. Standard deviation of 11,08 indicates a moderate dispersion of values around the mean. The data are relatively varied, but not excessively. Skewness coefficient of 0,64 suggests a slightly positive skewness, meaning that the distribution is slightly skewed to the right. A kurtosis coefficient of 0,09 means that a value close to 0 suggests that the distribution is like a normal distribution. The interquartile range is moderate, indicating that the majority of values are

contained within a relatively narrow range, reinforcing the idea of a well-structured distribution.

Graphic analysis:

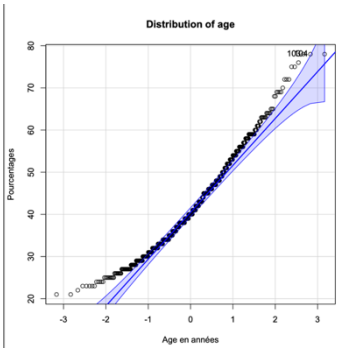


Histrogram:



The histogram has a near symmetric distribution with a subtle deviation: the frequency of the values is slightly elevated on the left side compared to the right. This suggests a minor right skewness.

Q-Q plot:



The Q-Q plot shows that while most data points align well with the reference line, the extreme values deviate from it.

Normality test of Shapiro-Wilk:

```
> normalityTest(~AGE, test="shapiro.test", data=bdfusion)

        Shapiro-Wilk normality test

data:  AGE
W = 0.96722, p-value = 8.054e-11
```

W is close to 1, which means that the distribution is almost normal. And the p-value is under 0.05, so the null hypothesis is rejected.

Tab A13: Normality tests conclusion

Variable	Normality test	Action plan
"AGE"	Mostly normal (except Shapiro-Wilk test)	Accept normality, no transformation needed
"NB_CLT"	Not normal	Apply log transformation, then retest normality Then, apply threshold (the median) to create a binary variable
"IRREGPART"	Not normal	Apply threshold (the median) to create a binary variable
"REGPART"	Not normal	Apply threshold (the median) to create a binary variable

For the "NB_CLT" variable" a log transformation was performed, and the normality was retest.

Normality retest for the new variable "NB_CLT_LOG":

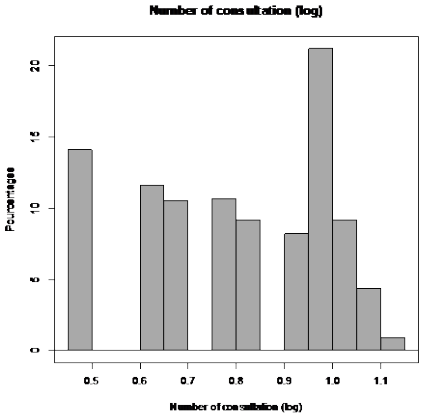
Descriptive statistics:

```
> numSummary(BDFUSION[,"NB_CLT_LOG", drop=FALSE], statistics=c("mean", "sd", "quantiles", "CV", "skewness",
+   "kurtosis"), quantiles=c(0,.25,.5,.75,1), type="2")
      mean        sd     IQR   skewness kurtosis        0%     25%      50% 75%     100%   n
 0.8067243 0.1956157 0.39794 -0.3407806  -1.1287 0.4771213 0.60206 0.845098   1 1.146128 645
```

- Mean and median close (0,81 and 0,85)
- Narrow standard deviation (0,19)
- Asymmetry coefficient at -0,34
- Kurtosis coefficient -1,13
- P25 = 0,60 and P75 = 1, giving IQR 0,4

The data appears to be approximatively symmetric. The mean (0,81) and the median (0,85) are close in value. The standard deviation is relatively small (0,19), it means that the data are tightly clustered around the mean with little dispersion. The asymmetry coefficient (-0,34) indicates a slight negative skew. Then, the kurtosis coefficient of -1,13 suggests that the distribution is relatively flat. The interquartile range is 0,4 reinforcing the idea that the data is fairly concentrated within a narrow range.

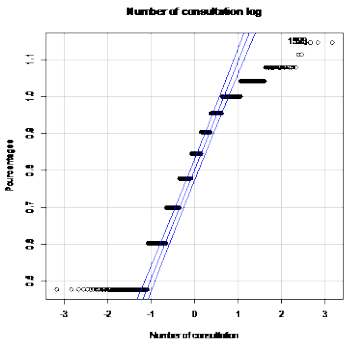
Graphic analysis:



Histrogram:

The distribution appears to be a little skewed with a right tail.

Q-Q plot:



The Q-Q plot graph seems to be symmetric except the extremities.

Normality Shapiro-Wilk test :

```
> normalityTest(~NB_CLT_LOG, test="shapiro.test", data=BDFUSION)

        Shapiro-Wilk normality test

data:  NB_CLT_LOG
W = 0.9193, p-value < 2.2e-16
```

The extremely low p-value suggests a statistically significant non normal distribution. The W value is lower than 1 reinforcing the rejection of the null hypothesis.
Giving this finding, the log transformed variable is still not considered as a normal distribution.
In the end, this variable was binarized at its median.
This concludes the section on investigating normality.

Univariate analysis

1. Univariate regressions by STI

This table presents the results of univariate binary logistic regression analyses, where the dependent variable (Y) is the presence of *Chlamydia* infection. Each independent variable from the dataset was tested individually, provided it was feasible and clinically relevant to do so. The aim was to explore potential associations between *Chlamydia* and each predictor, using odds ratios, confidence intervals, and p-values to assess the strength and significance of these associations.

Tab A14. Univariate regression with chlamydia (at least one episode between 2021 and 2023).

Variable X	***Coefficient ± SE***	***Odds Ratio (95% CI)***	***p-value***
Age	-0.01 ± 0.01	0.99 (0.97–1.00)	0.13
Anal sex (Yes)	1.42 ± 0.62	4.15 (1.43–17.60)	0.02
Vaginal sex (Yes)	-0.24 ± 0.28	0.78 (0.44–1.33)	0.38
Oral sex (Yes)	1.18 ± 0.63	3.26 (1.09–13.98)	0.06
Alcohol (Yes)	-0.57 ± 0.29	0.57 (0.31–0.98)	0.05
Drugs (Yes)	-0.05 ± 0.17	0.95 (0.68–1.32)	0.76
Cannabis (Yes)	-0.19 ± 0.21	0.83 (0.54–1.25)	0.38
Tobacco (Yes)	-0.33 ± 0.42	0.72 (0.30–1.58)	0.44
Viagra (Yes)	0.06 ± 0.42	1.07 (0.45–2.28)	0.88
Cocaine (Yes)	-0.21 ± 0.26	0.81 (0.48–1.33)	0.42
Heroin (Yes)	NA[1]	NA	NA
Amphetamine (Yes)	0.45 ± 0.34	1.57 (0.79–3.07)	0.19
LSD (Yes)	-0.29 ± 0.49	0.75 (0.26–1.84)	0.55
Cathinones (Yes)	0.41 ± 0.36	1.51 (0.73–3.07)	0.25
Crystal (Yes)	0.14 ± 0.63	1.15 (0.29–3.85)	0.82
Poppers (Yes)	-0.23 ± 0.21	0.80 (0.53–1.84)	0.27
STI (Yes)	0.58 ± 0.33	1.79 (0.92–3.43)	0.08
Multipart (Yes)	1.08 ± 0.42	2.95 (1.38–7.31)	0.01
Sexwork (Yes)	-0.34 ± 0.53	0.71 (0.23–1.89)	0.52
HIV-partner reason (Yes)	-0.19 ± 0.46	0.82 (0.31–1.94)	0.67

[1] Extreme estimates due to very few/too many cases in this variable X. This lack of data led to unstable results, with inflated odds ratios and wide confidence intervals, we chose not to estimate them and write “NA”.

Post-PEP (Yes)	-0.28 ± 0.26	0.76 (0.45–1.25)	0.29
Chemsex reason (Yes)	0.67 ± 0.30	1.95 (1.07–3.53)	0.03
History of chemsex (Yes)	0.60 ± 0.21	1.83 (1.22–2.74)	<0.01
Current chemsex (Yes)	0.68 ± 0.22	1.97 (1.29–3.02)	<0.01
PEP (Yes)	-0.03 ± 0.18	0.97 (0.67–1.39)	0.88
Gonorrhoeae (Yes)	1.27 ± 0.18	3.55 (2.51–5.04)	<0.01
Syphilis (Yes)	0.56 ± 0.22	1.76 (1.14–2.69)	0.01
MPOX2022 (Yes)	1.13 ± 0.53	3.10 (1.10–9.37)	0.03
Syringe (Yes)	0.48 ± 0.68	1.62 (0.40–6.18)	0.48
Sniff (Yes)	0.19 ± 0.22	1.21 (0.78–1.87)	0.39
Smoke (Yes)	0.06 ± 0.40	1.06 (0.47–2.76)	0.88
Share (Yes)	0.28 ± 0.30	1.33 (0.73–2.37)	0.35
Current intermittent PrEP	-0.73 ± 0.18	0.48 (0.34–0.68)	<0.01
Current mixed PrEP	-0.08 ± 0.37	0.92 (0.44–1.87)	0.82
Historic intermittent PrEP	-0.77 ± 0.21	0.47 (0.31–0.70)	<0.01
Historic mixed PrEP	-0.28 ± 0.21	0.76 (0.50–1.14)	0.18
Consultations (≥7 vs <7)	0.53 ± 0.17	1.70 (1.22–2.38)	<0.01
National B (Yes)	-0.13 ± 0.37	0.88 (0.43–1.88)	0.73
Origin B EU (Yes)	-0.51 ± 0.28	0.60 (0.35–1.04)	0.06
Origin B AF (Yes)	0.47 ± 0.37	1.61 (0.77–3.29)	0.2
HIV-partner life (Yes)	0.07 ± 0.21	1.08 (0.71–1.62)	0.72
Partner drug sex (Yes)	0.50 ± 0.19	1.65 (1.12–2.42)	0.01
Sex with prostitute (Yes)	0.13 ± 0.31	1.14 (0.61–2.06)	0.67
Multipartner (Yes)	0.66 ± 0.24	1.94 (1.22–3.16)	0.01
Prostitution work (Yes)	-0.47 ± 0.44	0.62 (0.24–1.41)	0.29
Blood/fi sex (Yes)	-0.11 ± 0.20	0.90 (0.60–1.32)	0.59
>1 Regular partners	-0.29 ± 0.18	0.75 (0.52–1.08)	0.12
>10 Irregular partners	0.45 ± 0.18	1.57 (1.11–2.24)	0.01

Tab A15. Univariate regression with gonorrhea (at least one episode between 2021 and 2023).

Variable X	***Coefficient ± SE***	***Odds Ratio (95% CI)***	***p-value***
Age	-0.03 ± 0.01	0.97 (0.96-0.99)	<0.01
Anal sex (Yes)	1.11 ± 0.55	3.02 (1.15-10.42)	0.04
Vaginal sex (Yes)	-0.26 ± 0.28	0.77 (0.44-1.31)	0.35
Oral sex (Yes)	0.56 ± 0.52	1.74 (0.68-5.38)	0.28
Alcohol (Yes)	-0.27 ± 0.27	0.77 (0.44-1.29)	0.33
Drugs (Yes)	0.27 ± 0.17	1.31 (0.95-1.83)	0.11
Cannabis (Yes)	-0.12 ± 0.21	0.89 (0.58-1.34)	0.59
Tobacco (Yes)	0.44 ± 0.38	1.55 (0.72-3.24)	0.25
Viagra (Yes)	0.88 ± 0.4	2.4 (1.09-5.38)	0.03
Cocaine (Yes)	0.15 ± 0.25	1.17 (0.71-1.88)	0.53
Heroin (Yes)	NA	NA	NA
Amphetamine (Yes)	0.32 ± 0.35	1.38 (0.69–2.69)	0.36
LSD (Yes)	0.33 ± 0.44	1.39 (0.56–3.27)	0.46
Cathinones (Yes)	0.66 ± 0.36	1.93 (0.94–3.92)	0.07
Crystal (Yes)	0.13 ± 0.63	1.13 (0.29–3.80)	0.84
Poppers (Yes)	0.08 ± 0.20	1.08 (0.73–1.60)	0.68
STI (Yes)	0.23 ± 0.34	1.26 (0.63–2.42)	0.50
Multipart (Yes)	1.28 ± 0.45	3.61 (1.62–9.60)	<0.01
Sexwork (Yes)	-0.36 ± 0.53	0.70 (0.22–1.86)	0.50
HIV-partner reason (Yes)	-0.67 ± 0.51	0.51 (0.17–1.29)	0.19
Post-PEP (Yes)	0.09 ± 0.25	1.10 (0.67–1.77)	0.71
Chemsex reason (Yes)	0.84 ± 0.30	2.30 (1.27–4.19)	<0.01
History of chemsex (Yes)	0.84 ± 0.21	2.31 (1.55–3.47)	<0.01
Current chemsex (Yes)	0.71 ± 0.22	2.03 (1.33–3.11)	<0.01
PEP (Yes)	0.19 ± 0.18	1.21 (0.84–1.72)	0.30
Chlamydia (Yes)	1.27 ± 0.18	3.55 (2.51–5.04)	<0.01
Syphilis (Yes)	0.69 ± 0.22	1.99 (1.30–3.05)	<0.01
MPOX2022 (Yes)	1.74 ± 0.59	5.69 (1.92–20.72)	<0.01
Syringe (Yes)	-0.01 ± 0.71	0.99 (0.21–3.79)	0.99
Sniff (Yes)	0.52 ± 0.22	1.68 (1.09–2.58)	0.02
Smoke (Yes)	0,65 ± 0,38	1,91 (0,89-4,05)	0,09

Share (Yes)	0.88 ± 0.29	2.40 (1.35–4.30)	<0.01
Current intermittent PrEP	-0.50 ± 0.17	0.60 (0.31–0.70)	<0.01
Current mixed PrEP	0.39 ± 0.36	1.48 (0.50–1.14)	0.28
Historic intermittent PrEP	-0.53 ± 0.21	0.59 (0.39–0.83)	0.01
Historic mixed PrEP	0.01 ± 0.21	1.01 (0.67–1.52)	0.97
Consultations (≥7 vs <7)	0.85 ± 0.17	2.35 (1.67–3.31)	<0.01
National B (Yes)	0.22 ± 0.39	1.24 (0.60–2.79)	0.58
Origin B EU (Yes)	-0.90 ± 0.29	0.91 (0.52–1.62)	0.74
Origin B AF (Yes)	0.32 ± 0.37	1.37 (0.65–2.81)	0.39
HIV-partner life (Yes)	0.06 ± 0.21	1.07 (0.70–1.60)	0.76
Partner drug sex (Yes)	0.76 ± 0.19	2.14 (1.46–3.12)	<0.01
Sex with prostitute (Yes)	-0.07 ± 0.32	0.93 (0.49–1.70)	0.82
Multipartner (Yes)	0.56 ± 0.24	1.76 (1.12–2.83)	0.01
Prostitution work (Yes)	0.50 ± 0.38	1.64 (0.76–3.48)	0.20
Blood/fi sex (Yes)	0.21 ± 0.19	1.24 (0.84–1.80)	0.28
>1 Regular partners	-0.07 ± 0.19	0.93 (0.65–1.34)	0.70
>10 Irregular partners	0.88 ± 0.19	2.40 (1.67–3.50)	<0.01

Tab A16. Univariate regression with syphilis (at least one episode between 2021 and 2023).

Variable X	***Coefficient ± SE***	***Odds Ratio (95% CI)***	***p-value***
Age	-0.01 ± 0.01	0.99 (0.97–1.01)	0.51
Anal sex (Yes)	NA	NA	NA

Vaginal sex (Yes)	-0.44 ± 0.39	0.64 (0.28–1.31)	0.26
Oral sex (Yes)	NA	NA	NA
Alcohol (Yes)	0.004 ± 0.34	1 (0.50–1.87)	0.99
Drugs (Yes)	0.30 ± 0.22	1.36 (0.89–2.08)	0.16
Cannabis (Yes)	-0.44 ± 0.30	0.64 (0.35–1.13)	0.14
Tobacco (Yes)	0.27 ± 0.47	1.32 (0.48–3.11)	0.56
Viagra (Yes)	0.88 ± 0.44	2.42 (0.97–5.55)	0.05
Cocaine (Yes)	-0.13 ± 0.33	0.88 (0.44–1.63)	0.69
Heroin (Yes)	NA	NA	NA
Amphetamine (Yes)	-0.22 ± 0.49	0.80 (0.27–1.94)	0.65
LSD (Yes)	0.15 ± 0.56	1.16 (0.33–3.19)	0.79
Cathinones (Yes)	0.87 ± 0.40	2.39 (1.06–5.06)	0.03
Crystal (Yes)	1.11 ± 0.64	3.05 (0.79–10.28)	0.08
Poppers (Yes)	0.43 ± 0.24	1.53 (0.94–2.44)	0.08
STI (Yes)	1.29 ± 0.35	3.62 (1.80–7.11)	<0.01
Multipart (Yes)	1.07 ± 0.61	2.91 (1.04–12.18)	0.08
Sexwork (Yes)	0.91 ± 0.51	2.48 (0.85–6.44)	0.07
HIV-partner reason (Yes)	-0.31 ± 0.63	0.73 (0.17–2.18)	0.62
Post-PEP (Yes)	-0.37 ± 0.36	0.69 (0.33–1.33)	0.3
Chemsex reason (Yes)	1.06 ± 0.33	2.89 (1.49–5.41)	<0.01
History of chemsex (Yes)	0.87 ± 0.25	2.39 (1.48–3.81)	<0.01
Current chemsex (Yes)	0.85 ± 0.25	2.35 (1.42–3.82)	<0.01
PEP (Yes)	-0.36 ± 0.25	0.70 (0.42–1.13)	0.16
Gonorrhoeae (Yes)	0.69 ± 0.22	1.99 (1.30–3.05)	<0.01
Syphilis (Yes)	0.56 ± 0.22	1.76 (1.14–2.69)	<0.01
MPOX2022 (Yes)	1.57 ± 0.53	4.80 (1.65–13.67)	<0.01
Syringe (Yes)	0.97 ± 0.72	2.64 (0.55–10.19)	0.17
Sniff (Yes)	0.19 ± 0.28	1.21 (0.68–2.06)	0.49
Smoke (Yes)	0.72 ± 0.43	2.06 (0.84–4.62)	0.09
Share (Yes)	0.39 ± 0.36	1.48 (0.70–2.89)	0.28
Current intermittent PrEP	-0.32 ± 0.22	0.73 (0.47–1.12)	0.15
Current mixed PrEP	-0.59 ± 0.55	0.55 (0.16–1.48)	0.28
Historic intermittent PrEP	-0.61 ± 0.27	0.54 (0.32–0.91)	0.02
Historic mixed PrEP	-0.31 ± 0.26	0.73 (0.44–1.23)	0.24
Consultations (≥7 vs <7)	0.47 ± 0.22	1.59 (1.04–2.47)	0.03
National B (Yes)	-0.34 ± 0.44	0.71 (0.32–1.83)	0.45

Origin B EU (Yes)	-0.30 ± 0.34	0.74 (0.39–1.51)	0.38
Origin B AF (Yes)	0.18 ± 0.47	1.20 (0.44–2.81)	0.70
HIV-partner life (Yes)	0.10 ± 0.27	1.11 (0.65–1.84)	0.69
Partner drug sex (Yes)	0.55 ± 0.24	1.74 (1.08–2.76)	0.02
Sex with prostitute (Yes)	-1.16 ± 0.61	0.31 (0.08–0.88)	0.05
Multipartner (Yes)	0.13 ± 0.29	1.14 (0.66–2.06)	0.66
Prostitution work (Yes)	0.07 ± 0.50	1.07 (0.35–2.66)	0.89
Blood/fi sex (Yes)	0.33 ± 0.24	1.39 (0.86–2.21)	0.17
>1 Regular partners	0.06 ± 0.24	1.07 (0.67–1.72)	0.79
>10 Irregular partners	0.34 ± 0.23	1.41 (0.90–2.23)	0.14

Tableau A17. Univariate regression with protection variables and chlamydia

VARIABLE	COEFFICIENT ± SE	OR (95% CI)	P-VALUE
IRREGULAR	-0.41 ± 0.19	0.67 (0.46–0.96)	0.03
PARTNER	0.14 ± 0.07	1.15 (1.01–1.31)	0.04
REGULAR	0.01 ± 0.33	1.01 (0.51–0.91)	0.99
PARTNER	-0.003 ± 0.08	1.00 (0.86–1.17)	0.97
ANAL SEX	0.04 ± 0.21	1.40 (0.68–1.57)	0.86
	0.01 ± 0.08	1.01 (0.87–1.17)	0.94
VAGINAL SEX	0.22 ± 0.56	1.24 (0.41–3.69)	0.70
	-0.05 ± 0.18	0.96 (0.67–1.35)	0.80
ORAL SEX	-1.53 ± 1.06	0.22 (0.01–1.16)	0.15
	0.25 ± 0.16	1.29 (0.96–1.83)	0.12
HIV-PARTNER SEX	-0.05 ± 0.39	0.95 (0.44–2.03)	0.90
	NA	NA	NA
DRUGPARTNER	-0.32 ± 0.39	0.73 (0.33–1.55)	0.42
SEX	0.12 ± 0.12	1.12 (0.89–1.43)	0.33
MSM	-0.14 ± 0.22	0.87 (0.55–1.33)	0.52
	0.05 ± 0.08	1.05 (0.91–1.22)	0.51
PRO	0.14 ± 0.59	1.15 (0.36–3.70)	0.82
	0.01 ± 0.23	1.01 (0.64–1.58)	0.96
MULTI	-0.31 ± 0.25	0.73 (0.44–1.19)	0.22
	0.07 ± 0.08	1.07 (0.92–1.26)	0.38
PROWORK	0.14 ± 0.59	1.15 (0.36–3.70)	0.82
	0.01 ± 0.23	1.01 (0.64–1.58)	0.96
BLOOD/FI SEX	-0.77 ± 0.40	0.46 (0.20–0.99)	0.06
	0.13 ± 0.12	1.14 (0.90–1.45)	0.29

In the table, the first univariate regression appears in the first row, with the variable "always protected". This analysis compares only participants who exclusively use protection with the associated STI.

Immediately below, on the following row, is the second univariate regression performed with the continuous variable. This continuous variable was used to assess, via univariate logistic regression, whether a decrease in protection use increases the likelihood of contracting an STI.

Tab A18. Univariate regression with protection variables and gonorrhea

VARIABLE	COEFFICIENT ± SE	OR (95% CI)	P-VALUE
IRREGULAR PARTNER	-0.60 ± 0.20	0.55 (0.37 – 0.80)	0.002
	0.16 ± 0.07	1.17 (1.02 – 1.33)	0.02
REGULAR PARTNER	-0.40 ± 0.36	0.67 (0.32 – 1.31)	0.26
	0.11 ± 0.08	1.12 (0.96 – 1.33)	0.17
ANAL SEX	-0.53 ± 0.23	0.59 (0.37 – 0.91)	0.02
	0.16 ± 0.08	1.17 (1.01 – 1.36)	0.04
VAGINAL SEX	-0.40 ± 0.35	0.67 (0.32 – 1.31)	0.26
	0.11 ± 0.08	1.12 (0.96 – 1.33)	0.17
ORAL SEX	-0.19 ± 0.70	0.83 (0.18 – 3.00)	0.78
	0.10 ± 0.14	1.11 (0.85 – 1.50)	0.47
HIV PARTNER SEX	-0.11 ± 0.39	0.89 (0.42 – 1.90)	0.77
	-0.01 ± 0.11	0.99 (0.80 – 1.22)	0.92
DRUG PARTNER SEX	-0.46 ± 0.39	0.63 (0.29 – 1.33)	0.23
	0.07 ± 0.12	1.08 (0.85 – 1.37)	0.53
MSM	-0.81 ± 0.25	0.45 (0.27 – 0.71)	0.001
	0.21 ± 0.08	1.24 (1.06 – 1.45)	0.007
PRO	-0.68 ± 0.44	0.51 (0.31 – 1.77)	0.26
	0.29 ± 0.24	1.34 (0.85 – 2.15)	0.21
MULTI	-0.30 ± 0.25	0.74 (0.45 – 1.19)	0.23
	0.04 ± 0.08	1.04 (0.89 – 1.22)	0.62
PROWORK	1.10 ± 0.85	3.00 (0.59 – 18.21)	0.20
	-0.42 ± 0.36	0.65 (0.30 – 1.28)	0.24
BLOOD/FI SEX	-0.59 ± 0.37	0.56 (0.26 – 1.14)	0.12
	0.15 ± 0.12	1.16 (0.93 – 1.47)	0.20

Tab A19. Univariate regression with protection variables and syphilis

VARIABLE	COEFFICIENT ± SE	OR (95% CI)	P-VALUE
IRREGULAR PARTNER	-0.48 ± 0.25	0.62 (0.37 – 1.00)	0.06
	0.12 ± 0.08	1.13 (0.96 – 1.33)	0.15
REGULAR PARTNER	-0.23 ± 0.43	0.79 (0.31 – 1.75)	0.59
	-0.004 ± 0.10	1.00 (0.83 – 1.22)	0.96
ANAL SEX	-0.44 ± 0.29	0.64 (0.35 – 1.12)	0.13
	0.07 ± 0.09	1.07 (0.89 – 1.29)	0.49
VAGINAL SEX	NA	NA	NA
	0.56 ± 0.32	1.75 (0.98 – 3.59)	0.08
ORAL SEX	0.17 ± 0.80	1.19 (0.18 – 4.84)	0.83
	0.06 ± 0.18	1.06 (0.77 – 1.59)	0.73
HIV PARTNER SEX	-0.11 ± 0.50	0.89 (0.33 – 2.35)	0.82
	-0.03 ± 0.14	0.97 (0.74 – 1.27)	0.84
DRUG PARTNER SEX	-1.09 ± 0.57	0.34 (0.09 – 0.94)	0.06
	0.11 ± 0.14	1.11 (0.84 – 1.48)	0.47
MSM	-0.59 ± 0.32	0.55 (0.28 – 1.01)	0.07
	0.13 ± 0.10	1.14 (0.94 – 1.39)	0.18
PRO	-1.08 ± 1.26	0.34 (0.02 – 3.78)	0.39
	0.40 ± 0.46	1.49 (0.59 – 4.27)	0.39
MULTI	-1.38 ± 0.48	0.25 (0.09 – 0.59)	0.04
	0.28 ± 0.11	1.32 (1.06 – 1.66)	0.01
PROWORK	0.73 ± 1.23	2.08 (0.22 – 45.81)	0.55
	-0.12 ± 0.48	0.89 (0.28 – 2.12)	0.81
BLOOD/FI SEX	-0.63 ± 0.48	0.53 (0.20 – 1.30)	0.18
	0.09 ± 0.14	1.09 (0.82 – 1.45)	0.54

Multivariable modeling of factors associated with STIs.

Factors associated with CHLAMYDIA infection.

Estimates: coefficients, ORs, 95% Cis
Model fit: AIC and likelihood ratio test

```
Coefficients:
                          Estimate   Std. Error z value  Pr(>|z|)
(Intercept)            -17.43359210 682.36437166  -0.026    0.9796
ANALSEXF2[T.Yes]        15.14493773 682.36419638   0.022    0.9823
MULTIPARTF2[T.Yes]       0.93682917   0.47876841   1.957    0.0504 .
CHEMSEXREASONF2[T.Yes]   0.00380373   0.42127003   0.009    0.9928
CHEMSEXCURF2[T.Yes]      0.57512066   0.33096240   1.738    0.0823 .
GONOF2[T.Yes]            0.89938676   0.20093337   4.476 0.0000076 ***
SYPHF2[T.Yes]            0.01895239   0.25504615   0.074    0.9408
MPXF22[T.Yes]            0.59032524   0.64095574   0.921    0.3570
HISTOSCHEMA_F[T.Inter]   0.09781912   0.42612457   0.230    0.8184
HISTOSCHEMA_F[T.Mixed]  -0.12090807   0.29622549  -0.408    0.6832
SCHEMACUR_F[T.Inter]    -0.72045726   0.35548613  -2.027    0.0427 *
SCHEMACUR_F[T.Mixed]    -0.01895283   0.45927513  -0.041    0.9671
NBCLTBIN_F[T.>=7]        0.28450264   0.19893762   1.430    0.1527
PDRUGSEXF2[T.Yes]        0.09367045   0.23970624   0.391    0.6960
MULTIF2[T.Yes]           0.53404447   0.27034870   1.975    0.0482 *
IRRB_F[T.>=10]          -0.00009329   0.20688352   0.000    0.9996
---
```

```
> exp(confint(GLM.1))
                              2.5 %       97.5 %
(Intercept)                      NA 1.601245e+14
ANALSEXF2[T.Yes]       5.196669e-16           NA
MULTIPARTF2[T.Yes]     1.064141e+00 7.159311e+00
CHEMSEXREASONF2[T.Yes] 4.372881e-01 2.293041e+00
CHEMSEXCURF2[T.Yes]    9.269784e-01 3.409811e+00
GONOF2[T.Yes]          1.658662e+00 3.649302e+00
SYPHF2[T.Yes]          6.135039e-01 1.671279e+00
MPXF22[T.Yes]          5.161732e-01 6.712562e+00
HISTOSCHEMA_F[T.Inter] 4.802684e-01 2.559611e+00
HISTOSCHEMA_F[T.Mixed] 4.936549e-01 1.580465e+00
SCHEMACUR_F[T.Inter]   2.400433e-01 9.710190e-01
SCHEMACUR_F[T.Mixed]   3.940644e-01 2.407745e+00
NBCLTBIN_F[T.>=7]      9.003460e-01 1.965697e+00
PDRUGSEXF2[T.Yes]      6.829735e-01 1.751043e+00
MULTIF2[T.Yes]         1.016816e+00 2.945545e+00
IRRB_F[T.>=10]         6.665538e-01 1.501664e+00
```

```
    Null deviance: 746.54  on 588  degrees of freedom
Residual deviance: 667.45  on 573  degrees of freedom
  (55 observations effacées parce que manquantes)
AIC: 699.45

Number of Fisher Scoring iterations: 15
```

```
> exp(coef(GLM.1))  # Exponentiated coefficients ("odds ratios")
          (Intercept)       ANALSEXF2[T.Yes]     MULTIPARTF2[T.Yes] CHEMSEXREASONF2[T.Yes]    CHEMSEXCURF2[T.Yes]
         2.683411e-08          3.778878e+06          2.551877e+00          1.003811e+00          1.777345e+00
        GONOF2[T.Yes]          SYPHF2[T.Yes]         MPXF22[T.Yes] HISTOSCHEMA_F[T.Inter] HISTOSCHEMA_F[T.Mixed]
         2.458095e+00          1.019133e+00          1.804575e+00          1.102763e+00          8.861154e-01
  SCHEMACUR_F[T.Inter]  SCHEMACUR_F[T.Mixed]     NBCLTBIN_F[T.>=7]      PDRUGSEXF2[T.Yes]         MULTIF2[T.Yes]
         4.865297e-01          9.812256e-01          1.329101e+00          1.098198e+00          1.705818e+00
       IRRB_F[T.>=10]
         9.999067e-01
```

```
> require(lmtest)

> lrtest(GLM.1)
Likelihood ratio test

Model 1: CHLAMF2 ~ ANALSEXF2 + MULTIPARTF2 + CHEMSEXREASONF2 + CHEMSEXCURF2 +
    GONOF2 + SYPHF2 + MPXF22 + HISTOSCHEMA_F + SCHEMACUR_F +
    NBCLTBIN_F + PDRUGSEXF2 + MULTIF2 + IRRB_F
Model 2: CHLAMF2 ~ 1
  #Df  LogLik  Df  Chisq Pr(>Chisq)
1  16 -333.73
2   1 -373.27 -15 79.084  1.027e-10 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Correlation matrix of explanatory variables:

```
> cor(bddfusion[,c("ANALSEX","CHEMSEX_CUR","CHEMSEXREASON","GONO","HISTO_SCHEMA","IRRPART_B","MPX22","MULTIP",
+   "MULTIPART","NBCLT_BIN","PDRUGSEX","SCHEMA_CUR","SYPH")], use="complete")
                ANALSEX  CHEMSEX_CUR CHEMSEXREASON         GONO HISTO_SCHEMA   IRRPART_B        MPX22       MULTIP
ANALSEX      1.00000000  0.026398503   0.040152392  0.098169514  0.019582039 -0.07331000  0.019894597  0.031142553
CHEMSEX_CUR  0.02639850  1.000000000   0.612103701  0.147205566 -0.007268036 -0.10437927  0.100132117  0.090107786
CHEMSEXREASON 0.04015239 0.612103701   1.000000000  0.114339283  0.042912785 -0.10978604  0.002813483  0.057233169
GONO         0.09816951  0.147205566   0.114339283  1.000000000 -0.004067724 -0.20720776  0.151775703  0.098485920
HISTO_SCHEMA 0.01958204 -0.007268036   0.042912785 -0.004067724  1.000000000 -0.05439488  0.013208611  0.012508497
IRRPART_B    -0.07331000 -0.104379273  -0.109786038 -0.207207762 -0.054394876  1.00000000 -0.013461036 -0.168836669
MPX22        0.01989460  0.100132117   0.002813483  0.151775703  0.013208611 -0.01346104  1.000000000 -0.055061607
MULTIP       0.03114255  0.090107786   0.057233169  0.098485920  0.012508497 -0.16883667 -0.055061607  1.000000000
MULTIPART    0.15938686 -0.007021459   0.029886305  0.109911068 -0.007914470 -0.03407063  0.039446127  0.024266506
NBCLT_BIN    -0.09566794 -0.017002023  -0.021690977 -0.190445959  0.134647659  0.06133103 -0.088200352 -0.031119511
PDRUGSEX     0.05100411  0.448354309   0.327368407  0.159487636 -0.022355814 -0.16167352  0.054990267  0.124870637
SCHEMA_CUR   0.06235259  0.018105283   0.061518548  0.072269101  0.462723649 -0.09668281 -0.025891566 -0.009901984
SYPH         0.06049657  0.159109312   0.147615217  0.117890539  0.046094649 -0.06631154  0.100132117  0.006901873

                MULTIPART   NBCLT_BIN    PDRUGSEX   SCHEMA_CUR         SYPH
ANALSEX       0.159386858 -0.09566794  0.05100411  0.062352589  0.060496570
CHEMSEX_CUR  -0.007021459 -0.01700202  0.44835431  0.018105283  0.159109312
CHEMSEXREASON 0.029886305 -0.02169098  0.32736841  0.061518548  0.147615217
GONO          0.109911068 -0.19044596  0.15948764  0.072269101  0.117890539
HISTO_SCHEMA -0.007914470  0.13464766 -0.02235581  0.462723649  0.046094649
IRRPART_B    -0.034070626  0.06133103 -0.16167352 -0.096682812 -0.066311538
MPX22         0.039446127 -0.08820035  0.05499027 -0.025891566  0.100132117
MULTIP        0.024266506 -0.03111951  0.12487064 -0.009901984  0.006901873
MULTIPART     1.000000000 -0.12894154 -0.01073271  0.017690140  0.065533617
NBCLT_BIN    -0.128941541  1.00000000  0.04818988 -0.050350576 -0.090975735
PDRUGSEX     -0.010732712  0.04818988  1.00000000  0.023353170  0.097154877
SCHEMA_CUR    0.017690140 -0.05035058  0.02335317  1.000000000  0.049725777
SYPH          0.065533617 -0.09097573  0.09715488  0.049725777  1.000000000
```

Factors associated with GONORRHEA infection.

Estimates: coefficients, ORs, 95% ICs

Model fit: AIC and likelihood ratio test

```
                       Estimate Std. Error z value   Pr(>|z|)
(Intercept)           -16.174804 665.208037  -0.024    0.98060
AGE                    -0.040315   0.009953  -4.051 0.00005109 ***
ANALSEXF2[T.Yes]       14.864023 665.207849   0.022    0.98217
CHEMSEXCURF2[T.Yes]     0.283250   0.338219   0.837    0.40233
CHEMSEXREASONF2[T.Yes] -0.019806   0.444800  -0.045    0.96448
CHLAMF2[T.Yes]          0.941612   0.201240   4.679 0.00000288 ***
HISTOSCHEMA_F[T.Inter] -0.128459   0.431773  -0.298    0.76607
HISTOSCHEMA_F[T.Mixed] -0.002017   0.307267  -0.007    0.99476
IRRB_F[T.>=10]          0.703964   0.214203   3.286    0.00101 **
MPXF22[T.Yes]           2.541079   0.917018   2.771    0.00559 **
MULTIF2[T.Yes]          0.381898   0.276236   1.383    0.16682
MULTIPARTF2[T.Yes]      0.688414   0.491259   1.401    0.16112
NBCLTBIN_F[T.>=7]       0.845377   0.211887   3.990 0.00006614 ***
SCHEMACUR_F[T.Inter]   -0.266093   0.354681  -0.750    0.45312
SCHEMACUR_F[T.Mixed]    0.409500   0.468583   0.874    0.38217
SHAREF2[T.Yes]          0.532789   0.408438   1.304    0.19208
SNIFF2[T.Yes]          -0.070740   0.350048  -0.202    0.83985
SYPHF2[T.Yes]           0.255490   0.259647   0.984    0.32512
VIAGRAF2[T.Yes]         0.856803   0.487061   1.759    0.07856 .
```

```
                                 NA 8.216553e+13
AGE                    9.415086e-01 9.790293e-01
ANALSEXF2[T.Yes]       1.436088e-15           NA
CHEMSEXCURF2[T.Yes]    6.796112e-01 2.572882e+00
CHEMSEXREASONF2[T.Yes] 4.091836e-01 2.352738e+00
CHLAMF2[T.Yes]         1.730086e+00 3.811023e+00
HISTOSCHEMA_F[T.Inter] 3.776616e-01 2.057124e+00
HISTOSCHEMA_F[T.Mixed] 5.446605e-01 1.820868e+00
IRRB_F[T.>=10]         1.334744e+00 3.095254e+00
MPXF22[T.Yes]          2.477835e+00 1.015952e+02
MULTIF2[T.Yes]         8.614414e-01 2.553253e+00
MULTIPARTF2[T.Yes]     8.052480e-01 5.692289e+00
NBCLTBIN_F[T.>=7]      1.543463e+00 3.545885e+00
SCHEMACUR_F[T.Inter]   3.805669e-01 1.533401e+00
SCHEMACUR_F[T.Mixed]   5.986003e-01 3.790991e+00
SHAREF2[T.Yes]         7.644831e-01 3.814588e+00
SNIFF2[T.Yes]          4.617808e-01 1.830351e+00
SYPHF2[T.Yes]          7.720291e-01 2.141389e+00
VIAGRAF2[T.Yes]        9.021674e-01 6.175406e+00
```

```
    Null deviance: 774.72  on 604  degrees of freedom
Residual deviance: 640.48  on 586  degrees of freedom
  (39 observations effacées parce que manquantes)
AIC: 678.48

Number of Fisher Scoring iterations: 15
```

```
> exp(coef(GLM.3))  # Exponentiated coefficients ("odds ratios")
          (Intercept)                   AGE       ANALSEXF2[T.Yes]    CHEMSEXCURF2[T.Yes] CHEMSEXREASONF2[T.Yes]
         9.448699e-08          9.604867e-01          2.853405e+06          1.327437e+00          9.803886e-01
       CHLAMF2[T.Yes] HISTOSCHEMA_F[T.Inter] HISTOSCHEMA_F[T.Mixed]         IRRB_F[T.>=10]          MPXF22[T.Yes]
         2.564112e+00          8.794492e-01          9.979848e-01          2.021752e+00          1.269336e+01
       MULTIF2[T.Yes]     MULTIPARTF2[T.Yes]      NBCLTBIN_F[T.>=7]   SCHEMACUR_F[T.Inter]   SCHEMACUR_F[T.Mixed]
         1.465062e+00          1.990556e+00          2.328856e+00          7.663682e-01          1.506064e+00
       SHAREF2[T.Yes]          SNIFF2[T.Yes]          SYPHF2[T.Yes]        VIAGRAF2[T.Yes]
         1.703678e+00          9.317041e-01          1.291094e+00          2.355618e+00
```

```
> lrtest(GLM.3)
Likelihood ratio test

Model 1: GONOF2 ~ AGE + ANALSEXF2 + CHEMSEXCURF2 + CHEMSEXREASONF2 + CHLAMF2 +
    HISTOSCHEMA_F + IRRB_F + MPXF22 + MULTIF2 + MULTIPARTF2 +
    NBCLTBIN_F + SCHEMACUR_F + SHAREF2 + SNIFF2 + SYPHF2 + VIAGRAF2
Model 2: GONOF2 ~ 1
  #Df  LogLik  Df  Chisq Pr(>Chisq)
1  19 -320.24
2   1 -387.36 -18 134.24  < 2.2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Correlation matrix of explanatory variables:

```
> cor(bddfusion[,c("AGE","ANALSEX","CHEMSEX_CUR","CHEMSEXREASON","CHLAM","HISTO_SCHEMA","IRRPART_B","MPX22","MULTIP",
+   "MULTIPART","NBCLT_BIN","SCHEMA_CUR","SHARE","SNIF","SYPH","VIAGRA")], use="complete")
                    AGE      ANALSEX  CHEMSEX_CUR CHEMSEXREASON       CHLAM HISTO_SCHEMA   IRRPART_B        MPX22
AGE           1.000000000 -0.032789745  0.026441931   0.053930599  0.06803795 -0.063076507 -0.02119421 -0.005463618
ANALSEX      -0.032789745  1.000000000  0.026251526   0.039036973  0.09670259  0.020518949 -0.07287267  0.019358263
CHEMSEX_CUR   0.026441931  0.026251526  1.000000000   0.601697210  0.13413146 -0.009698943 -0.10120666  0.098333597
CHEMSEXREASON 0.053930599  0.039036973  0.601697210   1.000000000  0.09991600  0.039784028 -0.10726698  0.003918078
CHLAM         0.068037949  0.096702591  0.134131462   0.099916002  1.00000000  0.054358665 -0.09753708  0.074653839
HISTO_SCHEMA -0.063076507  0.020518949 -0.009698943   0.039784028  0.05435867  1.000000000 -0.05391425  0.011782068
IRRPART_B    -0.021194209 -0.072872669 -0.101206656  -0.107266979 -0.09753708 -0.053914250  1.00000000 -0.012777062
MPX22        -0.005463618  0.019358263  0.098333597   0.003918078  0.07465384  0.011782068 -0.01277706  1.000000000
MULTIP       -0.036678103  0.031381371  0.092496496   0.055419461  0.11074266  0.010121220 -0.16892059 -0.055078989
MULTIPART     0.029568224  0.160186042 -0.006401935   0.027722373  0.10803340 -0.005432651 -0.03458715  0.038354441
NBCLT_BIN     0.170334989 -0.095098549 -0.018008350  -0.019910425 -0.12830902  0.133224735  0.06131829 -0.086297464
SCHEMA_CUR   -0.018972844  0.062572968  0.021952747   0.058907029  0.11534596  0.463107479 -0.09827416 -0.026547746
SHARE         0.018096396  0.040845257  0.275368847   0.253625541  0.02826375 -0.005991837 -0.10954289  0.000355812
SNIF          0.037186924 -0.006688103  0.448249889   0.412534306  0.03578509  0.025154201 -0.09504840  0.033209070
SYPH          0.039481049  0.059829060  0.159823693   0.144696051  0.06762324  0.053706230 -0.05491846  0.098333597
VIAGRA        0.017042935  0.028252646  0.224282544   0.191098618  0.01075615 -0.004144551 -0.05863383 -0.029533797

                  MULTIP    MULTIPART   NBCLT_BIN   SCHEMA_CUR        SHARE         SNIF        SYPH       VIAGRA
AGE          -0.036678103  0.029568224  0.17033499 -0.018972844  0.018096396  0.037186924  0.03948105  0.017042935
ANALSEX       0.031381371  0.160186042 -0.09509855  0.062572968  0.040845257 -0.006688103  0.05982906  0.028252646
CHEMSEX_CUR   0.092496496 -0.006401935 -0.01800835  0.021952747  0.275368847  0.448249889  0.15982369  0.224282544
CHEMSEXREASON 0.055419461  0.027722373 -0.01991042  0.058907029  0.253625541  0.412534306  0.14469605  0.191098618
CHLAM         0.110742663  0.108033396 -0.12830902  0.115345959  0.028263748  0.035785090  0.06762324  0.010756146
HISTO_SCHEMA  0.010121220 -0.005432651  0.13322474  0.463107479 -0.005991837  0.025154201  0.05370623 -0.004144551
IRRPART_B    -0.168920592 -0.034587151  0.06131829 -0.098274162 -0.109542889 -0.095048395 -0.05491846 -0.058633828
MPX22        -0.055078989  0.038354441 -0.08629746 -0.026547746  0.000355812  0.033209070  0.09833360 -0.029533797
MULTIP        1.000000000  0.025106205 -0.02476564 -0.008702982  0.095748978  0.071149944  0.01136090  0.055501584
MULTIPART     0.025106205  1.000000000 -0.12852347  0.019262686  0.057043330  0.065932344  0.06499291  0.022936852
NBCLT_BIN    -0.024765637 -0.128523472  1.00000000 -0.056102956 -0.089865968 -0.013184788 -0.08093357  0.120882433
SCHEMA_CUR   -0.008702982  0.019262686 -0.05610296  1.000000000  0.041915267  0.049800840  0.05276809  0.014732099
SHARE         0.095748978  0.057043330 -0.08986597  0.041915267  1.000000000  0.564985255  0.04726380  0.148808877
SNIF          0.071149944  0.065932344 -0.01318479  0.049800840  0.564985255  1.000000000  0.03593937  0.222439715
SYPH          0.011360899  0.064992913 -0.08093357  0.052768087  0.047263797  0.035939366  1.00000000  0.089042405
VIAGRA        0.055501584  0.022936852  0.12088243  0.014732099  0.148808877  0.222439715  0.08904241  1.000000000
```

Factors associated with SYPHILIS infection.

Estimates: coefficients, ORs, 95% ICs
Model fit: AIC and likelihood ratio test

```
Coefficients:
                    Estimate Std. Error z value Pr(>|z|)
(Intercept)         -2.22926    0.27540  -8.095 5.75e-16 ***
VIAGRAF2[T.Yes]      0.20217    0.57421   0.352  0.72477
CATHF2[T.Yes]        0.14196    0.51762   0.274  0.78389
STIF2[T.Yes]         1.06341    0.38482   2.763  0.00572 **
CHEMSEXCURF2[T.Yes]  0.42569    0.38255   1.113  0.26580
CHEMSEXREASONF2[T.Yes] 0.31870  0.46523   0.685  0.49331
GONOF2[T.Yes]        0.38643    0.25092   1.540  0.12355
CHLAMF2[T.Yes]       0.07166    0.25096   0.286  0.77524
MPXF22[T.Yes]        1.14494    0.60720   1.886  0.05935 .
SCHEMACUR_F[T.Inter] -0.20061   0.24289  -0.826  0.40884
SCHEMACUR_F[T.Mixed] -0.44238   0.57142  -0.774  0.43882
NBCLTBIN_F[T.>=7]    0.40088    0.24921   1.609  0.10770
PDRUGSEXF2[T.Yes]    0.10204    0.29940   0.341  0.73325
---
```

```
> exp(confint(GLM.5))
                              2.5 %     97.5 %
(Intercept)             0.0613606  0.1810332
VIAGRAF2[T.Yes]         0.3662363  3.5746803
CATHF2[T.Yes]           0.3976283  3.0727329
STIF2[T.Yes]            1.3355930  6.0953143
CHEMSEXCURF2[T.Yes]     0.7057052  3.1865525
CHEMSEXREASONF2[T.Yes] 0.5492579  3.4355949
GONOF2[T.Yes]           0.8961427  2.4018776
CHLAMF2[T.Yes]          0.6521881  1.7483487
MPXF22[T.Yes]           0.9188468 10.3901320
SCHEMACUR_F[T.Inter]    0.5079946  1.3194637
SCHEMACUR_F[T.Mixed]    0.1800589  1.7861854
NBCLTBIN_F[T.>=7]       0.9198320  2.4505602
PDRUGSEXF2[T.Yes]       0.6055598  1.9658767
```

```
    Null deviance: 532.66  on 604  degrees of freedom
Residual deviance: 496.15  on 592  degrees of freedom
  (39 observations effacées parce que manquantes)
AIC: 522.15

Number of Fisher Scoring iterations: 4
```

```
> exp(coef(GLM.5))  # Exponentiated coefficients ("odds ratios")
          (Intercept)        VIAGRAF2[T.Yes]          CATHF2[T.Yes]          STIF2[T.Yes]    CHEMSEXCURF2[T.Yes]
            0.1076077             1.2240597             1.1525333             2.8962170             1.5306487
CHEMSEXREASONF2[T.Yes]          GONOF2[T.Yes]         CHLAMF2[T.Yes]         MPXF22[T.Yes]   SCHEMACUR_F[T.Inter]
            1.3753443             1.4717177             1.0742868             3.1422636             0.8182310
  SCHEMACUR_F[T.Mixed]      NBCLTBIN_F[T.>=7]      PDRUGSEXF2[T.Yes]
            0.6425038             1.4931430             1.1074243
```

```
> lrtest(GLM.5)
Likelihood ratio test

Model 1: SYPHF2 ~ VIAGRAF2 + CATHF2 + STIF2 + CHEMSEXCURF2 + CHEMSEXREASONF2 +
    GONOF2 + CHLAMF2 + MPXF22 + SCHEMACUR_F + NBCLTBIN_F + PDRUGSEXF2
Model 2: SYPHF2 ~ 1
  #Df  LogLik  Df  Chisq Pr(>Chisq)
1  13 -248.07
2   1 -266.33 -12 36.514  0.0002677 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Correlation matrix of explanatory variables:

```
> cor(bddfusion[,c("CATH","CHEMSEX_CUR","CHEMSEXREASON","CHLAM","GONO","IRRPART_B","MPX22","NBCLT_BIN","PDRUGSEX
+   "SCHEMA_CUR","STI","VIAGRA")], use="complete")
                CATH CHEMSEX_CUR CHEMSEXREASON        CHLAM        GONO   IRRPART_B        MPX22   NBCLT_BI
CATH        1.00000000  0.37287021   0.385330193  0.060537339  0.07381120 -0.04411640 -0.033518558  0.1112483
CHEMSEX_CUR 0.37287021  1.00000000   0.612677055  0.142686326  0.14721645 -0.10632694  0.100835662 -0.0171924
CHEMSEXREASON 0.38533019 0.61267705  1.000000000  0.104473477  0.11430969 -0.11076698  0.003373566 -0.0217492
CHLAM       0.06053734  0.14268633   0.104473477  1.000000000  0.27928140 -0.10438164  0.077169372 -0.1288355
GONO        0.07381120  0.14721645   0.114309691  0.279281402  1.00000000 -0.20731231  0.151213097 -0.1952901
IRRPART_B  -0.04411640 -0.10632694  -0.110766980 -0.104381639 -0.20731231  1.00000000 -0.014319573  0.0573285
MPX22      -0.03351856  0.10083566   0.003373566  0.077169372  0.15121310 -0.01431957  1.000000000 -0.0876992
NBCLT_BIN   0.11124831 -0.01719240  -0.021749293 -0.128835496 -0.19529011  0.05732854 -0.087699219  1.0000000
PDRUGSEX    0.32021080  0.45016653   0.328702651  0.108591264  0.15959951 -0.16385977  0.055976239  0.0473249
SCHEMA_CUR  0.02649421  0.01906054   0.061939310  0.118522375  0.08113867 -0.09818267 -0.025440750 -0.0557091
STI         0.13100001  0.19758583   0.217061369  0.076630145  0.02891783 -0.03981029  0.013857430 -0.0564504
VIAGRA      0.30618012  0.22222312   0.203251990  0.007595968  0.07919320 -0.08569544 -0.028669536  0.1243970
              PDRUGSEX  SCHEMA_CUR         STI       VIAGRA
CATH        0.32021080  0.02649421  0.13100001  0.306180121
CHEMSEX_CUR 0.45016653  0.01906054  0.19758583  0.222223119
```

	PDRUGSEX	SCHEMA_CUR	STI	VIAGRA
CATH	0.32021080	0.02649421	0.13100001	0.306180121
CHEMSEX_CUR	0.45016653	0.01906054	0.19758583	0.222223119
CHEMSEXREASON	0.32870265	0.06193931	0.21706137	0.203251990
CHLAM	0.10859126	0.11852238	0.07663015	0.007595968
GONO	0.15959951	0.08113867	0.02891783	0.079193202
IRRPART_B	-0.16385977	-0.09818267	-0.03981029	-0.085695444
MPX22	0.05597624	-0.02544075	0.01385743	-0.028669536
NBCLT_BIN	0.04732493	-0.05570918	-0.05645041	0.124396999
PDRUGSEX	1.00000000	0.02459449	0.11530210	0.227723611
SCHEMA_CUR	0.02459449	1.00000000	0.02750851	0.013018584
STI	0.11530210	0.02750851	1.00000000	0.095537100
VIAGRA	0.22772361	0.01301858	0.09553710	1.000000000

Codebook of the data base

N = 644

Variable	*Coding*	*Description*
NB_CLT	Discrete (3 to 14)	Total number of PrEP consultations for the patient
NB_CLT_BIN	1 = less than seven or equal 2 = more than seven	Dichotomous variable for the number of consultations per patient
SEX	1 = Male 2 = Female 3 = Transgender Female	Patient's gender identity
AGE	Discrete (21 to 78)	Patient's age in years
AGECAT !!! Only on the software!!!	1 = Q1 (21 – 35 years old) 2 = Q2 (36 to 50 years old) 3 = Q3 (51 to 65 years old) 4 = Q4 (66 to 78 years old)	Patient's categorized ages into quantiles
HISTO_SCHEMA	1 = Continuous 2 = Intermittent 3 = Mixed	History of PrEP use
SCHEMA_CUR	1 = Continuous 2 = Intermittent	Current PrEP use

	3 = Mixed	
SEXOR	1 = Homo/bisexuel 2 = Heterosexual	Patient's self-reported sexual orientation
HISTO_CHEMSEX	1 = Yes 2 = No	History of chemsex practice
CHEMSEX_CUR	1 = Yes 2 = No	Current chemsex practice
NATION_COUNTRY	Names	Patients' legal or political affiliation with a country
NATION	1 = Europe 2 = Africa 3 = America 4 = Asia	Patient's legal or political affiliation with a continent
NATION_B	1 = Yes 2 = No	Binary transformation for the European nationality
ORIGIN	1 = Central europe 2 = Eastern Europe 3 = North Africa 4 = Sub-Saharan Africa 5 = Middle East 6 = South America 7 = Asia	Patient's geographical, ethnic, or cultural origin
ORIGIN_BEU	1 = Yes 2 = No	Binary transformation for the European origin

ORIGIN_BAF	1 = Yes 2 = No	Binary transformation for the African origin
PEP	1 = Yes 2 = No	Use of PEP at least once in the patient's lifetime
CHLAM21	1 = Yes 2 = No	At least one diagnosed episode of chlamydia in 2021
CHLAM22	1 = Yes 2 = No	At least one diagnosed episode of chlamydia in 2022
CHLAM23	1 = Yes 2 = No	At least one diagnosed episode of chlamydia in 2023
CHLAM	1 = Yes 2 = No	At least one diagnosed episode of chlamydia between 2021-2023
GONO21	1 = Yes 2 = No	At least one diagnosed episode of gonorrhea in 2021
GONO22	1 = Yes 2 = No	At least one diagnosed episode of gonorrhea in 2022
GONO23	1 = Yes 2 = No	At least one diagnosed episode of gonorrhea in 2023
GONO	1 = Yes 2 = No	At leat one diagnosed episode of gonorrhea in 2021-2023

SYPH21	1 = Yes 2 = No	At least one diagnosed episode of syphilis in 2021
SYPH22	1 = Yes 2 = No	At least one diagnosed episode of syphilis in 2022
SYPH23	1 = Yes 2 = No	At least one diagnosed episode of syphilis in 2023
SYPH	1 = Yes 2 = No	At least one diagnosed episode of syphilis between 2021-2022
HCV	1 = Yes 2 = No	Hepatitis C diagnosed
MPX22	1 = Yes 2 = No	Monkeypox diagnosed in 2022
ALSTI	1 = Yes 2 = No	At least one of those STIs (chlamydia, gonorrhea, syphilis) diagnosed episode between 2021-2023
SCORE	0 to 9	An individual score of STIs calculated by giving one point for one diagnosed STI (chlamydia, gonorrhea, syphilis) per year (on a total of 3 years)
MULTPART	1 = Yes 2 = No	Patients request the PrEP because they have several sexual partners

STI	1 = Yes 2 = No	Patients request the PrEP because they have several STIs
SEXWORK	1 = Yes 2 = No	Patients request the PrEP because they are sexual workers
HIVPART	1 = Yes 2 = No	Patients request the PrEP because they have a partner infected with HIV
POSTPEP	1 = Yes 2 = No	Patients request the PrEP after taking the PEP
CHEMSEXREASON	1 = Yes 2 = No	Patients request the PrEP because they have chemsex practice
INJECTION	1 = Yes 2 = No	Patients request the PrEP because they are at risk of contracting HIV by injection
OTHER	1 = Yes 2 = No	Patients request the PrEP for another reason
ARRETPREP	1 = Yes 2 = No	Patient stopped taking the PrEP
REASONSTOP	1 = No longer needed 2 = Side effects 3 = Death 4 = Other	Reason why the patient stopped the PrEP use
IRRPART	Discrete (0 to 700)	Number of irregular sexual partners

IRRPART_P	1 = Always 2 = Often 3 = Sometimes 4 = Never 5 = Except once	Protection during sex with irregular partners
IRRPART_B	1 = Yes 2 = No	The number of irregular partners is </= to the median (10)
REGPART	Discrete (0 to 50)	Number of regular sexual partners
REGPART_P	1 = Always 2 = Often 3 = Sometimes 4 = Never 5 = Except once	Protection during sex with regular partners
REGPART_B	1 = Yes 2 = No	The number of regular partners is </= to the median (1)
VAGSEX	1 = Yes 2 = No	Vaginal sex (intercourse)
VAGSEX_P	1 = Always 2 = Often 3 = Sometimes 4 = Never	Protection during vaginal sex (intercourse)
ANALSEX	1 = Yes 2 = No	Anal sex (intercourse)

ANALSEX_P	1 = Always 2 = Often 3 = Sometimes 4 = Never 5 = Except once	Protection during anal sex (intercourse)
ORALSEX	1 = Yes 2 = No	Oral sex (intercourse)
ORALSEX_P	1 = Always 2 = Often 3 = Sometimes 4 = Never 5 = Except once	Protection during oral sex (intercourse)
HIVPART	1 = Yes 2 = No	Sex (intercourse) with an HIV-positive partner
HIVPART_P	1 = Always 2 = Often 3 = Sometimes 4 = Never 5 = Except once	Protection during sex with an HIV-positive partner
PDRUGSEX	1 = Yes 2 = No	Sex (intercourse) with a partner who takes drugs

PDRUGSEX_P	1 = Always 2 = Often 3 = Sometimes 4 = Never 5 = Except once	Protection during sex (intercourse) with a partner who takes drugs
MSM	1 = Yes 2 = No	Men having sex with men
MSM_P	1 = Always 2 = Often 3 = Sometimes 4 = Never 5 = Except once	Protection during men sex with men
PRO	1 = Yes 2 = No	Sex (intercourse) with a prostitute
PRO_P	1 = Always 2 = Sometimes 3 = Never	Protection during sex with a prostitute
MULTP	1 = Yes 2 = No	Sex with a partner who has multiple sexual partners
MULTP_P	1 = Always 2 = Often 3 = Sometimes 4 = Never 5 = Except once	Protection during sex with a partner who has multiple sexual partners
PROWORK	1 = Yes	Patient prostitutes himself

	2 = No	
PROWORK_P	1 = Always 2 = Often 3 = Sometimes 4 = Never	Protection when the patient prostitutes himself
BLOODFISEX	1 = Yes 2 = No	Sexual practice that includes fisting and bleeding
BLOODFISEX_P	1 = Always 2 = Often 3 = Sometimes 4 = Never 5 = Except once	Protection during sexual practice that includes fisting and bleeding
DRUG	1 = Yes 2 = No	Patient uses drugs
ALCOHOL	1 = Yes 2 = No	Patient drinks alcohol
CANNABIS	1 = Yes 2 = No	Patient consumes cannabis
TOBACCO	1 = Yes 2 = No	Patient smokes tobacco
VIAGRA	1 = Yes 2 = No	Patient uses viagra
COCAINE	1 = Yes 2 = No	Patient consumes cocaine

HEROINE	1 = Yes 2 = No	Patient consumes heroine
AMPHET	1 = Yes 2 = No	Patient consumes amphetamine
CATH	1 = Yes 2 = No	Patient consumes cathinone
LSD	1 = Yes 2 = No	Patient consumes LSD
CRYSTAL	1 = Yes 2 = No	Patient consumes crystal
POPPERS	1 = Yes 2 = No	Patient consumes poppers
SYRINGE	1 = Yes 2 = No	Drug administration by syringe
SNIF	1 = Yes 2 = No	Drug administration by inhalation
SMOKE	1 = Yes 2 = No	Drug administration by smoking
SHARE	1 = Yes 2 = No	Drug administration by sharing