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ORIGINAL PAPER

Toward Development of Enhanced Preventive Interventions for HIV Sexual Risk among Alcohol-Using Populations: Confronting the 'Mere Pause from Thinking'

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Abstract The papers in this issue detail state-of-the science knowledge regarding the role of alcohol use in HIV/AIDS risk, as well as offer suggestions for ways forward for behavioral HIV prevention for at-risk alcohol-using populations. In light of recent evidence suggesting that the anticipated uptake of the newer biomedical HIV prevention approaches, prominently including pre-exposure prophylaxis, has been stalled owing to a host of barriers, it has become ever more clear that behavioral prevention avenues must continue to receive due consideration as a viable HIV/AIDS prevention approach. The papers collected here make a valuable contribution to "combination prevention" efforts to curb HIV spread.

Keywords Alcohol · HIV/AIDS · Prevention · Intervention · Behavioral research

What's drinking? A mere pause from thinking!
~Lord Byron, The Deformed Transformed

Introduction

According to World Health Organization estimates, approximately 35 million people in the world were living with HIV at the end of 2012 [1]. In the United States, the Centers for Disease Control and Prevention has estimated that approximately 1.2 million people are HIV-infected, with approximately 50,000 new infections occurring each year [2] and nearly 1 in 8 unaware of their infection [3]. U.S. groups at particularly elevated risk for HIV include men who have sex with men (MSM), particularly younger (including adolescent), black/African American MSM [4]; women, particularly black women [5], and injection drug users (IDUs) [6].

Like other sexually transmitted diseases, the spread of HIV/AIDS is facilitated by inconsistent use of barrier methods, such as condoms. Alcohol use can elevate sexual risk for acquiring and transmitting HIV/AIDS in a number of ways, such as by interfering with decision-making (including the decision to have sex and the choice of a partner), by hampering individuals' negotiations concerning condoms use during sex, by hindering the dexterity required to apply a condom prior to sex as well as increasing the chances of their premature removal, and by coloring expectations about the effects of alcohol use on sexual experiences [7–12]. In particular, heavy episodic—or binge—drinking, commonly defined as consumption of 5+ drinks on a single drinking occasion (4+ drinks for a female) [13], clearly ranks as among the most harmful of drinking patterns in facilitating HIV-risky behaviors, as such behavior typically elevates the blood alcohol concentration levels well above the 0.08 g-percent level at which cognitive abilities most necessary for engagement in safe sex and/or adhering to highly active antiretroviral therapy regimen are likely to be compromised. Thus, it is not surprising that alcohol use has been associated with incident HIV infection [14] as well as with involvement in HIV-risky sexual behaviors among a variety of at-risk groups such as female sex workers (FSWs) [15, 16]; men who have sex with men [17–21], including older MSM [22]; people living with HIV/AIDS [23, 24]; HIV-

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serodiscordant couples in the epicenter of the HIV pandemic, sub-Sahara Africa [25], and—as detailed in the paper by Carey et al. here [26] —women, including certain high-risk subgroups of women such as the young adult African American mothers with low parenting satisfaction that are the focus of the paper by Swartzendruber and colleagues [27] included here. Moreover, it should be emphasized that the implications of alcohol use for HIV sexual risk are in *addition to* its potentially adverse effects on likelihood of getting tested for HIV, of being linked to and remaining attached to HIV care, and of adhering to HIV antiretroviral regimen. In their paper included here, for instance, Walter and colleagues [28] find a significant negative relationship between reported level of alcohol use and being tested for HIV in a national sample of over 15,000 adult women.

Recognition of, and coming to grips with, alcohol's role in HIV spread is particularly crucial insofar as alcohol—unlike many types of illicit drugs—is relatively available in most parts of the world. Thus, worldwide alcohol consumption in 2010 was equal to 6.2 litres of pure alcohol per person aged 15 years or older, which translates into 13.5 g of pure alcohol per day, with about 16 % of drinkers in this age group engaging in heavy episodic drinking [29]. In the U.S., over 87 % of people 18 years or older in 2012 reported having ever consumed alcohol, 71 % reported drinking in the past year, and over 56 % drank alcohol in the past month, with nearly one-quarter of people ages 18+ years reporting binge drinking in the previous month and approximately 17 million adults ages 18+ years (7.2 % of this age group) meeting the criteria for an alcohol use disorder (AUD, i.e., alcohol abuse or dependence) [30]. Approximately 38 million U.S. adults report binge drinking an average of four times per month, consuming an average of about 8 drinks per binge episode [31].

Moreover, it does not appear that such drinking levels are likely to greatly decline anytime soon. Some recent evidence indicates that the share of the U.S. adult population reporting current regular alcohol use may have increased in recent years [32, 33]. Another recent report that used data from 2 large, nationally representative surveys of U.S. adults [34] suggests that the volume and frequency of drinking and prevalence of at least monthly heavy episodic drinking among drinkers increased between 2001 and 2013, while yet another recent analysis concluded that heavy drinking and binge drinking prevalence increased in most U.S. counties between 2005 and 2012 [35]. Furthermore, young people in the U.S. seemingly are able to purchase alcohol without age identification relatively easily [36–38]. Worldwide, a lack of restrictive alcohol marketing policies has been noted [39, 40], while Internet alcohol vendor practices have been criticized as largely insufficient to prevent sales to minors [41]. Exposure to such alcohol advertising has been found to impact the drinking patterns of underage persons [42–44].

Around the world, a number of countries with large or growing HIV/AIDS epidemics have been forced to come to grips with the myriad ways in which alcohol use fosters HIV spread. Russia accounts for nearly 70 % of the known HIV infections in Eastern Europe and Central Asia today [45], and while high rates of HIV among IDUs is the major driver of epidemic spread there [46], it is Russia's extremely high per capita alcohol consumption that fosters particular concern about future HIV spread via sexual transmission [46–48]. The W.H.O. [29] has noted that the recent worldwide increase in alcohol per capita consumption has mainly been driven by increased consumption in China—which had an estimated 780,000 people living with HIV/AIDS at the end of 2011 [49] and where sexual contact, often involving alcohol use [50, 51], is the primary mode of HIV transmission—and India, which had an estimated 2,100,000 people living with HIV in 2012 [52], and where heavy drinking plays a major role in HIV spread among men [53, 54], MSM [55], migrant workers [56], FSWs [57], and HIV-infected clients of FSWs [58]. In Sub-Saharan Africa—the region most severely affected by HIV/AIDS, where nearly 5 % of adults live with HIV [45]—the W.H.O. has observed that the high growth rate of the region's adolescent and adult population suggests a likely increase in the number of potential consumers of alcohol [29], and some research suggests that, at least in South Africa, binge drinking and hazardous or harmful drinking rates have increased in recent years [59]. In this region, alcohol use often has been linked to unprotected sex [60, 61] and new HIV infections [62–64], with a number of studies [16, 65–67] calling particular attention to the role of hazardous drinking in HIV/AIDS spread in South Africa.

Approaches to Prevention of Alcohol-Related HIV Risk

Given alcohol's prominent role in facilitating HIV/AIDS spread, the primary prevention of alcohol use and abuse logically constitutes a potential avenue for controlling the pandemic. Thus, a motivated political body might seek to reduce HIV/AIDS risk by limiting access to or availability of alcohol, as so-called structural (variously termed policy or environmental) approaches to alcohol prevention aim to do. Evidence that such an approach might bear some fruit in the fight against HIV spread is suggested by the substantial body of research that indicates that reducing alcohol availability—by, for example, increasing the price of alcoholic beverages, usually achieved through increasing taxes on alcohol—can reduce alcohol consumption [68–72] and alcohol-attributable mortality [73–75].

Conversely, *expanded* access to, or availability of, alcohol—in the form of, for example, lower minimum legal purchase age, reduced alcohol prices, drink specials, increased hours and days of sale, or proximity to dense concentration of alcohol outlets—has been associated with early initiation into drinking [76], higher likelihood of alcohol use and/or AUD [77–79], increases in alcohol-related mortality [80–82], acute alcohol intoxication hospitalizations [83], and other alcohol-related harms [84]. A number of studies have found that alcohol sales and hazardous consumption levels can be reduced by imposing such measures as minimum legal driving age laws [85]; providing alcohol-free social programs [86]; enacting more stringent alcohol control policies [87] or stronger policy enforcement [88–90], including dram shop liability laws [91]; placing limits on days and hours of alcohol sale [92], and creating state-specific alcohol retail monopolies [93].

Despite the demonstrated effectiveness of most of these primary prevention approaches for limiting alcohol use and abuse, they are not without some significant limitations as a means of stifling HIV spread. Consumption of alcohol is, after all, legal if not also encouraged to some degree for appropriately-aged persons in large parts of the world. Similarly, an alcohol treatment approach to stemming HIV spread also has limitations. For instance, it seems likely (although only rarely assessed in most HIV studies) that some fraction of all persons engaging in HIV-risky sex have an alcohol use disorder [see, e.g., 94]. While such individuals might well benefit from an alcohol treatment program that can reduce their alcohol-related HIV sexual risk, their entrance into and remaining in alcohol treatment can hardly be assumed. Barriers to substance abuse treatment-seeking long have included such factors as stigma, ambivalence about wanting to quit, financial and insurance barriers, and family-related concerns [95–99]. Thus, AUD often goes untreated in the U.S. [100, 101]. For instance, a nationally representative sample of U.S. adults 18+ years of age found that only one-quarter of individuals with prior-to-past-year onset of alcohol dependence had *ever* sought help for alcohol problems [102]. Moreover, post-treatment relapse to alcohol use, as well as relapse following "natural" remission, is relatively common [103, 104], and drinking patterns can fluctuate greatly over the life course [105–108].

For these and other reasons having to do with feasibility, cost, and political considerations, HIV preventive interventions with alcohol-using populations have tended to be of the psychosocial or psychoeducational variety, conducted at the individual level, and typically targeting HIV-risky sexual behaviors. Importantly, however, studies of the efficacy of such interventions usually have reported limited or mixed results [109–112]. This particularly has been the case for interventions with MSM. Over the years, little evidence of reduced HIV incidence has been noted in prevention trials conducted with MSM who report substance use issues (see, e.g., 113, 114). A systematic review published two years ago [115] concluded that it might be difficult to demonstrate significant positive change in sexual behavior among MSM with substance use issues insofar as such individuals often experience concurrent psychosocial health problems, such as depression and partner violence, while an even more recent systematic review [116] concluded that well-designed, theoretically informed research aimed at establishing HIV intervention efficacy for MSM reporting hazardous drinking or AUDs was alarmingly scarce.

Toward Enhanced Preventive Interventions for Alcohol-Related HIV Sexual Risk

The desire to improve behavioral interventions for preventing alcohol-related HIV risk constituted the motivating factor in the National Institute on Alcohol Abuse's (NIAAA) decision to bring together, during one particularly frigid week in February, 2014, some 20 HIV prevention interventionists and basic behavioral researchers (i.e., those who conduct non-applied research to develop an understanding of the determinants and processes affecting alcohol-related HIV risk and protective behaviors) for a 2-day workshop. The presentations made at this workshop—which was generously co-funded by the National Institutes of Health's Office of Disease Prevention (ODP) [117] —culminated in the papers that have been collected for this Special Issue of *AIDS & Behavior*.

In particular, the conference organizers, recognizing that research in HIV preventive interventions and basic alcohol-related behavioral research has developed along relatively independent lines in recent decades, felt that HIV preventive interventions targeting those who drink alcohol at hazardous levels and/or during sex might be improved to the extent that they adopted some of the insights from NIAAA's basic behavioral research program that long has focused on understanding how alcohol use and drinking context can affect in-the-event sexual decision-making. Workshop presenters were asked to assess what had been learned from this research that might be useful in building better HIV preventive interventions with alcohol users.

To most of the assembled researchers, it was clear that while years of experimental and observational research had shown that alcohol consumption generally is positively related to event-level sexual risk, likely mediated and moderated by other factors, most of the prominent conceptual models guiding behavioral HIV preventive interventions had ignored alcohol's role among the complex of factors determining HIV-risky sexual behaviors [118].

Thus, while arguably the most prominent of these standard HIV prevention models, the Information- Motivation-Behavioral (IMB) model [119], posits that HIV risk behavior involvement is influenced by informational, motivational, and behavioral factors, it seemed apparent to the gathered researchers that the IMB framework needed to be extended to include alcohol-related constructs in order to better understand relationships between alcohol use and HIV risk behavior. For instance, in an examination that looked at IMB theoretical constructs and alcohol-related contextual factors as potential mediators in separate models in a sample of STI clinic patients in South Africa, Pitpitan et al. [120] found that, 1 year after an HIV risk reduction counseling session, the intervention had indirectly affected sexual risk behavior through alcohol-related—but not IMB—constructs, concluding that alcohol use and related factors play critical roles in explaining HIV and STI risk reduction intervention effects. Indeed, an integration of research exploring alcohol's acute effects on HIV sexual risk decision making with the existing HIV prevention models appeared to be consistent with at least one of the "Research Priorities for Behavioral and Social Science Research" specified in the *FY 2014 Trans-NIH Plan for HIV-Related Research* [121], namely, to "[c]onduct translational research… to foster and optimize the use of existing efficacious biomedical, behavioral, and social interventions to prevent, diagnose, and treat HIV infections and to promote access, acceptability, adherence, and continuation along the cascade from prevention to treatment, particularly among those currently underrepresented in such research (e.g., noninjection substance users, men who have sex with men [MSM], and incarcerated individuals)". Such an approach, then, appeared to have the potential to produce advances in the development of an effective HIV preventive intervention with alcohol users.

Several other considerations added to the sense of urgency among those gathered at the 2014 workshop. An overriding concern was the 50,000 new HIV cases reported each year in the U.S., coupled with the continued absence of a viable HIV vaccine. Moreover, it had become clear that despite the undeniable promise of the newer, biomedical HIV prevention approaches—such as microbicides, circumcision, and early initiation of antiretroviral therapy (treatment-as-prevention) [122]—*behavioral* prevention needed to continue to play a prominent role in the worldwide response to HIV/AIDS. Indeed, recognition that behavioral interventions are necessary, if not sufficient, for producing reductions in HIV transmission has led to calls for so-called "combination prevention" approaches that incorporate biomedical, social, and structural, as well as behavioral, interventions [114, 123–126].

Finally, recent technological developments—prominently including smartphone technology [127–129]—have made possible the collection of real-time reporting of drinking episodes and critical details on alcohol use patterns (for instance, type of alcohol, size of serving, number of servings, time of day, duration of use, and location consumed) as well as triggering social contexts. Such methods advance the practice of ecological momentary assessment, which refers to monitoring or sampling strategies that assess phenomena at the moment they occur in natural settings, thus avoiding the need for retrospective recall [130]. A growing number of studies have found that handheld computers [131–133], text messaging via cell phone [134], and Interactive Voice Response via mobile telephones [135] are useful tools for assessing daily alcohol use among both college students and adults. Other pioneering technologies have been developed, such as transdermal alcohol sensors that can continuously collect reliable and valid data on alcohol consumption in vivo [136] and wearable sensors that can directly measure a person's exposures or lifestyle factors—including exposure to psychosocial stress and addictive substances—and which permit examination of how the body responds to these factors (e.g., changes in blood pressure, heart rate, and body temperature) [137].

Not only do such tools have the potential to yield new insights into factors that lead to disease or risk for disease, they also can be used in "real time" to prompt changes in behaviors that can reduce health risks or optimize health outcomes. The development of so-called mobile health (*mHealth*) interventions—such as the use of portable handheld technology to provide daily individualized feedback on dietary behavior that can increase dietary intake of healthy food groups [138] and increase physical activity levels among underactive adults [139], and educational interventions that use text messaging to improve glycemic control of patients with diabetes [140, 141], improve smoking cessation rates [142–144], and foster behavior modification for weight control [145, 146]—opens up new doors of possibility for HIV prevention intervention delivery [see, e.g., 147, 148]. To the NIAAA/ODP workshop attendees, the implications of such developments were intriguing. While considerable gaps clearly remain in our understanding of the processes involved in "heat of the moment" decision making, these new technologies appeared to illuminate some possible directions for the development of a preventive intervention for alcohol-related HIV risk that, ultimately, might be deliverable, in real time, in—or, at least, close to—"the moment".

For such reasons, then, it seemed apparent to the workshop participants that the generally mixed record of success of earlier HIV prevention efforts with drinking populations must not become a deterrent to the continued search for effective behavioral prevention approaches for alcohol-related HIV risk. Nevertheless, it was hard to deny

that the sheer complexity of the association between alcohol use and HIV-risky sex loomed as a major obstacle to the further development of such interventions. Indeed, several decades of research have been unable to establish a direct causal connection between alcohol use and HIV-risky sex [149–153]. Overall, it might be said that the bulk of the empirical evidence tends to suggest that the relationship is not at all a simple one but, rather, is the result of a complex interaction comprising alcohol use (at some level/dose) in tandem with a host of both distal and proximal factors. These distal factors, many of which are discussed in the papers presented here, include the psychobehavioral consequences of sexual violence (both perpetration and victimization) history [154, 155]; the social contexts of alcohol consumption, including alcohol serving venues [156, 157] and associated alcohol expectancies [158, 159]; the nature of the sexual partnerships and how they relate to drinking with sex [160–162]; neurobehavioral self-regulation and neuropsychological functioning [163, 164]; personality factors [165–167], and motivations for sex. Proximal alcohol-related factors extend to alcohol dose [168–170], blood alcohol concentration limb [171, 172], and alcohol's psychopharmacological effects [173, 174], including effects on sexual arousal [175, 176]. Adding to this complexity is the fact that while this multitude of factors might be said to influence—in the heat of the moment—the drinking individuals' likelihood of participation in HIV-risky sex, the relative importance of each in shaping in-the-moment HIV risk is likely to vary among the different at-risk groups for HIV, such as men who have sex with men [177–179], sex workers [180], male clients of female sex workers [181], HIV-positive individuals [23, 182], transgender women [183], and heterosexual women with high-risk partners, including ex-prisoners returning to the community [184, 185], bisexual male partners, and injection drug users [47], and extending to both domestic and international (including low-resourced) settings.

In unraveling the complexity of the alcohol-risky sex relationship, at the heart of the matter is the question of exactly *how* the two are related. For some time now, two models have dominated explorations of this issue. Alcohol Myopia Theory [173], discussed in a number of the papers included in this volume, posits that intoxicated individuals are unable to fully process information in their environments, and so are disproportionately influenced by the more salient cues. More specifically, for HIV transmission, the theory contends that the cognitive impairment effects of alcohol shifts individuals' attention away from more distant inhibiting cues (such as concern about HIV transmission) towards more salient impelling cues (such as sexual arousal), thus moving the decisional balance, for the drinking individual, toward greater risk taking. From a somewhat more psychological perspective, a number of studies in recent decades have suggested that *expectancies* predict alcohol-related HIV risk—that is, individuals who strongly believe that alcohol enhances sexual arousal and performance are more likely to engage in risky sex after drinking [186–189]. Several subsequent attempts to merge Myopia Theory and Expectancy Theory have been put forward [190, 191], while more recent formulations [e.g., 192] have suggested that sexual risk behavior may be best understood as a function of complex person-by-situation interactions. In recent years, support has grown for a dual-process model of self-control that posits two distinct cognitive systems underlying self-control: a fast acting, reflexive, "automatic", intuitive dimension that emphasizes affective processes and a reflective, slower acting, deliberative, resource demanding dimension consisting of executive function processes [193–195]. By extension, when exertion of self-control is compromised—such as occurs following use of alcohol—it might be expected that the role of the deliberative processes in self-control decreases as behavior becomes more closely associated with automatic processes.

In general, attempts to unravel the alcohol-risky sex relationship have fallen short owing to a failure to transcend a familiar set of methodological challenges. Many of the studies suggesting an association between alcohol use and risky sex have been so-called "global association" studies—which examine typical patterns of alcohol use and sexual behavior—or "situational association" investigations, which look at behavior patterns that take place in particular settings or time periods. However, the cross-sectional nature of the research designs of these studies and their typical use of retrospective data militate against conclusions about causality in the alcohol-risky sex relationship. "Event-level" investigations, which look at alcohol use during specific sexual events, also have primarily relied on self-reported, retrospective responses.

Experimental studies—a number of which appear in this volume—have some marked advantages over these other approaches in attempting to establish causality in the alcohol-risky sex association. Such studies may involve manipulation of alcohol dose (i.e., so-called alcohol administration studies), often using a placebo or a balanced placebo design to randomly assign participants to an alcohol, placebo, or no-alcohol control condition. In these studies, some participants are told that they will receive alcohol but are given either alcohol (that is, both expect and receive alcohol) or no alcohol (i.e., expect alcohol, receive placebo). Another group of participants typically are told that they will receive a non-alcoholic beverage, which they are then given (control condition). Such an experimental design permits a test of the pharmacological and psychological effects of alcohol consumption, although

such studies are limited in their ability to detect the impact of extremely high alcohol doses (i.e., those resulting in blood alcohol concentrations above .10 g-percent) on human behaviors. In addition, as it is clearly unethical to directly observe sexual behavior in the laboratory, experimental studies may manipulate exposure to a sexual stimulus—using a written or role-play vignette or video—to study sexual arousal, often carefully measuring perceived likelihood or intentions to engage in unprotected sex with a hypothetical partner, as portrayed in the vignette [196]. While concerns are sometimes raised about whether findings from laboratory studies accurately reflect "real life" sexual behavior under the influence of alcohol, the limitations in external validity inherent in such an approach must be weighed against the often valuable insights that may be gained from such studies.

Several papers in this volume make important contributions to the investigation of the nature of the alcohol-risky sex relationship. In a major addition to the expectancy literature, Cooper et al. [197] use data from 7442 discrete sexual events collected over a 10+ year period from a community sample of nearly 2000 Black and White young adults and find that, on average, people tend to believe that drinking alcohol both enhances and disinhibits sexual experience, with those who strongly endorse enhancement expectancies reporting that they drink significantly more on sexual occasions than those who do not hold such beliefs. Nevertheless, the researchers find that respondents' reported sexual experiences are actually *less* positive on drinking than on sober occasions, even after controlling for a number of individual difference and event-level characteristics, raising the question as to why people—despite these relatively unhappy experiences—so readily adhere to their positive beliefs. The authors offer that psychoeducational interventions that deliver to participants accurate information on the observed effects of alcohol on the quality of sexual experience might be a fruitful prevention approach.

The meta-analysis by Scott-Sheldon and colleagues presented here [198] also is likely to be counted as a major contribution to the basic behavioral literature on alcohol use and HIV-risky sex. Reviewing all experimental studies that have manipulated alcohol consumption by randomly assigning participants to an alcohol condition (i.e., alcohol, placebo, no alcohol control), administered alcohol prior to a sexual stimulus, and assessed sexual outcomes (e.g., intentions to engage in unprotected sex, sexual communication and negotiation skills) following exposure to the stimulus, the authors find that, consistent with the alcohol myopia model, alcohol consumption is associated with greater *intentions* to engage in unprotected sex. They suggest that addressing alcohol use as a determinant of intentions to engage in unprotected sex may lead to more effective HIV interventions.

The paper by Kiene and colleagues [199] explores the assumptions of expectancy theory and alcohol myopia theory as possible moderators that help elucidate the circumstances under which alcohol may affect individuals' ability to use a condom. Investigating 82 HIV+ individuals who are asked to complete 42 daily phone interviews assessing sexual behavior and alcohol consumption, the authors find support for both theories; in some cases the moderation effects were found to be stronger when both partners had consumed alcohol.

Alcohol Use and HIV-Risky Sex: Appraisal of Distal Factors

The papers collected for this special issue explore the wide variety of distal and proximal factors found to be involved in HIV sexual risk-taking among alcohol users. In each paper the investigators suggest HIV prevention approaches that might usefully be employed with the population under study.

The paper by Feldstein Ewing and colleagues [200] reviews and evaluates the literature on the developmental neuroscience of sexual risk and alcohol use in human adolescents with an eye toward prevention and intervention implications. They note that the extant research suggests that three regions of the brain—prefrontal cortical, reward, and emotion/memory—seem to be critical for an understanding of the nature of adolescent decision-making regarding sexual behavior. Going forward, efforts to reduce unplanned pregnancy and STI/HIV in this age group are likely to require an understanding of the dynamic nature of these regions of the brain as well as the roles of co-occurring alcohol use and hormonal changes, moderated by gender.

Representing the other extreme—in terms of level of scientific inquiry—are two papers here that explore HIV risk as imbedded in the alcohol drinkers' social environment. A growing number of papers in recent years have investigated the ways in which venues, or social gathering places, influence HIV risk behaviors [see, e.g., 201–203]. For instance, micro-level social norms that operate in certain venues may dictate heavy drinking [204], while certain sex partner meeting venues have been linked to higher likelihood of use of alcohol before sex [205, 206]. It may be that some individuals are more likely to choose risky sex partners, or simply choose to have unprotected sex, in certain alcohol-heavy settings, irrespective of the actual amount of alcohol they consume there [see, e.g., 207].

In their paper here, Mair and associates [208] investigate whether more frequent and heavier drinking in specific drinking contexts is associated with unplanned sex, unprotected sex, and number of sexual contacts. These investigators utilize a large sample of California college students who, while not a high-risk group for HIV, are at elevated risk for other STIs, and find that greater frequencies of drinking in almost all contexts (e.g., Greek parties, off-campus parties, campus events, dorms, and bars) are associated with greater numbers of sexual partners and unplanned and unprotected sex in the past month, with heavier drinking at bars increasing the risks related to all outcomes. Risks related to frequencies of use of contexts are similar for men and women, but heavier drinking at bars is associated with more unprotected sex among men only. While it is unclear whether similar results might be found among populations that are at high HIV risk, such as MSM, this study suggests that a better understanding of the contribution of specific drinking contexts to the extent and content of alcohol use and likelihood of risky sexual behaviors can be helpful in targeting effective prevention programs to specific locations and types of drinkers.

The paper by Pitpitan and Kalichman [209] expands on the theme of HIV prevention possibilities at the level of the drinking environment. Their review of the literature on HIV prevention research based in alcohol venues (defined as places that sell or serve alcohol for onsite consumption, including bars, bottle stores, nightclubs, wine shops, and informal *shebeens*) finds that few prevention strategies have been implemented in such places. While HIV prevention interventions conducted in such venues may be targeted at the individual, social, or structural level, the authors argue that interventions that target more than one level are likely to lead to the most sustainable behavior change.

History of Violence: Effects on in-the-Moment HIV Sexual Risk

Two papers included here explore the issue of interpersonal violence history and its consequences for HIV sexual risk. This issue has become widely recognized in recent years [210], including by such highly visible bodies as The United States President's Emergency Plan for AIDS Relief (PEPFAR) [211], the W.H.O. [212, 213], and the U.S. Federal Working Group on the Intersection of HIV/AIDS, Violence against Women and Girls, and Gender–Related Health Disparities [214]. This interest no doubt has been sparked by several systematic reviews that have found a moderate-to-strong statistically significant association between intimate partner violence (IPV) and HIV infection among women [215, 216], while a recent assessment of nationally representative cross-sectional data from 10 countries in sub-Sahara Africa concluded that male controlling behavior—in its own right, or as an indicator of ongoing or severe violence—puts women at risk for HIV infection [217]. Importantly, violence victimization history also plays a significant role in the vulnerability of MSM to HIV infection [218].

IPV and sexual violence are the forms of interpersonal violence that have received the most attention as contributors to HIV risk. While the specific behaviors that comprise intimate partner violence can vary somewhat from study to study, the CDC [219] views IPV as physical or sexual violence, stalking, or psychological aggression by a current or former intimate partner. A recent World Health Organization report [220] found that 30 % of women worldwide who have ever been in a relationship have experienced physical and/or sexual violence by an intimate partner. In findings from CDC's National Intimate Partner and Sexual Violence Survey (NISVS), 1 in 4 U.S. women and 1 in 7 men have been a victim of severe physical violence by an intimate partner [221]. The NISVS also found that 44 % of U.S. lesbian women and 61 % of bisexual—compared to 35 % of heterosexual—women reported lifetime experience of rape, physical violence, and/or stalking by an intimate partner, while 26 % of gay and 37 % of bisexual men, compared to 29 % of heterosexual men, reported such lifetime victimization by an intimate partner [222]. *Sexual violence*, as viewed broadly by the CDC, includes completed or attempted rape, non-penetrative abusive sexual contact, or non-contact sexual abuse (such as voyeurism), occurring when the victim does not consent to the sexual activity or is unable to consent or refuse, and may be perpetrated by persons well known, not as well known, or unknown to the victim [223]. Approximately 1.3 million U.S. women were raped during the year preceding the NISVS survey and 18 % reported lifetime rape victimization [221].

There are at least 4 ways in which HIV and violence overlap in women's lives [224]. Thus, forced or coercive unprotected sexual intercourse with an infected partner may directly increase a woman's risk for HIV infection, especially when it results in a genitoanal injury that facilitates viral transmission [225, 226]; violence victimization history may increase a woman's risk for HIV infection by reinforcing gender submissive attitudes that limit confidence in her ability to negotiate HIV preventive behaviors with her partner(s) [227, 228]; among HIV-positive women, the disclosure of her HIV serostatus to partners may put them at elevated risk for violence [229–231]; and childhood physical and sexual abuse victimization may set a course for subsequent sexual risk-taking behavior in adolescence and adulthood [232–235].

Moreover, the downstream effects of violence victimization can extend to posttraumatic stress disorder (PTSD), depression, and dissociation, which may last for years and can affect HIV risk behavior decision-making profoundly [236, 237]. Victimization history and its psychological sequelae also may adversely affect the victim's likelihood of seeking HIV testing, of remaining in HIV care, and of adhering to HIV antiretroviral treatment regimen [238, 239], while also increasing the victim's vulnerability to subsequent revictimization. Victimization history also is often associated with heavy drinking and/or binge drinking [240, 241]. A self-medication explanation has received substantial support in explaining the often-noted comorbidity between PTSD and harmful drinking patterns [242, 243]. This use of alcohol and/or drugs by traumatized or victimized women may further limit their ability to negotiate HIV preventive behaviors with partner(s), and often has been associated with elevated risk for unprotected sex [67, 244], while also potentially adversely affecting likelihood of remaining attached to HIV care.

As mentioned, two papers presented here examine the consequences, for in-the-moment HIV risk, of a history of interpersonal violence in combination with alcohol consumption. In the alcohol administration study by George and colleagues at the University of Washington [245], over 400 community-recruited women were asked to project themselves into a scenario depicting a male partner exerting high or low pressure for unprotected sex. As expected, alcohol intoxication was associated with increased likelihood of abdication in the condom decision, but a novel finding of the study was that women's decision to abdicate, which would appear to be a direct pathway to unprotected intercourse, was affected by partner pressure via anticipated negative partner reaction. From these and other findings, this study suggests that women with varying degrees of sexual victimization history severity make different decisions when using— and not using—alcohol. Results suggest that future HIV intervention strategies might benefit from a thorough probe of victimization history, target risky drinking levels, and aim to build sexual assertiveness skills.

Although women comprise at least three-fourths of rape and sexual assault victims in the U.S., it is important to not lose sight of the fact that the overwhelming majority of sexual violence perpetrators—against both females and males—are men [246], many of whom are, or had been, drinking at the time of the event. Estimates of the prevalence of alcohol consumption by perpetrators in sexually aggressive incidents range from 30 to 75 % [see 247, 248], while many studies have found that male perpetrators of sexual aggression and IPV have increased odds of *high-volume* drinking [249, 250]. One team of researchers using a community-recruited sample of young, heterosexual male social drinkers found that more than half of subjects reported a history of sexual assault perpetration, with 60 % of these reporting *repeat* perpetration [251]. In this study, almost half of perpetrators had used alcohol prior to *every* sexual assault incident. Importantly, for HIV prevention, over 41 percent of these perpetrators had *never* used a condom during their penetrative sexually aggressive acts, and alcohol use and condom nonuse were positively correlated with acts of forcible rape. In another study by this team of men aged 21–35 years who engaged in heavy episodic drinking [252], condoms reportedly had not been used in 70 percent of penetrative sexual assaults since age 15, with perpetrators significantly less likely to use condoms when they had consumed alcohol. Also worth noting, for HIV prevention, is that some studies [e.g., 253, 254] have found that sexually violent men often report elevated likelihood of STI infections.

Although no single factor describes the motives of all sexual assault perpetrators on all occasions, "alcohol myopia" theory predicts that intoxicated men's reduced cognitive capacity focuses their attention on instigatory sexual cues (e.g., arousal) while impairing their perception and interpretation of inhibitory cues [248]. Experimental alcohol administration studies have provided some support for these predictions [e.g., 255]. Abbey [247, 256] has suggested that intoxication increases the likelihood of sexual aggression at both an early stage in a potential sexual interaction—where cognitive impairments induced by alcohol encourage a man who is sexually attracted to a woman to focus on cues consistent with his sexual interest, while minimizing disconfirming ones [257, 258] —and later in the interaction where, should his advances be rejected, his state of intoxication encourages an aggressive response, particularly in cases where he feels provoked by his (mis)perception of earlier encouragement [259].

In the alcohol administration study by Davis and colleagues presented here [260], the researchers use a sexual risk analogue to examine—in a community sample of male heterosexual non-problem drinkers who report elevated HIV sexual risk—the direct and indirect effects of intoxication and sexual aggression history on intentions to engage in condom use resistance (CUR; i.e., attempts to engage in unprotected sexual intercourse with a partner who wants to use a condom). Their results demonstrate that alcohol intoxication directly increases CUR intentions and that sexual aggression history directly and indirectly increases CUR intentions, which might contribute to elevated sexual risk. It should be cautioned that these findings may not extend to men who typically consume alcohol in different patterns (e.g., lighter drinkers, or problem drinkers), or to men who use condoms consistently, or to MSM, while, in the real world, many individuals typically drink to higher intoxication levels than can be ethically achieved in

an alcohol administration study. Nevertheless, these results suggest the importance of addressing both alcohol use and sexual aggression history in HIV-risky sex prevention programs, and underline the value of research into the intersection of men's alcohol use, sexual aggression, and sexual risk behaviors, especially condom use resistance. As the authors are careful to point out, because more severe perpetrators in this study had greater CUR intentions, prevention efforts might increase their impact by targeting men who report a history of sexual aggression perpetration. Moreover, as these men with more severe sexual aggression histories reported greater in-the-moment feelings of impulsivity, which directly predicted greater CUR intentions, teaching men to cope with these feelings through emotion regulation strategies might be a useful strategy in reducing their resistance to condom use. Furthermore, as more favorable CUR attitudes also predicted greater CUR intentions, interventions focused on changing CUR-related attitudes—by, for example, emphasizing some of the negative effects of CUR—might be effective. Finally, insofar as CUR self-efficacy was related to greater CUR intentions, interventions that seek to reduce men's self-efficacy for CUR might *also* attempt to buttress their self-efficacy for involvement in mutually pleasurable *protected* sex.

While these and similar studies clearly suggest that substance use may facilitate the expression of sexual assault and interpersonal violence, gender-based relationship power inequities and gender norms comprise the "upstream" bedrock out of which male-initiated violence towards women is expressed [261–263]. Programs to address such inequities that have been put forward in recent years include gender-transformative interventions that attempt to shift norms of masculinity in the direction of greater gender equitability [264]; micro-enterprise programs that can provide women with a degree of independence from controlling or abusive males [265]; community mobilization interventions aimed at preventing violence against women and reducing HIV risk behaviors [266]; HIV prevention programs that utilize critical reflection and participatory learning approaches to confront gender based violence in the lives of participants [267]; implementation of laws and policies promoting gender equality [212], and interventions that combine several of these approaches [e.g., 268, 269].

Other Proximal Factors in the Alcohol-Risky Sex Relationship

The papers in this issue by George et al. [245] and Davis et al. [260], reviewed above, detail some of the ways in which an individual's history of violence victimization and perpetration may impact their "in the moment" sexual risk-taking behaviors. In addition, several other papers in this issue that were introduced earlier in this chapter highlight the seemingly important role of sexual arousal in the alcohol-risky sex relationship. Thus, for instance, the results of the meta-analysis by Scott-Sheldon and colleagues [198] indicated that the effect of alcohol consumption on unprotected sex intentions was greater when sexual arousal was heightened; Cooper and colleagues [197] found that those individuals with strong expectancies for sexual enhancement reported greater arousal at high alcohol consumption levels than did those with weak enhancement expectancies, and suggested that individuals may prize arousal effects more highly than other effects that might be experienced.

Two more papers included here examine the intersection of arousal, alcohol consumption, and HIV sexual risk in MSM, and suggest some implications of the findings for HIV preventive interventions with this population. Maisto and associates [270] review the research evidence on the effects of acute alcohol intoxication and sexual arousal on sexual risk behaviors in heterosexual men (the focus of the large majority of studies) as well as MSM. Remarkably, they find that only one previous experimental study of alcohol and sexual risk in MSM has been published [175]. The authors integrate the body of empirical evidence and related theoretical advances to derive implications for development of effective HIV prevention interventions targeting MSM. The paper by Shuper and colleagues [271] presents a detailed study protocol of a controlled experiment with HIV-positive MSM who undergo an alcohol consumption manipulation (i.e., alcohol/placebo/control) and sexual arousal induction, and are then asked to indicate their intentions to engage in protected and condomless sexual acts with hypothetical partners with differing HIV serostatus, condom use preference, and physical attractiveness. While the data from this ongoing experiment have yet to be analyzed, forthcoming analyses will assess alcohol's impact on HIV-positive MSMs' condomless sex intentions in the context of experimentally-manipulated factors as well as risk-relevant personality traits and alcohol-related expectancies.

Tara MacDonald and colleagues [272] add to our understanding of the relationships among attachment orientations, perceived partner rejection, and condom use. In Study 1 (of 2 studies), they find that a survey measure of perceived partner rejection mediates the relationship between attachment anxiety and reported condom use. In Study 2, in which women subjects are asked to respond to condom use scenarios in which partner rejection is manipulated, the researchers note a 3-way interaction among attachment anxiety, attachment avoidance, and condom use intentions: specifically, perceived rejection from a potential sexual partner is associated with greater

intentions to engage in unprotected sexual intercourse among women high in attachment anxiety and low in attachment avoidance, and among those high in attachment avoidance and low in attachment anxiety. These results support the idea that—similar to a finding from the George et al. study [245] in this issue described earlier—rejection fears may be relatively influential factors in some women's sexual decision-making. The researchers suggest that training such women in the importance of using condoms despite their fears of partner rejection, educating them to recognize the signs of rejection during sexual encounters, and equipping them with the tools to refuse unprotected sex despite the potential for partner rejection are likely to be useful additions to condom promotion interventions. Moreover, these results would seem to have particularly important implications for alcohol-using women. Insofar as "alcohol myopia" theory suggests that intoxicated individuals are likely to focus their attention on the most salient cues in their environment, it may be that a sexual partner's signaling of potentially rejecting behavior is likely to constitute, for intoxicated women, a particularly prominent cue that they may act upon, perhaps especially among those high in attachment anxiety.

Towards a New Model for Building HIV Prevention Interventions

While the goal of building more effective HIV preventive interventions for alcohol-using populations constituted the primary motivation for the 2014 NIAAA/ODP workshop, elaboration of a blueprint to guide the process for accomplishing this was seen as somewhat beyond the scope of the meeting. The paper here by Collins and associates [273] suggests a novel approach to building health interventions that, while diverging sharply from the standard model (at least, the one long employed on the kinds of intervention projects that have been supported by major research funders such as the National Institutes of Health), offers great long-term promise for the HIV/AIDS prevention community. These authors introduce a new methodological framework—the multiphase optimization strategy (MOST)—that has been inspired by engineering principles. Although many behavioral interventions comprise multiple components, under the MOST framework this randomized experimentation is conducted in order to gather information about the individual performance of each intervention component, and to gauge whether its presence or absence impacts other components. This information is used in building an intervention that meets a specific optimization criterion (defined a priori in terms of effectiveness, cost, cost-effectiveness, and/or scalability). Using, as an illustration, a hypothetical example involving the building of a new intervention, Collins and colleagues discuss how the MOST framework can be used to develop, optimize, and evaluate behavioral interventions that might someday pay off in improved interventions for prevention and treatment of HIV/AIDS.

Summing Up

The papers in this issue detail state-of-the science knowledge regarding the role of alcohol use in HIV/AIDS risk, as well as offer suggestions for ways forward for behavioral HIV prevention for at-risk alcohol-using populations. In light of recent evidence suggesting that the anticipated uptake of the newer biomedical HIV prevention approaches, prominently including pre-exposure prophylaxis (PrEP), has been stalled owing to a host of barriers—including low levels of awareness, cost, mistrust, lack of healthcare provider training in PrEP, possible stigma, and adherence and safety concerns [274–277]—it has become ever more clear that *behavioral* prevention avenues must continue to receive due consideration (and appropriate resources!) as a viable HIV/AIDS prevention approach. The papers collected here make a valuable contribution to "combination prevention" efforts to curb HIV spread. It is hoped that the coming years will see the adoption of many of the insights, perspectives and models described here in enhancing HIV/AIDS prevention efforts.

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