

*Invited Review***Virtual CROI 2020: Highlights of Epidemiology, Public Health, and Prevention Research***Susan P. Buchbinder, MD; Albert Y. Liu, MD*

At the 2020 Conference on Retroviruses and Opportunistic Infections, held virtually as a result of the emerging COVID-19 pandemic, trends in the HIV epidemic were highlighted, with decreasing HIV incidence reported across several countries, although key regions remain heavily impacted, including the US South. Adolescent girls and young women, men who have sex with men (MSM), transgender persons, and people who inject drugs continue to experience a high burden of new infections. Sexually transmitted infections during pregnancy can lead to a number of adverse outcomes in infants; novel strategies to detect and treat these infections are needed. Innovative HIV testing strategies, including self-testing and assisted partner services, are expanding the reach of testing; however, linkage to care can be improved. Novel preexposure prophylaxis (PrEP) delivery strategies are increasing uptake of PrEP in different groups, although adherence and persistence remain a challenge. Use of on-demand PrEP is increasing among MSM in the US. Strategies are needed to address barriers to PrEP uptake and persistence among cis- and transgender women. Several novel regimens for postexposure prophylaxis show promise.

Keywords: HIV, epidemiology, postexposure prophylaxis, PEP, preexposure prophylaxis, PrEP, prevention, sexually transmitted infections, STIs, testing

The 2020 Conference on Retroviruses and Opportunistic Infections (CROI 2020) was held virtually in recognition of the emerging COVID-19 pandemic.

Epidemiology

One of the symposia at CROI 2020 focused on what makes HIV epidemics recede. Delpeche described the HIV epidemic in the United Kingdom, 4 countries with a combined population of 66 million (Abstract 58). New HIV diagnoses have fallen by 39% in men who have sex with men (MSM) and by 24% in heterosexuals from 2015 to 2018. She pointed out that other European countries have seen similar declines. Potential reasons for the decline include increased HIV testing (an estimated 93% are aware of their HIV infection) and increased treatment (an

estimated 97% of people diagnosed are on treatment, and 97% of them are fully virally suppressed). PrEP scale-up is also likely to have played a role, with an estimated 15,000 persons on PrEP by the end of 2018. Delpeche attributes these successes to political will, partnerships across the HIV sector, innovations (such as the Dean Street clinic to provide expedited care for MSM), and building local solutions based on local data.

Kagaayi reported on changes in the HIV epidemic in Rakai, Uganda (Abstract 59). Early in the HIV epidemic, HIV prevalence was very high: 13% over all but 47% in the main road trading centers. They implemented many different programs throughout the region, including those for prevention of mother-to-child transmission (MTCT), scale up of treatment, voluntary medical male

circumcision, and community outreach for delivery of antiretroviral treatment (ART) and preexposure prophylaxis (PrEP). Among 40 communities, including 4 fishing communities with highest prevalence (43%), 79% of people report

The US South is home to 38% of the population but 52% of new diagnoses, with African Americans disproportionately affected in all risk groups

being on ART with 81% of those being virally suppressed, and 65% of men being circumcised. With this scale-up of combination prevention, HIV incidence has declined from 1.2/100 person-years (py) to 0.43/100 py in 2018, a 59% decrease. Even fishing communities have seen a reduction in HIV incidence from 3.4/100 py to 1.6/100 py in 2016, a 48% reduction. Kagaayi pointed to the ongoing challenges to prevention in the region, including a growing population, lower ART coverage among men and young adults, suboptimal PrEP uptake, migration (with recent migrants having higher HIV incidence rates), and persistent viremia in approximately 13% of the HIV-infected population. However, through the building of clinical research capacity and the grounding of services and research within the community, great progress has been made.

Mena reported on the status of the epidemic in the US South, which has a much less positive picture than was seen in the United Kingdom or in Rakai, Uganda (Abstract 60). He pointed

Dr Buchbinder is Clinical Professor of Medicine and Epidemiology at the University of California San Francisco and Director of Bridge HIV at the San Francisco Department of Public Health. Send correspondence to Albert Liu, MD, MPH, Bridge HIV, Population Health Division, San Francisco Department of Public Health, 25 Van Ness Avenue, Ste 100, San Francisco, CA 94102. Dr Liu is Associate Clinical Professor of Medicine at University of California San Francisco and Clinical Research Director of Bridge HIV at the San Francisco Department of Public Health. Received on April 20, 2020; accepted on May 1, 2020.

out that the US South is home to 38% of the population but 52% of new HIV diagnoses, with African Americans disproportionately affected in all risk groups. Some of the structural factors for increased HIV infection rates may include rurality, racism, poverty, stigma, homophobia, education disparities, inadequate federal funding, and poorer healthcare infrastructure. He called on developing innovative programs, giving examples of a high-touch care service for people who were not previously virally suppressed, achieving viral suppression rates above 80%, and a rapid PrEP program that successfully delivered PrEP to 43% of people entering the program, higher than has been seen in some other programs. Mena ended by pointing to the reduction in new infections in Louisiana in 2018 to the lowest level in a decade, coincident with implementing Medicaid expansion in that state. Del Rio confirmed the importance of Medicaid expansion in addressing the HIV epidemic nationally (Abstract 61). He also presented data from a modeling study, suggesting that if the status quo is maintained in 6 US cities, we can expect only a 7% decrease in HIV incidence over 5 years and only 8.6% over 10 years. However, with an optimal combination of prevention, diagnosis, and treatment services, several of the cities can approach the Ending the HIV Epidemic goals. Del Rio closed by pointing out that this will require an unprecedented effort to bridge the implementation gap to reach these goals.

General Population

Slymaker and colleagues reported on data from 2015 and 2016 from 8 African population-based observational cohorts (Abstract 848). They found overall incidence of 0.6/100 py in men aged 15 to 24 years, 1.1/100 py in men aged 25 to 49 years, 2.2/100 py in women aged 15 to 24 years, and 1.2/100 py in women aged 25 to 49 years. Risk factors for HIV infection included lack of circumcision in younger men; risk factors for older men and younger women included being formerly married; and for older women,

residential mobility, being single, having more partners in the past year, having a new partner in the past year, and having a regular partner in the past year. They pointed out that the largest population-attributable fractions (the proportion of new infections attributable to a specific risk factor) were lack of male circumcision for younger men and being formerly married for older men and young women. This suggests that prevention efforts need to scale up male circumcision for young men, and prevention programs should target those formerly married, who may not be highlighted in current prevention programs.

Camlin and colleagues reported data from more than 117,000 adults aged 15 years or older from 32 rural communities participating in the SEARCH (Sustainable East Africa Research in Community Health) program (Abstract 849). They found that the risk of acquisition by 3 years after study entry was higher in adults who reported temporary or permanent mobility before entering the study. The strongest association with risk was having lived more than 12 months outside of the community in the past 3 years, and having changed residence in the past 12 months.

Risher and colleagues modeled the effect of age on HIV incidence using data from Tanzania, Uganda, Malawi, Zimbabwe, and South Africa (Abstract 851). The average age of infection increased slightly in most sites since 2000, although these changes were minimal. Overall infection in younger ages (15-24 years) accounted for approximately half (38%-63%) of infections in women and approximately a quarter (19%-39%) of infections in men. Akullian and colleagues evaluated HIV incidence among people in rural KwaZulu Natal, South Africa (Abstract 148). They found that incidence declined in men and women under 30 years of age, with the steepest declines in women under 20 years of age, and men under 25 years. They hypothesize that some of the decline may be due to a focus on voluntary medical male circumcision for younger men, with then less forward transmission to

young women. Treatment scale-up has decreased death rates, leading to aging cohorts of people living with HIV and higher HIV prevalence among older age groups. However, peak HIV incidence for women still occurred at age 25 years, but shifted for men by approximately 5 to 10 years older in the period after implementation of universal test and treat.

Key Populations

Adolescent Girls and Young Women.

Rucinski and colleagues presented data on 14,669 adolescent girls and young women (AGYW) aged 15 to 24 years across 14 regions in Tanzania (Abstract 855). Overall, 43% engaged in transactional sex, 33% in intergenerational

HIV incidence rates declined from 1.2/100 person years to 0.42/100 person years since the implementation of universal test and treat and scale up of voluntary medical male circumcision in Uganda

sex, and 5% in both. HIV prevalence was 2% overall. Although neither transactional nor intergenerational sex alone was associated with HIV infection, engaging in both was significantly associated with HIV infection adjusted prevalence ratio (aPR) 1.7; 95% (confidence interval [CI], 1.03-2.94). They concluded that focusing prevention efforts on AGYW who engage in transactional intergenerational sex may yield the greatest benefit.

Lewis and colleagues presented data on 2710 AGYW aged 15 to 24 years in KwaZulu Natal, South Africa (Abstract 856). HIV incidence over 18 months of follow-up was 3.92/100 py overall, and 3.74/100 py among 15- to 19-year-olds and 4.13/100 py among 20- to 24-year-olds. Among 15- to 19-year-olds, significant predictors included having no family support adjusted hazard ratio (aHR), 3.19; $P < .01$,

number of lifetime sex partners (aHR, 1.14; $P=.05$), and having a sexually transmitted infection (STI) at enrollment (aHR, 2.52; $P=0.03$). Among 20- to 24-year-olds, predictors included not having a high school education (aHR, 1.78; $P=.04$), and inconsistent condom use (aHR, 12.56; $P=.01$). They recommend addressing structural and behavioral factors to address high rates of HIV infection in this population of AGYW.

Ussery and colleagues presented a secondary analysis of data from the Botswana Combination Prevention Project, a pair-matched community randomized trial of 30 communities in Botswana from 2014 to 2018 (Abstract 149). Intervention communities received increased HIV testing, enhanced linkage to care, and expanded ART, including universal treatment starting in July 2016. HIV infection rates among 18,597 HIV-seronegative persons undergoing repeat testing were highest in women (HR, 3.06), 25- to 34-year olds (HR, 3.45), and women aged 16 to 24 years (HR, 7.05). In exploring hypotheses for high infection rates in AGYW, they found that viral suppression rates were lower among younger men (<35

Delivery of prevention services to rural areas, where services may be less accessible, is crucial

years) than older men, and that there was a substantial introduction of infections across communities. In addition to calling for increased testing and treatment of young men, they suggested that AGYW who are particularly vulnerable to infection may need primary prevention strategies such as PrEP.

Grabowski and colleagues presented data on declining HIV incidence rates among the Rakai Community Cohort Study, an open population-based cohort of 30 communities in southern Uganda (Abstract 150). Of 19,645 HIV-seronegative participants, 990 incident infections occurred over time. However, HIV incidence has declined from 1.2/100 py overall to 0.42/100 py since

the implementation of universal test and treat and scale up of voluntary medical male circumcision. Rates declined most dramatically among AGYW, falling to an incidence of 0.21/100 py, with an adjusted incidence rate ratio (aIRR) of 0.16. Rates also declined among men (aIRR, 0.41). The authors called for an Ending the HIV Epidemic effort in Africa.

Men Who Have Sex With Men. Wansom and colleagues presented data from a cohort study of 1017 MSM in Bangkok, Thailand (Abstract 852). HIV prevalence was 7%. Among HIV-seronegative MSM, incidence from 2017 to 2019 was 3.73%. Independent risk factors for infection included younger age (18-19 years: aHR 10.88; 20-22 years: aHR, 2.9); sexual attraction for men only (aHR, 14.91); number of lifetime partners (aHR, 2.01); not always using condoms with casual male partners (aHR, 2.43); and having previously had an HIV test (aHR, 1.99). Overall retention was 93%, suggesting that this population would be suitable for prevention intervention studies.

Frascino and colleagues presented data on 520 MSM and 109 transgender women (TGW) in Haiti, recruited from 2339 venues where men and women meet new sexual partners (Abstract 858). Overall HIV prevalence was 2.2% among MSM and 27.6% among TGW. Forced sex was common, reported by 39.6% of MSM and 76.5% of TGW. A history of forced sex was significantly associated with HIV infection (aPR, 6.0 in MSM and 7.6 in TGW). The authors urge further research into understanding the mechanisms by which forced sex increase HIV risk.

Sarno and colleagues evaluated MSM in couples in the US who had had condomless anal sex with a serodiscordant or with a casual partner (Abstract 859). In evaluating the impact of rurality on prevention services, they found that for every 0.1 increase in rurality score, the odds of HIV testing decreased by 16% ($P<.05$), the odds of STI testing decreased by 24% ($P<.01$), and the odds of current PrEP use decreased by 30% ($P<.001$). This highlights the importance of delivery of preven-

tion services to rural areas, where services may be less readily accessible.

Grebe and colleagues presented data on the risk of HIV in blood from first-time blood donors, comparing

There was no increased incidence of HIV-positive blood donation before and after decision to allow MSM to donate blood after a 12-month deferral period

the period of time before versus after the decision in 2015 to allow MSM to donate blood after a 12-month deferral period since the last MSM contact (Abstract 145). Data were drawn from the US Transfusion-Transmissible Infections Monitoring System, which monitors approximately 60% of the US blood donations. They found no increased incidence of HIV-seropositivity in blood donated after versus before the change in the ruling.

Transgender Persons. Hontelez and colleagues presented data on HIV prevalence among male and transgender sex workers compared with female sex workers in Zimbabwe (Abstract 879). HIV prevalence was 36.5% among female sex workers (FSWs), not significantly different than 37.6% among 218 transgender female sex workers or 38.1% among 139 transgender male sex workers, but significantly higher than the 28.2% prevalence among 206 male sex workers ($P=.04$). Both transgender female and male sex workers had high rates of condomless anal sex (50.8% and 55.9%, respectively). The high HIV prevalence points to the need for effective prevention strategies for sex workers of all genders.

Keruly and colleagues presented data on the prevalence of HIV, hepatitis C virus (HCV), herpes simplex virus-2 (HSV-2), and syphilis among TGW in 6 US cities (Abstract 880). HIV prevalence was 29%, HCV 5%, HSV-2 48%, and syphilis 14%, with increasing prevalence by age. Black women had the highest burden of disease of any racial/

ethnic groups. TGW living in Southern cities also had a higher burden of disease than those in the Northeast.

Radix and colleagues presented data on HIV prevalence and risk factors among transmasculine men attending the Callen Lorde Health Center in New York City (Abstract 881). Among 577 transmasculine patients, HIV prevalence was 2.8% overall, but 6.8% among African Americans and 3.2% among Latinx transmales. HIV prevalence was 11.1% among transmales who had sex with cisgender men only. On multivariable analysis, having more than a high school diploma was associated with a lower risk of HIV infection (aOR, 0.08; $P=.009$) and having cisgender male partners only was associated with a higher risk of HIV (aOR, 10.58; 95% CI, .026). Radix pointed to the importance of investigating sexual behaviors as well as gender identity in studies of HIV prevention.

Lesko and colleagues presented data on 420 TGW out of more than 144,000 people with HIV in the NA-ACCORD (North American AIDS Cohort Collaboration on Research and Design) study (Abstract 882). They found that TGW spent, on average, 16.7 months in care not on ART, 19.5 months on ART but not suppressed, and 46.8 months on ART and virally suppressed. These time periods were equal or better than what was seen for cisgender women and cisgender men. They suggest that future studies identify gender-affirming practices that may promote good health outcomes among TGW.

People Who Inject Drugs. Strathdee gave a plenary presentation on the HIV epidemic in people who inject drugs (PWID) (Abstract 62). She noted the ongoing opioid epidemic in the US, in which there have been more overdose deaths in each of the last 4 years than there were from HIV at its peak in the epidemic. Fentanyl is a particularly dangerous drug, in that it does not need to be heated to be administered, and is injected more frequently than some other drugs, leading to the potential for more needle sharing. HIV diagnoses declined in PWID through 2014, and the numbers have been essentially

level since then. However, there has been a change in the demographics of those infections. They are now more common in white and younger persons and persons living outside of major cities. The NHBS (National HIV Behavioral Surveillance) study, conducted every 3 years in PWID, found an HIV prevalence of 6% in 23 cities 2018. Only

There have been more overdose deaths in each of the last 4 years than there were from HIV at its peak in the epidemic

55% of PWID in the survey had had an HIV test in the previous 12 months, and 32% shared injection equipment. Strathdee also provided details on a number of outbreaks among PWID among different regions of the country, and noted that they often occur in regions with high poverty, unemployment, and homelessness; are often preceded by a spike in HCV infections; and often occur in places with suboptimal harm reduction and health care services. She showed a modeling study that suggested that 90% of cases in the outbreak in Scott County, Indiana, could have been avoided had there been an earlier response to the epidemic.

Strathdee noted that clinicians were responsible for early identification of several outbreaks, pointing to the importance of clinicians working with their local health departments. PrEP uptake has been poor in PWID, and the care cascade is often poorer than in other populations. Moreover, national data suggest that substance use is quite high among people living with HIV who are not virally suppressed, with 41% having alcohol use disorder, 36% methamphetamine use disorder, and 36% opioid use disorder. Mirtazapine has been found to be associated with abstinence from methamphetamine use and a decrease in risky sexual behavior among MSM. Integrated systems navigation paired with peer counseling was found to be associated with a doubling in viral suppression rates and improvement in mortality among PWID. Strathdee closed by calling for

scale-up of evidence-based interventions and addressing structural drivers of substance use to control the HIV epidemic.

Solomon and colleagues presented data from a spatial network research project in New Delhi, India (Abstract 147). A total of 2512 PWID were recruited using 10 index participants from July 2017 to July 2019. This study only included 20 cisgender women and 3 transgender women. Overall, participants reported injecting at least twice per day over the past 6 months, and 42% reported sharing needles. HIV prevalence was 37% at baseline, with 92.6% having detectable HIV RNA. HCV prevalence was 65.1%. HIV incidence was 22.3/100 py and HCV incidence 25.3/100 py. Risk factors associated with HIV incidence included age (IRR, 0.81), recent needle sharing (IRR, 2.16), injection frequency (IRR, 1.05), “path distance” (the number of steps between an index participant and a person with a detectable viral load) (IRR, 0.69), and injecting at a particular spatial hotspot (IRR, 3.14). Solomon pointed out that epidemic control is not attainable without addressing the explosive epidemic among PWID in low- and middle-income countries.

Handanagic and colleagues reported on the unmet need for medication-assisted treatment (MAT) among PWID in NHBS (Abstract 887). Of 10,965 PWID, 28% reported unmet need for MAT in the past 12 months, and 82% of these reported visiting a health care practitioner within the past year. Those reporting an unmet need for MAT were more likely than those without an unmet need to report injecting more than once per day (aPR, 1.09), receptive sharing of syringes (aPR, 1.11), and opioid overdose (aPR, 1.33) in the past 12 months. The authors concluded that health care practitioners could be an important source for referral to MAT. Dasgupta and colleagues reported on unmet needs among PWID living with HIV in care in the national Medical Monitoring Project, from June 2015 to May 2018 (Abstract 888). Overall, 79% reported at least 1 unmet need including dental services (38%), drug or alcohol treatment

(20%), transportation assistance (20%), HIV peer support groups (20%), and mental health services (16%). Of note, fear or embarrassment was the most common reason for lack of drug or alcohol treatment (79%) and for mental health services (59%), suggesting that addressing stigma may help people living with HIV to access needed services, which in turn could improve their HIV-related health.

Ramaswamy and colleagues reported on death rates among PWID with HIV in New York City (Abstract 892). Among 145,799 people with HIV, more than 25,000 reported a history of injection drug use. The age adjusted death rates declined among all risk groups over time, but remained highest among PWID. After adjusting for demographic factors, PWID aged 50 to 59 years, Hispanics, and those living in high and very high poverty neighborhoods had a higher risk of death. Of PWID, 60% died of a non-HIV-related cause. The authors called on efforts to reduce non-HIV- (eg, smoking, hepatitis C) and HIV-associated causes of death. Jain and colleagues also reported on death among people with HIV who use substances who were not on ART at the start of Project Hope (Abstract 893). In this study of 801 participants, the median survival time was 54 months. Average survival time was 27% lower in persons with HIV/HCV coinfection than those infected with HIV alone ($P = .049$), and living in the South was associated with a 38% lower survival rate ($P = .02$). The authors called for greater access to integrated care to address the HIV care cascade among this group of persons with HIV. Metcalfe and colleagues reported on deaths among PWID in Scotland (Abstract 894). Among 412 PWID, all-cause mortality remained stable over time, with an overall death rate of 3.66/100 py; rates were 0.58/100 py for AIDS-related deaths but 1.57/100 py for drug-related deaths. Among those diagnosed more recently (2015-2018), death rates were higher, with non-HIV related deaths of 6.96/100 py and drug-related deaths of 4.4/100 py. The authors called for more MAT availability, and safer drug consumption sites.

Bazzi and colleagues reported on PrEP indications and use among PWID in Boston participating in NHBS (Abstract 1024). Among 423 HIV-seronegative PWID, 92% had a PrEP indication by US Preventive Services Taskforce (USPSTF) guidelines, including 69% with only injection drug use risk and 23% who also had sexual risk. Overall, only 39% had heard of PrEP, 11% had discussed PrEP with their practitioner, and 2% had taken PrEP in the prior year, indicating a need for increased PrEP education and access among PWID.

Men. Mwinnyaa and colleagues presented data on 1458 non-critical male patients seen in 1 of 3 emergency departments in the Eastern Cape province of South Africa (Abstract 860). They found an HIV prevalence of 21% overall, with prevalence peaking at 35% for 36- to 45-year-olds. Only 59% were aware of their infection, 47% tested positive for the presence of ART drugs, and 43% were virally suppressed. None of the 19 HIV-seropositive men younger than 25 years tested positive for ART presence. This study highlights the high prevalence of infection among men attending emergency department visits and suggests this is an important venue for identifying untreated HIV-seropositive men, to link them to care.

Sexually Transmitted Infections

A symposium focused on STIs in women and infants (Symposium S-02). Taylor provided an update on mother-to-child transmission of syphilis (Abstract 054). Congenital syphilis is a result of transmission of *Treponema pallidum* from mother to child during pregnancy, and is associated with a number of adverse outcomes including low birth weight, prematurity, long bone deformities, and neurologic deficits, and is the second leading cause of preventable stillbirth. Importantly, congenital syphilis is preventable with screening of women during pregnancy and treatment with benzathine penicillin for those with a syphilis infection. The WHO estimated that 988,000 pregnant women had a

syphilis infection during pregnancy in 2016, corresponding to a 0.69% prevalence globally, which was largely unchanged from 2012. The African region had the highest prevalence of syphilis, followed by the Americas. WHO estimated that 661,000 infants were born

Congenital syphilis is preventable with screening of women during pregnancy and treatment with benzathine penicillin

with congenital syphilis in 2016, with 355,000 adverse outcomes and 200,000 stillbirths and neonatal deaths. By comparison, there were only 170,000 HIV infant cases in 2018. Congenital syphilis rates have declined in Africa, but increased in the Americas and Eastern Mediterranean region. In the US and Brazil, congenital syphilis rates have increased in parallel with increasing maternal syphilis infections. WHO has estimated a small global decline in congenital syphilis between 2012 and 2016, which was associated with small increases in antenatal visit coverage, antenatal screening coverage, and syphilis treatment coverage. Nonetheless, the majority of adverse outcomes occur in women who presented for antenatal care but did not receive syphilis screening, which represents a missed opportunity for the prevention of MT of syphilis. WHO global guidance recommends universal screening for syphilis as early as possible at the first antenatal care visit, and all pregnant women found to be positive should receive treatment with at least 1 dose of benzathine penicillin 2.4 units, which costs \$0.50 to \$2.50 per dose globally, but may be as high as \$125 per dose in high-income countries. There are substantial differences in testing coverage for HIV versus syphilis in pregnant women in antenatal clinics. For example, HIV screening coverage was more than 95% in Uganda and Zambia but syphilis testing coverage was only 43% and 56% in those countries, respectively, and in India, Nigeria, and Indonesia, syphilis screening

coverages were below 20%. The WHO has established criteria for elimination of MTCT of HIV and syphilis, including 95% coverage of antenatal care, HIV and syphilis testing, and treatment, and 14 countries have been validated so far. Challenges with achieving these goals have included a global shortage of benzathine penicillin between 2014 and 2017, with more than 40 countries experiencing shortages or complete stock outs, including in some high-income countries. These shortages highlight the need for alternative treatments for pregnant women with syphilis. Currently a phase II trial is underway in Brazil to evaluate the oral antibiotic cefixime for the treatment of active syphilis among non-pregnant women in Brazil, and may inform a future trial in pregnant women to prevent congenital syphilis. Additionally, WHO HIV testing guidelines now recommend the rapid dual HIV/syphilis test as the first test for pregnant women, which has been adopted in 15 countries. They have also adopted a Triple Elimination goal to include eliminating MTCT of hepatitis B virus (HBV), in addition to HIV and syphilis.

Low presented on chlamydia and gonorrhea in pregnancy (Abstract 55). WHO estimates women aged 15 to 49 years experience about 63.8 million new chlamydia infections and 37.1 million new gonorrhea infections each year. Although gonococcal infections are more common in men, chlamydia infections are more common in women, in whom the number of cases has increased with expanded screening programs. Both infections are mostly asymptomatic at the endocervix, although mucopurulent cervicitis may occur, with non-specific symptoms including discharge and post-coital or intermenstrual bleeding. Ascending infection to the upper genital tract can lead to pelvic inflammatory disease, which is also mostly asymptomatic, but can lead to infertility. When transmitted to the newborn, gonorrhea and chlamydia each can cause neonatal conjunctivitis, and chlamydia can cause neonatal pneumonia. Among pregnant women attending antenatal clinics, chlamydia is more prevalent

than gonorrhea, with wide geographic variability, but the highest prevalences (in the 10%-25% range) of these infections are in the Southern and Western Pacific and in South Africa. Several cohort studies have shown an association between chlamydia and gonorrhea infections and preterm birth, although these studies are subject to confounding and measurement bias. HIV infection itself has not been associated with pre-term birth. Protease inhibitor-containing ART may increase the risk of pre-term birth,¹ but the benefits of treatment are thought to outweigh these risks. There is a higher prevalence of chlamydia and gonorrhea in pregnant women living with HIV than those who are uninfected; however, the presence of chlamydia or gonorrhea in pregnancy has not been consistently associated with risk of HIV MTCT.

To prevent adverse pregnancy outcomes, additional evaluation of interventions is needed. In a cluster randomized trial in Rakai, Uganda, presumptive treatment with antibiotics versus syndromic management was associated with a reduction chlamydia and gonorrhea prevalence and there was a lower preterm birth rate ratio, although not statistically significant ($P = .77$; 95% CI, 0.56-1.05). Additionally, there was no effect on HIV acquisition, and all women were exposed to antimicrobials in the presumptive treatment arm. There are no completed randomized controlled trials of antenatal screening and treatment of chlamydia and gonorrhea, although several trials are now underway in Papua New Guinea, China, and several African countries. These include studies using rapid molecular tests, which allows same day testing and treatment. Several presumptive treatment trials are underway, combining STI treatment with malaria prophylaxis.

Shimakawa presented on the prevention of MTCT of HBV (Abstract 56). In 2016, the WHO adopted a strategy to eliminate hepatitis B and C by 2030, aiming to reduce incidence by 90% and mortality by 65%. Many countries in sub-Saharan Africa and Asia have a high prevalence of chronic HBV infection. Transmission of HBV occurs through

exposure to blood, semen, and vaginal fluid, and can occur perinatally (usually when baby passes through birth canal), during childhood (child/household-to-child), or through sexual contact or sharing contaminated needles, syringes, or blood products. Almost all countries have now integrated 3 doses of hepatitis B vaccination of infants into their program. These infant vaccines are highly effective in preventing horizontal transmission, but to prevent MTCT, the first dose should be started as soon as possible after birth. With the widespread implementation of infant hepatitis B vaccinations, horizontal transmission has dramatically dropped. However, cases acquired at birth through MTCT have remained unchanged over the last 30 years. MTCT of HBV is associated with an increased risk of chronic HBV infection, with risk inversely correlated with age at infection.

In a longitudinal cohort study of chronic HBV carriers in West Africa, the risk of developing liver fibrosis was 5-times higher in infants born to HBV-infected mothers than in those born to non-infected mothers. Without preventive measures, 70% to 90% of infants born to mothers who are hepatitis B e antigen (HBeAg) positive, a marker of high viral replication, become infected with HBV, compared with 5% to 30% of infants born to HBeAg-negative mothers. With infant vaccination beginning at 6 to 8 weeks, the transmission risk decreases to 30% to 60% and below 5% among HBeAg-positive and HBeAg-negative mothers, respectively, and with vaccination in neonates, the transmission risk drops to 10% to 30% and below 1%, respectively. The WHO recommends that all neonates receive hepatitis B vaccination as soon as possible after birth to prevent MTCT; however, most countries have not yet adopted this recommendation. In the Gambia, the first African country to adopt this recommendation, coverage of the birth dose vaccine was more than 90% by 6 months, however, only 1% received this vaccine within 24 hours of birth. In resource rich countries; hepatitis B immune globulin (HBIG), in addition to birth dose hepatitis B

vaccine, is given to infants born to high-risk mothers, which further lowers the transmission risk to 4% to 10%. In recent years, maternal antiviral therapy has been recommended during pregnancy in women with hepatitis B DNA at or above 200,000 IU/mL, the viral load threshold above which MTCT increases. The speaker described an unpublished systematic review that supports the efficacy and safety of peripartum prophylaxis with tenofovir disoproxil fumarate (TDF) in reducing MTCT of HBV. As availability of HBV DNA testing is limited in resource-limited settings, the use of HBeAg as a proxy marker of HBV DNA at or above 200,000 IU/mL was evaluated in a systematic review, which demonstrated pooled sensitivity and specificity of 88% and 93% of HBeAg, respectively. When birth dose vaccination is combined with HBIG and peripartum antiviral prophylaxis, transmission rates become very low.

Wald presented an update on herpes simplex virus (HSV) in pregnancy (Abstract 57). Globally, there were 417 million HSV-2 infections, with the highest prevalence in sub-Saharan Africa. Incident cases of HSV-2 infection are most common among young African women, who are also disproportionately impacted by HIV. Approximately 3.6 billion individuals are infected with HSV-1 globally, including 140 million cases of genital HSV-1 infection. Most individuals with HSV infection are undiagnosed, which has not changed significantly over time. In the Seattle-King County area, frequency of HSV-2 has declined over the last 20 years, with half of cases now being HSV-1 and half HSV-2 infections; HSV-2 prevalence has also been falling in pregnant women in this region. HSV-2 infection is an important risk factor for HIV acquisition, with a population-attributable fraction of 30% globally, but varies by region. Among high-risk women in Kenya, the population-attributable risk of HSV-2 infection for HIV acquisition is over 50%, which has not changed over time. Neonatal HSV is the most serious complication of HSV acquisition, resulting in high mortality and morbidity despite antiviral therapy. Import-

antly, most infants with neonatal HSV are born to women without a history of genital herpes. Among more than 2 million pregnancies in Medicaid data from 2009 to 2015, 900 cases of neonatal HSV infection were identified (incidence of 4.5/10,000 py). Overall mortality was 6%, with 16% of infants readmitted after discharge and 46% requiring an emergency department visit within the first 6 months of life, and total costs were estimated at \$60 million.

Globally, it is estimated that there are approximately 14,000 neonatal herpes cases annually, although there is a lack of reported cases from Africa, which may be due to a lack of diagnostic testing. In the US and Canada, about half of neonatal herpes cases are due to HSV-1. The risk of HSV transmission during labor is highest among women with newly acquired genital HSV (50% risk), compared with women with established genital HSV (<1% risk). Additionally, HSV isolation from the cervix (OR, 346) and invasive monitoring (eg, scalp electrodes) of the infant (OR, 6.8) was associated with risk of neonatal HSV, and Cesarean section was protective (OR, 0.14). Across 5 studies, daily antiviral therapy with acyclovir or valacyclovir in women with known recurrent genital herpes reduced clinical HSV recurrences by 75%, Cesarean sections for HSV by 70%, and HSV shedding at delivery by about 90%. However, none of these studies evaluated neonatal herpes; a case series has been published describing 8 infants born to women who received suppressive therapy at the end of pregnancy but developed neonatal herpes. HSV infection is associated with MTCT of HIV, with both HSV-2 seropositivity (aOR, 2.6) and HSV-2 shedding (aOR, 2.9) associated with perinatal HIV transmission. Additionally, the efficacy of zidovudine in preventing MTCT was lower among women with HSV-2, than among women who were HSV-2 seronegative, suggesting effect modification of the efficacy of antivirals by HSV-2 status, although it is unclear if this is still the case in the era of highly active ART. Several studies have demonstrated that tenofovir PrEP used topically as a gel

or orally partially reduced the risk of HSV-2 acquisition among heterosexual women and men, although PrEP on demand was not protective, and it is unclear if it is protective among MSM. Diagnosis of HSV by serologic testing has been challenging, as there have been high rates of false positive results for HSV-2 and false negative results for HSV-1 on commercial enzyme-linked immunosorbent assay ELISA tests. The most common antibody test for HSV infection is the Focus HerpeSelect enzyme immunoassay (EIA). Per the manufacturer, a positive test result is one above 1.1, however in about 50% of persons with results in the low positive range of 1.1 to 3.5, infections are not confirmed, highlighting the need for confirmatory tests for low positive results. Additionally, this test is not sensitive for HSV-1 infection. Genital herpes is associated with high levels of stigma, highlighting the need for work to destigmatize HSV infection.

Davey and colleagues evaluated the prevalence of *Mycoplasma genitalium* in 391 pregnant women living with HIV in South Africa (Abstract 1042). The prevalence of *Mycoplasma genitalium* among these women was high at 17%, and incidence was 5.7 per 100 woman years. Most infections (79%) were asymptomatic and would have been untreated in standard of care syndromic management. HIV-seropositive women with *Mycoplasma genitalium* who were not treated for STIs had twice the odds of having an adverse pregnancy outcome than women without this infection (aOR, 2.03). The researchers suggest the need to evaluate the impact of routine *Mycoplasma genitalium* screening on birth outcomes.

Cannon and colleagues reported on syphilis among bisexual men and its association with syphilis in women in the US (Abstract 1047). Across 16 high-morbidity syphilis areas, 13% of MSM with syphilis reported bisexual behavior, with larger proportions of syphilis cases among bisexual men occurring among black MSM and MSM in the South. In an ecological analysis, a doubling of early syphilis cases among bisexual men was associated with a 3.84 per 100,000 higher mean rate

of syphilis cases in women. These results suggest that “bridging” between MSM and women may partially explain observed disparities in syphilis rates in women.

Grabowski and colleagues reported on the burden of STIs in an HIV hyperendemic fishing community in Uganda (Abstract 1049). Among 898 participants (48% women), 40% were seropositive, and ART coverage was high (87%). Overall, the prevalence of gonorrhea was 9%, chlamydia 10%, and trichomonas infection 12%, with most STIs being asymptomatic. The prevalence of having at least 1 STI was 1.57-fold higher among HIV-seropositive versus HIV-seronegative persons, and syphilis and trichomonas were most likely to co-occur with HIV infection. The researchers suggest that integrated HIV and STI care could substantially lower STI burden in these high HIV burdened settings.

Klausner and colleagues reported on the use of genotyping to predict ciprofloxacin treatment outcome of gonorrhea across 8 STD clinics in the US (Abstract 1052). Among 106 patients with 117 gonorrhea infections that were wild type for the gyrase A serine 91 codon, treatment with a single oral dose of ciprofloxacin 500 mg was provided, with 100% microbiologic cure. The cure frequency did not differ by anatomic site of infection, sex, or age. In 2 cases with mutated gyrase A gonorrhea infection, therapy failed. These results suggest that resistance-guided treatment of gonorrhea with single-dose oral ciprofloxacin is highly efficacious.

HIV Testing

Testing Strategies

Hoover and colleagues evaluated the utility of more frequent HIV testing among 1338 MSM or TGW of color enrolled in the THRIVE (Targeted Highly-Effective Interventions to Reverse the HIV Epidemic) study who were not on PrEP (Abstract 949). They defined frequent testers as those who received a repeat HIV test within least 6 months, and infrequent testers as

those receiving testing less frequently than at 6 months. Although the diagnostic yield was similar for frequent versus infrequent testers (1.2% vs. 1.0%, respectively), frequent testers had a shorter time from testing to diagnosis of HIV infection (median 120 days vs. 364 days, respectively). This reinforces the recommendation that persons at risk of HIV infection get more frequent testing than annually.

Truong and colleagues presented data from a community-based health initiative in informal settlements in Kenya (Abstract 142). They used a combination of health fairs and home visits

In a randomized controlled trial of financial incentives in Uganda, participants who received financial incentives were significantly more likely to retest at 3 and 6 months than the control condition

for those not attending the fairs. Of more than 12,000 clients eligible for testing, testing uptake was 97%; they identified 101 newly diagnoses (0.81%). Of these, 93% were linked to same-day ART. This was a successful strategy for increasing testing and linkage to care.

Chamie and colleagues presented data from a randomized controlled trial of financial incentives to increase retesting among adults aged 18 to 59 years with sexual risk in Southwestern Uganda (Abstract 141). Overall, 525 persons were randomly assigned to financial incentives (equivalent of \$7 for retesting at 3 and 6 months), deposit contract (participant pays \$6 initially, with plans to receive \$7 back at each next test opportunity), or a control condition (counseling only). Participants randomly assigned to the financial incentive arm were significantly more likely to retest at 3 and 6 months than the control condition (52% vs. 18%, respectively; $P < .001$). Only 14% of those randomly assigned to the deposit contract arm opted to make a deposit, but

among those who did, retesting was significantly higher than those not opting for a deposit (46% vs. 11%, respectively). The data suggest that financial incentives are a potential method for increasing HIV testing rates among at-risk populations.

Self-Testing

Several presentations focused on the utility of HIV self-testing, particularly for populations in whom testing rates may be relatively low. Nangendo and colleagues presented data on oral HIV self-testing in 1628 men from 30 villages in Central Uganda (Abstract 955). Overall, 95.3% of men offered a self-test took it; only 808 had ever been tested and only 37% had tested in the last 12 months. HIV prevalence was 3.9%; of these seropositive individuals, 76% sought confirmatory testing at the local health facility. Of these, 96% initiated ART. Nasuuna and colleagues presented data from a self-testing program conducted in 38 facilities in Uganda (Abstract 958). Overall, 9378 self-test kits were distributed to partners of pregnant or lactating women, MSM, or FSW. HIV prevalence was 3%, 93% of which were in people not previously known to be HIV seropositive. HIV yield was 6% in FSW, 2.4% in MSM, and 1.4% in partners of pregnant and lactating women. Only 67% returned for confirmatory testing, and of these, only 74% were linked to care, suggesting that in this setting, additional support may be required to ensure confirmatory testing and rapid linkage to care and ART.

Mostert and colleagues presented data on more than 123,000 self-test kits distributed at 2313 companies in South Africa (Abstract 961). Uptake was 85% across all industries, and rates of uptake were twice as high in men as women. Of people taking a self-test, 13% had never had an HIV test, and 38% had last been tested more than 12 months prior. Uptake among those never or infrequently tested was 3-times higher in rural workplaces. The average cost per test was \$4.25, which the authors state is substantially lower than for other distribution models. In

sum, these studies suggest that HIV self-testing may reach populations untested or under-tested in other settings, but that in some settings, additional work is needed to ensure those who test positive on these preliminary tests present for confirmatory tests and HIV care.

Assisted Partner Services

Guthrie and colleagues presented on the use of assisted partner services (APS) to find untreated HIV-seropositive injection or sexual partners of PWID in Kenya (Abstract 42). They identified 627 HIV-seropositive index participants, who in turn identified 2772 partners, 91% of whom were successfully traced, enrolled, and screened for HIV. Overall, 29% of partners were found to be HIV seropositive, 23% of whom were not on ART, leading to a number needed to interview of 3.8 for every person identified who was not on ART. When followed up 6 months later, 76% of those not previously on ART were being treated by 6 months after study entry. This suggests that APS can identify persons who are not treated, but that linkage rates could be improved.

Golden and colleagues presented data on APS offered at 52 Ministry of Health clinics in Botswana from October 2018 to June 2019 (Abstract 939). Of 7015 HIV-seropositive patients, 99% were offered APS and 88% received these services, naming 5182 partners. Of these, 66% were tested, 22% of whom were HIV seropositive. Drawing on experience with syphilis APS, Golden calculated a case finding rate, or the proportion of sex partners newly diagnosed per index case. The case finding index in Botswana of 0.12 was considerably lower than the published literature in Africa, in which the case finding index was 0.25 to 0.45. This calls into question whether results in the literature are biased or do not reflect real-world experience, or if there are differences in Botswana, given the high background rate of testing in that country. However, Drammeh and colleagues also presented data on case finding in 9 African countries, and found the indices to range from 0.03 to 0.19, except in Cote D'Ivoire (0.36) and Ethiopia (0.39).

Namimbi reported on APS among 69 health facilities in 2 urban Ugandan districts from October 2017 to September 2018 (Abstract 937). Of more than 53,000 eligible persons, 67.4% agreed to be interviewed, and they identified more than 49,000 sex partners, 81% of whom were successfully contacted. Of these, 17% were already known they were HIV seropositive, and 61% of the remainder agreed to be tested. Among those tested, HIV seropositivity rate was 29.7%, and 96% of these were started on ART. Overall, 0.99% of index clients reported gender-based violence after notification of their partners. This study demonstrated excellent linkage to care. The number of sex partners identified was lower than expected, and the reasons for non-testing in nearly 40% of those contacted should be explored. Gender-based violence, although infrequent, deserves ongoing monitoring and linkage to services. Referring to the Golden presentation, noted above, the case finding index in this study was 0.16, also lower than what has been seen in the published literature. Remera presented data on APS services in 2632 cases in Rwanda from August 2018 to October 2019 (Abstract 942). Case finding index was also low here (0.09); however, linkage to care was high (93.7%). Factors associated with finding an HIV-seropositive partner were index client age (aOR, 0.98; $P=.002$), having a female partner (aOR, 2.1; $P<.001$), and finding the partner through client notification rather than provider notification (aOR 1.86; $P=.042$).

Preexposure Prophylaxis

Ogbuagu and colleagues presented data from 96 weeks of follow-up in the DISCOVER trial, a randomized controlled trial comparing emtricitabine/tenofovir alafenamide (FTC/TAF) and emtricitabine/TDF (FTC/TDF). PrEP in cis-gender men and transgender women who have sex with men (Abstract 92). Of 5399 participants randomized 1:1 in the 2 arms, retention was 82% through week 96. Median age was 34 years; 84% were white, 9% black, and 24% Latinx; only 1% were TGW. In the interim period

from 48 to 96 weeks, only 1 participant in the FTC/TAF arm became HIV infected, with the results still indicating that FTC/TAF is non-inferior to FTC/TDF in protecting against HIV acquisition (IRR, 0.54; 95% CI, 0.23–1.26). Adverse events were similar between arms, with only 1% of FTC/TAF and 2% of FTC/TDF discontinuing study drug because of adverse events. Bone mineral density increased by 0.6% in the FTC/TAF group and decreased by 1.0% in the FTC/TDF arm ($P<.001$), although these declines were modest, and there were no differences in fractures between the arms. Creatinine clearance rate reductions were also quite modest in each arm (–0.6 mL/min vs. –4.1 mL/min in FTC/TAF vs. FTC/TDF arms respectively), with only 1 case of Fanconi's syndrome, which was in the FTC/TDF arm. Fasting lipids were modestly better in the FTC/TDF arm, with low-density lipoprotein (LDL) level of –2 mg/dL vs. –7 mg/dL and HDL of –1 mg/dL vs. –4 mg/dL in the FTC/TAF vs. FTC/TDF arms, respectively. Weight gain was slightly higher in the FTC/TAF than FTC/TDF arms (1.7 kg vs. 0.5 kg weight gain; $P<.001$). Given these modest differences and non-inferiority, some are recommending that FTC/TDF be the initial PrEP regimen for most groups, reserving FTC/TAF for MSM or TGW who have underlying renal or bone disease.

Colby and colleagues addressed the issue of antiretroviral (ARV) drug resistance among 2442 people initiating PrEP in Thailand, who were retrospectively found to have acute HIV infection (Abstract 93). Through pooled RNA screening on baseline samples and follow-up testing at 1 month, they found 7 people acutely infected with HIV. Of these, 3 had FTC resistance with M184V/I, and the other 4 had no resistance to FTC or TDF. The 4 without FTC/TDF resistance had continued PrEP for 2 to 15 days after infection was detected; the 3 with FTC resistance had been on PrEP for 29 to 122 days before HIV infection was recognized. This suggests that ARV drug resistance is unlikely to develop in the first 15 days after starting PrEP, but could occur after 4 weeks on

treatment. This emphasizes the importance of not initiating people with acute symptoms on PrEP, and of repeat HIV testing 1 month after PrEP initiation.

Peluso and colleagues highlighted diagnostic and therapeutic challenges arising in individuals with early HIV infection who are on PrEP (Abstract 140). He describes the interface between PrEP use and undiagnosed HIV infection as the HIV/PrEP overlap period. Among 58 participants with early HIV infection in San Francisco, 11 had HIV/

Diagnostic and therapeutic challenges can arise with early HIV infection on PrEP

PrEP overlap, in whom 6 had acquired HIV while on PrEP, and 5 who had initiated PrEP but were found to be HIV-seropositive as part of their PrEP evaluation. Individuals with HIV/PrEP overlap had lower HIV RNA levels than those not on PrEP. He described one participant who started PrEP in the setting of occult acute HIV infection and developed the M184I mutation after 7 days, as this patient was found to have had wild-type virus on the day of PrEP initiation. He described a second participant adherent to daily PrEP for 1 year who seroconverted after a 2-week period of high intensity exposures (~45 condomless receptive anal sex partners). In this case, seroreversion occurred, in which initial antibody/antigen testing was positive with a detectable qualitative plasma RNA, but subsequent antigen/antibody testing and quantitative plasma RNA were negative. Early HIV infection was confirmed using quantitative PCR in peripheral blood mononuclear cells (PBMCs) collected via large volume sampling. Although objective adherence measures were not collected for this participant, it raises the possibility that PrEP may be "overwhelmed" with high levels of exposures in a short period of time, despite daily adherence. In a third case, he reports a participant who discontinued PrEP 1 month prior to presentation,

had an HIV exposure off PrEP and restarted PrEP 3 days later and presented to care 2 days after that. Initial testing showed a negative antigen/antibody test but quantitative plasma RNA detected at below 20 copies/mL; repeat testing showed undetectable plasma RNA; however, repeat large volume leukapheresis testing was able to establish infection. This case likely represents one of the earliest documented treatment of HIV infection. In challenging HIV/PrEP overlap scenarios, Peluso suggests repeating testing using different assays (eg, quantitative or qualitative plasma HIV RNA, HIV antigen/antibody testing, HIV antibody panel), following dynamics of quantitative assays over time, including evaluating signal-to-cutoff ratio from antigen/antibody assays; and having a low threshold to start ART.

Several presentations reported on the use of a urine tenofovir test to monitor PrEP adherence and predict outcomes. Spinelli and colleagues presented data on the accuracy of a novel real-time urine tenofovir assay (Abstract 91). They developed a lateral flow assay as a low-cost, point-of-care antibody-based test that measures PrEP adherence over the last 4 to 7 days. A cut-off of 1,500 ng/mL was selected, which accurately classified recent PrEP dosing in a prior directly-observed therapy study. In 324 cisgender and transgender men and women taking PrEP in 2 studies, the sensitivity, specificity, and accuracy of the novel point-of-care test was 98% to 100%. The authors suggest that this assay is now ready for field testing and could be used to trigger adherence interventions. Stalter and colleagues evaluated the association between urine tenofovir levels and HIV protection in the Partners PrEP study (Abstract 977). In a nested case-control study of 22 cases with urine collected at first HIV detection and 292 HIV-seronegative controls, a urine tenofovir level at or above 1500 ng/mL was observed in 36% of cases and 68% of controls and was associated with a 71% adjusted HIV risk reduction in this study.

Hebel and colleagues reported on the use of a urine tenofovir test to im-

prove PrEP adherence and predict non-retention (Abstract 1032). Among 688 PrEP patients across 16 clinics who received results from urine tenofovir screening using a liquid chromatography mass spectrometry test, 82 (12%) were found to be non-adherent and were provided enhanced adherence support; 61 (74%) of these patients were adherent on the urine test at their next visit, although a control population was not included. Additionally, non-adherent patients based on the urine assay were 70% more likely to miss their next visit and 114% more likely to be lost to follow-up.

Hepatitis Prevention and PrEP

As previous studies have demonstrated the prophylactic effect of TDF against HBV infection in people living with HIV, Mizushima and colleagues assessed the prophylactic effect of PrEP against HBV infection among HIV-uninfected MSM in Tokyo (Abstract 1025). Among 591 MSM who had a negative hepatitis B core (HBc) antibody at entry, HBV incidence was 3.57 cases/100 py overall, with 1 HBV infection occurring in a participant on PrEP and 14 HBV infections occurring in participants not on PrEP (aHR, 0.123; 95% CI, 0.016-0.948; $P=0.044$). The authors suggest that PrEP may be particularly indicated for MSM who do not respond to HBV vaccination.

Le Turnier and colleagues assessed hepatitis A virus (HAV) and HBV vaccination coverage and acceptability among 429 MSM on PrEP in the IPER-GAY study in France and Canada (Abstract 1026). Overall, 50% were HAV non-immune and 21% were HBV non-immune at baseline. In those who had more than 6 months of follow-up, 91 completed the HAV vaccination series of whom 93% seroconverted during follow-up; 79% completed the HBV vaccination series, of whom 80% seroconverted during follow-up. Given the rising incidence of sexually transmitted viral hepatitis among MSM, the researchers suggested that PrEP initiation visits are major opportunities to initiate HAV and HBV vaccination in this at-risk population.

PrEP Uptake, Persistence, and Adherence

Doblecki-Lewis and colleagues presented data on the implementation of an innovative mobile clinic to deliver PrEP and HIV/STI prevention services

In a large online sample of MSM in the US, 61% were interested in taking non-daily PrEP, and 5% of recent PrEP users reported non-daily dosing

in Florida (Abstract 984). To address structural and social barriers to PrEP care, the team developed a mobile prevention clinic providing HIV/STI testing and PrEP care delivered via a mobile van; the program is staffed by a medical practitioner, HIV/PrEP counselors, and a pharmacist. Among 429 clients provided services in the mobile clinic, 266 (62%) sought PrEP services, of whom 84% were Latino, 73% were foreign born, and 88% were MSM. Among clients assessed for PrEP, 95% filled an initial PrEP prescription, and 74% completed a follow-up visit. Overall, 24% PrEP clients had positive STI results at baseline. These findings suggest that low-barrier-to-entry PrEP services delivered through a mobile clinic can effectively engage priority populations, including immigrant Latino MSM, that have difficulty accessing traditional clinic settings.

Rao and colleagues reported on trends in PrEP awareness, interest, and use among MSM in Washington state (Abstract 985). Data were collected from 2017 to 2019 in 2 surveys: a statewide online survey of MSM (2 rounds) and an annual paper-based survey administered at the Pride parade (3 rounds). Results from both surveys were similar after adjusting for demographic differences. The proportion of high-risk MSM who had heard of PrEP increased from 84% in 2017 to 96% in 2019 ($P < .001$), however the proportion who reported use of or interest in starting PrEP, a measure of total demand,

remained stable at about 66% ($P = .7$). Current use of PrEP increased from 33% in 2017 to 43% to 46% in 2019 ($P < .001$), approaching the local target of 50% PrEP use among high-risk MSM.

Several presentations reported on the use of on-demand PrEP among MSM. Marcus and colleagues evaluated interest and use of non-daily PrEP in large online sample in the US (Abstract 987). Among 9,697 respondents, 91% were MSM, 69% white, and 67% commercially insured. Overall, 61% were interested in non-daily PrEP, and 5% of recent PrEP users reported non-daily dosing. These included taking PrEP only around the time of sex (48%), on a regular schedule but not daily (24%), and for a few weeks at a time (19%). Common reasons for non-daily PrEP use were infrequent sex (59%), concerns about the high cost of PrEP (49%), and concern about long-term adverse effects (39%). Non-daily PrEP was more prevalent among participants who lived in the West or Northeast than in the South, always planned sex in advance, had fewer sex partners, or reported drug use. These data suggest that non-daily PrEP regimens may increase uptake, especially in those with cost barriers and planned, infrequent sex, and highlight the need to provide clear guidance on effective non-daily PrEP dosing for MSM.

Hojilla and colleagues reported on the implementation of on-demand PrEP in a large integrated healthcare system in San Francisco (Abstract 1006). Among 2,338 active PrEP patients in their system, 12% were prescribed a PrEP 2-1-1 regimen. The majority (51%) used 2-1-1 PrEP exclusively, 15% used a combination of 2-1-1 and daily PrEP, and 19% chose to use daily PrEP despite initial interest in 2-1-1 PrEP. The most common motivation for using 2-1-1 PrEP was infrequent sex. Only 14% of patients reported challenges with using 2-1-1, including 6% who had issues with the dosing pattern or adherence, and 5% who had challenges with planning for sex in advance; of these patients, 58% switched on their own to daily dosing. There were no new HIV diagnoses over 136 py of follow-up.

Jongen and colleagues presented data on the use of a mobile app to assess adherence to on-demand PrEP among 139 MSM in Amsterdam (Abstract 1031). Participants used a mobile app to record their sexual activity on a daily basis. Among 6,583 condomless anal sex acts reported, 84% were covered by good event-driven PrEP adherence, defined as taking at least 1 tablet before and 1 tablet after condomless anal sex. Adherence to PrEP for condomless anal sex acts varied over time, with higher adherence with casual vs. steady partners, suggesting that event driven PrEP was used for episodes of higher perceived risk.

Golub and colleagues examined psychosocial factors associated with PrEP cascade outcomes in New York City sexual health clinics (Abstract 986). Of 160 PrEP-naïve participants visiting sexual health clinics, 73% received PrEP navigation services, 51% received a PrEP referral, 36% initiated PrEP, and 27% were still on PrEP at 3 months. In multivariable analyses, personal PrEP efficacy (ie, believing PrEP will work for me) measured on a 6-item scale was the strongest predictor of PrEP outcomes at every step of the cascade. Additionally, HIV worry was positively associated with all 4 cascade outcomes, intimacy barriers to condom use was associated with PrEP referral and initiation, and perceived HIV risk and medical mistrust were negatively associated with sustained PrEP use. These findings suggest the importance of messaging and counseling that increase self-efficacy beliefs, build trust, and promote PrEP as a counter to HIV worry.

Henny and colleagues evaluated the effectiveness of different PrEP navigation models in a multisite demonstration project (Abstract 988). Among 4,999 MSM of color who were eligible for PrEP, 85% were linked to care. The researchers identified 3 PrEP navigation models: 1) utilize peers from the community and a navigation protocol from the health department; 2) utilize professionals with a college degree or higher plus peers and the health department navigation protocol; and 3) utilize professionals and peers and

protocol designed by a local clinic or community-based organization. They found that navigation models designed by local service providers and staffed by career professionals and peer navigators were more than 3-times as likely to link eligible clients to PrEP than were navigation models using peers and health department protocols (89% vs. 22%, respectively; RR, 3.48; 95% CI, 2.61–4.62).

Beyrer and colleagues reported on the use of social media influencers to enhance recruitment of young Thai male sex workers aged 18 to 26 years into a prevention program (Abstract

PrEP navigation models designed by local service providers and staffed by career professionals and peer navigators were more likely to link eligible clients to PrEP

1013). After launch of a social media influencer campaign in collaboration with a community partner, monthly recruitment increased 82%, from an average of 17 enrollments per month to 63 per month. Among 900 participants enrolled overall, 75% chose to initiate PrEP.

Chapin-Bardales presented data on PrEP persistence and adherence among MSM in 4 US cities (Abstract 991). Among 391 MSM who participated in the 2017 National HIV Behavioral Surveillance in Los Angeles, San Francisco, Philadelphia, and Washington DC, 80% were persistent on PrEP (self-reported PrEP use in past 12 months and had detectable drug in dried blood spots (DBS). Overall, 80% were optimally or consistently adherent to PrEP (self-reported PrEP use in last month and TFV-DP consistent with 4 to 7 doses/week), and 66% were optimally adherent to PrEP (self-reported PrEP use in past month and had tenofovir diphosphate [TFV-DP] levels consistent with 7 doses/week). PrEP persistence was lower among participants who were under age 30 years, had less than college education, had public insurance,

and had fewer than 10 sex partners. PrEP adherence was lower among those who were under age 40 years, were of black race/ethnicity, had high school education or less, had fewer than 5 sex partners, and lived in Philadelphia.

Graham and colleagues reported on adherence measures among 161 Kenyan MSM (Abstract 992). Overall, 47% reported unprotected anal sex, 87% reported 3 or more male partners, and 66% reported transactional sex. Although the median self-reported adherence via the visual analog scale was 98%, DBS results were undetectable at 178 of 275 (65%) visits, and protective TFV-DP levels consistent with 4 or more doses/week was observed at only 10% of visits. In multivariable analyses, older age (aOR, 1.12), sex with a female partner (aOR, 3.98), and lower social support (aOR, 0.97) were associated with protective TFV-DP levels. These results highlight the need for tailored interventions to support PrEP adherence in this vulnerable population. Kimani and colleagues presented data on PrEP adherence among 42 MSM and 11 TGW in a cohort of Kenyan PrEP users (Abstract 878). By 6 months of follow-up, 79% of MSM were still on PrEP, but only 15% of whom had any detectable TFV-DP levels, none at levels at or greater than 4 pills per week. At 6 months, 64% of TGW were still on PrEP, of whom 43% had levels consistent with 4 pills or more per week. This suggests that more support may be needed to assist TGW and MSM to adhere to PrEP over time.

Parmley and colleagues evaluated PrEP cascade indicators among MSM and TGW in Zimbabwe where PrEP is being scaled up (Abstract 994). Among 1167 HIV-seronegative participants in Harare and Bulawayo, 46% were aware of PrEP, and of those aware, only 31% had ever taken PrEP. Among those who had never taken PrEP, 71% were interested in starting PrEP. Barriers to starting PrEP included not knowing where to access PrEP (25%), concern about adverse effects (20%), and low risk perception (20%). Although 75% of PrEP users had taken it in the past 6 months, common reasons for discontinuation included adverse effects

(60%), trust in partner (7%), and inability to continue to access PrEP (5%). These results suggest that messaging to create PrEP demand could incorporate information on locations where PrEP is accessible, risk behaviors for HIV, and adverse effects.

Songtaweasin and colleagues reported on protective drug levels among 294 MSM and TGW aged 15 to 19 years in Bangkok, Thailand (Abstract 1027). In this program, FTC/TDF PrEP with condoms were provided free of charge to participants, and participants were randomly assigned to receive a youth-friendly service with or without a mobile app to support PrEP adherence. Among 294 3-month risk periods over a 6-month period, 34% were protected by PrEP (TFV-DP level above 700 femtomoles/punch), 12% were protected by PrEP and condom use, and 16% by condom use alone; 38% remained at risk for HIV acquisition.

Toy and colleagues evaluated retention in a large publicly-funded PrEP program in British Columbia, Canada (Abstract 978). Among 4647 individuals who applied for PrEP, 4570 qualified for PrEP program enrollment, of whom 98% initiated PrEP. Among those who initiated PrEP, 76% were retained in the program. Factors associated with non-retention included having non-MSM risk factors, younger age, no prior PrEP use, and having an enrolling prescriber with no prior PrEP experience. There were 10 seroconversions in 5,752 py on PrEP, with an HIV diagnosis rate of 0.17/100 py. This low rate is in contrast to an HIV incidence of approximately 2/100 py among high-risk MSM prior to rollout of publicly funded PrEP.

Mayer and colleagues evaluated the PrEP continuum among MSM in the HIV Prevention Trials Network 078 study (Abstract 995). Of 382 HIV-sero negative MSM in 4 US cities, 70% met Centers for Disease Control and Prevention (CDC) criteria for PrEP use. Although most at-risk MSM (73%) had heard about PrEP, only 16% had used PrEP in the past year, and 7% had protective plasma tenofovir drug levels. Employment, health insurance, increased risk perception, and not being concerned about adverse effects were

associated with PrEP use. These findings suggest the need to address socioeconomic issues and misinformation about adverse effects to increase PrEP uptake in US MSM.

PrEP Metrics and Cost

Myers and colleagues proposed a new PrEP Equity Index to assist in setting local targets for PrEP coverage (Abstract 1005). This index is calculated by divid-

PrEP use would need to increase 65% to 295% in black MSM and 131% to 235% in Latino MSM to achieve equity with white MSM in New York City

ing PrEP coverage for white MSM by PrEP coverage for black or Latino MSM. For MSM in New York City, the PrEP Equity index for black MSM ranged from 1.7 to 3.9, and for Latino MSM, 2.3 to 3.3. PrEP targets were then set for these populations to quantify the improvement in PrEP coverage needed among black/Latino MSM to approximate the coverage of white MSM. They found that PrEP use would need to increase 65% to 295% in black MSM and 131% to 235% in Latino MSM to achieve equity with white MSM. Menza and colleagues evaluated population-based estimates of PrEP access to need in Oregon using state claims data combined with HIV, STI, and HCV surveillance data (Abstract 1008). There were 2.6 PrEP starts and 1.5 prevalent users based on HIV diagnoses, 0.13 PrEP starts and 0.07 prevalent users based on STI diagnoses (a measure of HIV acquisition risk), and 0.16 PrEP starts and 0.09 prevalent users based on hepatitis C diagnoses (a measure of need among people who inject drugs). The researchers suggest that their combined method provides a more complete assessment of PrEP access to need than those based on PrEP starts and HIV diagnoses alone.

Marcus and colleagues presented on the use of an HIV prediction model to evaluate PrEP coverage in the Kaiser

Permanente Northern California health-care system (Abstract 1007). An HIV risk score was calculated for more than 3 million members. Among 8,840 patients assessed as very high risk, only 40% had recently used PrEP use; recent PrEP use among these patients was lower among younger patients, women, black patients, and those with lowest socioeconomic status.

McManus reported on regional disparities in requirements for prior authorizations for FTC/TDF PrEP (Abstract 1009). Compared with qualified health plans in the Northeast, plans in the South were 15.9-times as likely to require prior authorizations for FTC/TDF, with the highest rates of prior authorization in Texas, Florida, Georgia, Mississippi, and Arkansas. The researchers point to the possible need for federal- or state-level health policy laws to address this system-level barrier.

Several presentations evaluated the cost of PrEP delivery in the US. Shrestha and colleagues evaluated health care utilization and costs of providing PrEP in 2 health centers in Chicago and Washington, DC (Abstract 1011). For 482 PrEP patients in Chicago and 56 PrEP patients in Washington, DC, a total of 13,213 and 1,728 office and laboratory visits, respectively, were conducted for PrEP delivery. The annual total cost of PrEP implementation per patient was \$1,593 in Chicago, and \$1,956 in Washington, DC. Furukawa and colleagues reported on third-party payer and patient out-of-pocket costs for PrEP medication in the US (Abstract 1012). In 2018, \$2.08 billion was spent to cover medication costs for the 219,691 persons on PrEP, of which 80% was covered by commercial insurance, 10% by Medicaid, 2% by Medicare, and 6% by pharmaceutical assistance programs. The average total cost of 30 FTC/TDF tablets was \$1,638, of which 94% was paid by third-party payers and 6% were out-of-pocket costs. Out-of-pocket costs were lowest for those with Medicaid and highest for those with commercial insurance.

Preexposure Prophylaxis in Women

Blumenthal and colleagues presented results from the first US PrEP

demonstration project among 136 at-risk cisgender women (Abstract 1036). Mean age was 40 years; 38% were black and 19% Latina. At 48 weeks, 61% were retained, 49% remained on PrEP, and only 18% had TFV-DP in DBS consistent with taking 6 or 7 doses/week. The most common reasons for non-persistence included concerns over adverse effects or long-term effects, change in risk, medical issues, and worry that PrEP might get stolen. HIV (0 cases/100 py) and STI incidence (5 cases/100 py) rates were low in this study. The researchers called for additional work to optimize PrEP adherence and retention in cisgender women at risk for HIV acquisition.

Yumori and colleagues evaluated missed opportunities for HIV prevention among patients testing positive for an STI at a large academic medical center in New York (Abstract 1035). Among 836 patient encounters, women were more likely to be inadequately screened or never screened for HIV than men (15% vs. 26%, respectively; OR, 0.51; 95% CI, 0.35-0.74). Men were more likely to have multi-site testing for STIs than women (20% vs. 0.36%, respectively; OR, 69.9; 95% CI, 17-285). Discussion of safe sex (40% vs. 53%), condom use (47% vs. 54%), and PrEP (1% vs. 17%) were all lower in women than in men. These findings highlight the need for effective interventions to increase referral of women for comprehensive HIV prevention care. Scott and colleagues assessed factors associated with intention to initiate PrEP in women at risk for HIV in Washington, DC (Abstract 1033). Among 362 at-risk women surveyed, demographic and behavioral risk was not associated with PrEP intentions, however psychosocial factors and healthcare practitioner support were positively associated with intention to initiate PrEP. The researchers suggest use of positive PrEP messaging and focus on the role of clinicians in provision of PrEP and social networks in destigmatizing PrEP.

Haberer and colleagues presented on HIV risk and PrEP adherence among 347 women aged 18 to 24 years in Kenya (Abstract 1030). Although interest

in PrEP use was high, adherence as measured by a real-time electronic adherence monitor indicated modest adherence, with only 14% women achieving more than 70% median PrEP adherence at 6 months. Higher baseline HIV risk as measured by a risk score was associated with lower adherence. In the same study, Pyra and colleagues evaluated the concordance between

PrEP use during pregnancy was not associated with adverse birth outcomes in a large cohort of women in Kenya

electronic monitoring and TFV-DP levels in DBS. Overall concordance was high (87%), but concordance was lower among women with anemia (67%). Additional studies are suggested to evaluate whether concordance between TFV-DP and electronic monitoring is moderated by hemoglobin levels.

Kinuthia and colleagues presented data on prenatal PrEP exposures and longitudinal birth outcomes among 4,451 women in Kenya (Abstract 1034). Overall, 17% used PrEP during pregnancy; those who used PrEP were more likely to report HIV risk factors, including having an HIV-seropositive partner, having a greater lifetime number of partners, engaging in transactional sex, having an STI, reporting intimate partner violence, and being physically assaulted or forced to have sex against her will. Compared with PrEP-unexposed infants, there was no difference in miscarriage, stillbirth, preterm birth, congenital malformations, birth weight, birth length, or gestational age. These results provide additional evidence that PrEP use during pregnancy does not influence adverse birth outcomes.

Anderson and colleagues evaluated the measurement of TFV-DP DBS for pregnant and postpartum adolescent and young women on PrEP in Africa (Abstract 980). Daily FTC/TDF was administered to 20 pregnant and 20 postpartum women aged 16 to 24

years for 12 weeks under directly observed therapy, and DBS were collected weekly. TFV-DP levels in DBS were 31% to 37% lower in pregnancy than in the postpartum period, which was expected based on increased renal function (median creatinine clearance rate, 151 mL/min vs. 109 mL/min, respectively) and lower hematocrit (median, 34.9 vs. 40.8, respectively) observed in pregnant vs. postpartum women. Based on these findings, the researchers recommend strict adherence to PrEP during pregnancy.

Several presentations focused on PrEP in TGW. Clark and colleagues presented results of a pilot randomized clinical trial of a social network-based intervention to support PrEP uptake and adherence among 89 Peruvian TGW (Abstract 1017). The TransPrEP intervention included 4 weekly workshops discussing PrEP adherence and biweekly maintenance workshops. Mean age of participants was 27 years, and 77% reported using feminizing hormones. At the 3-month follow-up, participants in the TransPrEP intervention arm were more likely to report taking "most" or "all" PrEP doses in the prior 30 days (91% vs. 73%) and have protective tenofovir levels in hair (36% vs. 10%); however, these differences

Transgender women of color had lower engagement at each step of the PrEP continuum compared with MSM of color in a multisite demonstration project

were not statistically significant. Iqbal and colleagues evaluated the PrEP continuum among 10,422 HIV-seronegative MSM and 1,009 TGW in the multisite THRIVE demonstration project. At each step of the continuum (screened, eligible, referred, linked, and prescribed PrEP), there were lower proportions of TGW of color than MSM of color. Malone and colleagues reported on PrEP

indication and care continuum among 751 TGW across 6 cities in the Southern and Eastern US (Abstract 1019). Overall, 39% of participants were indicated for PrEP; black participants and having self-perceived HIV risk were associated with higher PrEP indication, and having some college or more education were associated with lower PrEP indication. Among those indicated for PrEP, 84% were aware of PrEP, 74% had insurance, 23% were currently using PrEP, and 14% were adherent. Golub and colleagues reported on PrEP uptake and adherence among TGW receiving gender-affirming care at a community-based health center in New York City (Abstract 1022). The study recruited 2 cohorts: 100 TGW on PrEP and 50 TGW not on PrEP. A higher proportion of participants in the PrEP cohort had a CDC indication for PrEP than in the non-PrEP cohort (81% vs. 47%, respectively; $P < .001$); however, nearly half of TGW in the non-PrEP cohort had one or more PrEP indications. Among TGW not taking PrEP, 51% reported never having spoken with a doctor about PrEP, and 60% in the non-PrEP cohort reported an important reason they were not taking PrEP was because their doctor never offered it to them. Participants in the PrEP cohort had been taking PrEP for an average of 21 months, with high self-reported adherence and 79% of participants with urine tenofovir levels above 1000 ng/mL at 3 months. Golub pointed to the importance of focusing interventions on enhancing patient-clinician communication about PrEP for this high priority population. Cespedes and colleagues evaluated the safety, efficacy, and pharmacokinetics of FTC/TAF among 74 TGW in the DISCOVER trial (Abstract 1020). Overall, 72% of TGW in the study were taking gender-affirming hormones. No TGW acquired HIV in the study. Safety outcomes in TGW taking FTC/TDF and FTC/TAF were similar to those observed in MSM. Although intracellular TFV-DP PBMC concentrations were higher in TGW receiving FTC/TAF than those receiving FTC/TDF, TFV-DP and FTC-TP were similar between TGW taking gender-affirming hormones and MSM.

Investigational Approaches and Regimens for Event-Driven and Postexposure Prophylaxis

Several presentations evaluated alternative dosing regimens for postexposure prophylaxis (PEP) or event-driven PrEP. Bekerman and colleagues reported on 2 efficacy studies of bicitgravir (BIC)/FTC/TAF using event-driven schedules in macaques (Abstract 87). Macaques were challenged rectally with up to 8 low doses of SHIV every 2 weeks and administered 2 oral doses of ARVs at different times relative to virus exposure. In the first study, FTC/TAF and FTC/TAF plus BIC 25 mg given 2 hours before and 24 hours after exposure protected 5 of 6 and 6 of 6 animals, respectively, compared with 6 of 6 animals infected in the placebo group, resulting in a 95% per-exposure risk reduction, whereas PEP regimens with either regimen administered 24 and 48 hours after exposure or 48 and 72 hours after exposure provided little or no protection. In the second study, a higher dose of BIC (100 mg) was evaluated with FTC/TAF and protected 5 of 6 animals when administered 6 and 30 hours after exposure conferring a 90% per-exposure risk reduction, and 4 of 6 animals when administered 12 and 36 hours after exposure conferring an 82% per exposure risk reduction. These results indicate that simplified 2-dose

Weekly oral islatravir, a first-in class nucleoside reverse transcriptase translocation inhibitor, was protective against intravenous SIV challenge

PrEP or PEP schedules can protect macaques against SHIV acquisition, and FTC/TAF plus BIC 100 mg may be partially effective when initiated up to 12 hours post-exposure, although this is twice the dose of BIC than what is included in the combination BIC/FTC/TAF tablet.

Rapidly dissolving inserts are currently being developed for on-demand

topical prophylaxis against HIV and HSV acquisition. Dobard and colleagues reported on the efficacy TAF/elvitegravir (EVG) vaginal inserts when used as on-demand PEP in macaques (Abstract 88). In a study presented at last year's CROI, TAF/EVG administered vaginally 4 hours before SHIV challenge provided 92% efficacy against weekly SHIV challenges. In this study, 6 pigtailed macaques were administered TAF/EVG vaginal inserts as PEP 4 hours after weekly SHIV challenge for up to 13 weeks. Although control animals became infected after a median of 4 exposures, all 6 animals receiving the TAF/EVG inserts were protected, with 100% efficacy ($P=.009$). Drug exposure in plasma was low, but 72% and 38% had detectable TFV-DP in PBMCs at 4 hours and 7 days post dosing. These findings support the clinical advancement of vaginal TAF/EVG inserts for on-demand topical PrEP or PEP into phase I trials.

Markowitz and colleagues presented on the efficacy of weekly oral islatravir, an investigational first-in-class nucleoside reverse transcriptase translocation inhibitor, as PEP against intravenous simian immunodeficiency virus (SIV) challenge (Abstract 89LB). Rhesus macaques were challenged with intravenous SIV in 4 stages, administered descending (4, 3, 2, then 1) weekly islatravir doses starting 24 hours after exposure; the same animals were used in each stage, with stages separated by 7 weeks after the last dose. In the first 3 stages, 6 of 6 treated animals were protected with 4, 3, or 2 weekly doses of islatravir, compared with 6 of 6 untreated controls that became infected. In the final single dose stage, 4 of 6 macaques were protected, with 2 animals becoming viremic at day 14 and day 49 with wildtype virus. Extrapolating these results to human pharmacokinetics suggest that a single oral dose of 60 mg of islatravir given within 24 hours of exposure may provide effective PEP. Overall, these results support the potential utility of islatravir as a simplified PEP agent in humans.

Mayer and colleagues reported on the safety and tolerability of the once-daily single-tablet combination of

BIC/FTC/TAF for PEP (Abstract 996). Among 48 participants who presented for PEP and initiated a 28-day course of BIC/FTC/TAF in a community health center in Boston, 85% completed the regimen as prescribed. The most commonly reported adverse events were nausea with or without vomiting (15%), fatigue (6%), and diarrhea (6%). Elevated transaminase levels were noted in 2 participants and decreased creatinine clearance rate in 1 participant, but these laboratory abnormalities did not lead to product discontinuation and resolved after regimen completion. No HIV seroconversions were detected in the study. Compared with historical PEP regimens tested at the health center, BIC/FTC/TAF was significantly less likely to cause product-related symptoms.

HIV Vaccine Trials Network 702

CROI 2020 featured a special session on the results of the HIV Vaccine Trials Network (HVTN) 702 vaccine efficacy trial. Corey presented the rationale for conducting the trial. The RV144 vaccine trial, conducted in 16,000 Thai men and women, found a combination of an ALVAC (canarypox) prime with a gp120 protein boost, administered at 0, 3, 6, and 12 months, demonstrated a 31% reduction in HIV acquisition in the vaccine compared with the placebo arm. Efficacy was 60% at 1 year, before the immune response waned. Further supporting those results, non-human primate challenge models suggested that non-neutralizing antibodies could provide protection against HIV acquisition. A pox-protein public-private partnership was formed to move this concept forward for testing in South Africa. The vaccine needed to be redesigned, and the final products tested included a clade C insert in the ALVAC vaccine, and a bivalent clade C gp120 protein boost, adjuvanted with MF59. A phase I trial demonstrated that the original RV144 regimen was somewhat more immunogenic in South African participants than in the Thai participants. When the new clade C regimen was administered to South African participants in a follow-up phase I trial,

immunogenicity on almost all measures was substantially improved compared with the original RV144 regimen. These supporting studies led to a decision to move forward with the clade C regimen, to be evaluated for efficacy in the HVTN 702 trial, that enrolled from October 2016 to June 2019. However, the HVTN 702 trial leadership was notified by the Data and Safety Monitoring Board on January 23, 2020, that the vaccine had met prespecified stopping rules with no efficacy seen. Gray presented the efficacy trial results in the 5404 HVTN 702 trial volunteers, of whom 3786 were women and 1618 were men. Overall, 99% of both women and men in the trial were black; 98% of women were heterosexual, and 86% of men were heterosexual. Overall HIV incidence was 3.3/100 py in both arms of the study; 4.3/100 py in women and 1.2/100 py in men. There was no significant difference in HIV incidence between the vaccine and placebo arms overall, or stratified by sex. Corey explored some potential explanations for this failure to demonstrate efficacy. There may have been differences in the immunogenicity of the vaccines

in HVTN 702 compared with RV144 that could explain the lack of efficacy in HVTN 702. Viruses are more diverse in South Africa than were seen in Thailand 10 years ago, when the study was conducted, which could create a higher bar for vaccine efficacy in this population. Host genetics are different between the 2 populations, and several polymorphisms seen to correlate with protection in the Thai population in RV144 are less common in South Africans. Other host factors could contribute, including potential differences in pre-existing immunity, mucosal inflammation, or microbiomes between the 2 populations, which could have influenced vaccine efficacy. Also, the “force of infection” or level of exposure in the South African population was substantially higher than in RV144; in the RV144 trial, women at higher risk showed lower levels of vaccine efficacy than women at lower risk. Additional analyses will be conducted to try to understand the lack of efficacy seen in the HVTN 702 trial. In the meantime, 2 large efficacy studies of broadly neutralizing monoclonal antibodies are being studied in 2 efficacy trials

(named AMP) that expect results in August 2020. There are also 2 efficacy trials of Ad26 mosaic vaccines, one in sub-Saharan African women, and the other in men and transgender persons in North and South America and Europe; results from these trials will be available at a later date. 

All cited abstracts appear in the CROI 2020 Abstract Book, available online at www.CROIconference.org

Financial affiliations in the past 12 months: Dr Buchbinder and Dr Liu have participated in research trials that received provision of medicines from Gilead Sciences, Inc. Dr Liu has received an investigator-sponsored research grant from Gilead Sciences, Inc

Additional Reference Cited in Text

1. Mesfin YM, Kibret KT, Taye A. Is protease inhibitors based antiretroviral therapy during pregnancy associated with an increased risk of preterm birth? Systematic review and a meta-analysis. *Reprod Health*. 2016;13:30.

Top Antivir Med. 2020;28(2):429-454.
©2020, IAS–USA. All rights reserved