

**IS THERE A CAUSAL RELATIONSHIP BETWEEN ALCOHOL AND HIV?
IMPLICATIONS FOR POLICY, PRACTICE AND FUTURE RESEARCH**

Charles D.H. Parry¹, Jürgen Rehm² & Neo K. Morojele³

¹Alcohol & Drug Abuse Research Unit, Medical Research Council, and
Department of Psychiatry, Stellenbosch University, Cape Town, South Africa

²Public Health & Regulatory Policy, Centre for Addiction and
Mental Health, Toronto, Canada

³Alcohol & Drug Abuse Research Unit, Medical Research Council,
Pretoria, South Africa

ABSTRACT

There is now conclusive evidence of a causal linkage between heavy drinking patterns and/or alcohol use disorders and the worsening of the disease course for HIV. However, while alcohol usage is consistently associated with the prevalence and incidence of HIV, further research is needed to substantiate causality in terms of the acquisition of this disease. The burden attributable to alcohol use in South Africa in 2004 has been estimated to be 1.3 million years in terms of years lost through premature death caused by alcohol and years lived with an alcohol-related disability (or just over 6% of all years lost from all causes). Of all years lost through death and disability that can be attributed to alcohol, 10% for men and 28% for women can be directly attributed to alcohol's impact on the progression of HIV in infected individuals. The implications of the above will be discussed in terms of research gaps that need to be addressed and broader policy responses that are needed in the health and social services sectors. In addition, emphasis will be given to specific practices that should be considered for rollout by agencies involved in substance abuse and HIV/AIDS treatment and prevention.

KEY WORDS: Alcohol, HIV and AIDS, South Africa

INTRODUCTION

Sub-Saharan Africa (SSA) remains the region most heavily affected by HIV and AIDS. In 2008 it accounted for 67% of HIV infections worldwide, accounting for 70% of new infections and 70% of AIDS-related deaths (UNAIDS and WHO, 2009). South Africa is

one country in SSA that has been substantially affected, with an adult (15-49 years) HIV prevalence rate of 18.1% in 2007 and approximately 350,000 AIDS deaths reported in that year (WHO, UNAIDS & UNICEF, 2008).

SSA has a high proportion of the population that abstains from drinking, reported to be 55% of males and 69% of females, while annual per

capita consumption of alcohol *per drinker* is very high in this region, at an estimated 19.5 litres (Roerecke, Obot, Patra, & Rehm, 2008). Average drinking pattern scores in SSA are also high, 2.9 out of 4 in Afro Region D and 3.1 out of 4 in Afro Region E, reflecting detrimental drinking patterns such as heavy episodic drinking and drinking outside of meals (Roerecke et al., 2008). A recent review of drinking practices in 20 African countries reported that 23% of South Africans had drunk alcohol in the previous week, but of these 29% could be categorized as high consumers (that is, drinking 15 or more units of alcohol during the previous week) and 48% could be categorized as heavy drinkers (that is, drinking five or more units on one or more occasions during this time period). Of the 20 countries, South Africa was ranked fourth highest in terms of the proportion of heavy drinkers as a percentage of current drinkers (Clausen, Rossow, Naidoo, & Kowal, 2009). In this country rates of heavy drinking are four to five times higher on weekends than on weekdays (Parry, Plüdemann, Steyn, Bradshaw, Norman, & Laubscher, 2005).

In this article we will review international research on the linkages between alcohol and HIV before presenting the results of analyses reported by Rehm, Kehoe, Rehm, and Patra (2009b) on the burden of alcohol in terms of death and disability in South Africa. In particular we will present data quantifying the contribution of alcohol to the progression of HIV disease. The implications of this burden and also the strong association between alcohol and the acquisition of HIV will be discussed in terms of new policies and practices needed and what research is required to fill in some of the gaps in our understanding of causality and how best to intervene.

LINKAGES BETWEEN ALCOHOL AND HIV

In July 2008, 25 experts from eight countries and WHO and UNAIDS, and comprising various disciplines, met in Cape Town to review

evidence relating to the linkages between alcohol consumption and HIV and TB and also to examine potential causal impacts of alcohol use on both the incidence and course of these infectious disease categories. This group reviewed data from published and unpublished studies and meta-analyses that were prepared specifically for the meeting together with information on biological pathways to better understand the causal linkages. The consensus of this meeting was that there was conclusive evidence of a “causal linkage between heavy drinking patterns and/or alcohol use disorders (AUD) and the incidence of active TB”, and that “these exposure categories were also causally linked to worsening of the disease course for both TB and HIV” (Parry, Rehm, Poznyak, & Room, 2009, p. 331). It was agreed that while alcohol usage was consistently *associated* with the prevalence and incidence of HIV, further research was needed to substantiate causality (Parry et al., 2009). It was noted that that much of the observed association between alcohol consumption and HIV incidence could be the result of other factors such as inherent personality traits (such as extraversion), high sensation seeking, or psychiatric disorders (such as sexual compulsivity) and various situational factors. For a more detailed discussion of these issues readers are referred to Shuper et al. (2010).

Alcohol and the incidence of HIV

Despite the uncertainty about whether alcohol is a significant contributor to the incidence of HIV on its own, it is still useful to review several studies published since 2006 in order to understand behavioural aspects of the *association* between alcohol and the acquisition of HIV and also to guide future research efforts in this area. These will be looked at chronologically. Understanding this association may also be useful in guiding policy and practice, even in the absence of *conclusive* evidence of a causal relationship at this time.

First Morojele et al. (2004) reported on the findings of their household survey of adult, township residents in South Africa. They found that alcohol use frequency, quantities

consumed and problem use were significantly associated with number of sexual partners and engagement in regretted sex, but not significantly related to inconsistent condom use (Morrojele et al., 2004). Kiene et al. (2006) subsequently reported on the findings of their study conducted among patients living with HIV/AIDS (PLWHA) in clinical care in KwaZulu Natal province of South Africa. They found that moderate or higher risk drinking before sex (more than 1.8 drinks for women and more than 3 drinks for men) was positively associated with an increased likelihood and number of subsequent unprotected sex acts.

The following year Fisher, Bang & Kapiga (2007) published a systematic review and meta-analysis of 20 African studies of the reported risks associated with alcohol use and HIV. A crude dose-response relationship was observed, with non-problem drinkers (57%), and problem drinkers (104) more likely to be HIV positive than non-drinkers. Men and women had comparable risk estimates, while studies among high-risk groups tended to report greater odds ratios (ORs) than studies of the general population. That same year Kalichman and colleagues reported on a randomized trial to test a behavioural risk-reduction counselling intervention for use in STI clinics in southern Africa. (Kalichman, Simbayi, Jooste, & Cain, 2007). Participants received either a 60-minute HIV and alcohol risk-reduction intervention or a 20-minute education condition. The risk-reduction intervention demonstrated more than a 25% increase in condom use and a 65% reduction in unprotected intercourse over the 6-month follow up period. Unfortunately it was not possible to separate out the impact of the alcohol interventions from the HIV-related interventions.

In 2009 Baliunas, Rehm, Irving and Shuper reported on an investigation to extend prior research involving alcohol-risky sex and alcohol-risky sex-HIV seroconversion associations by conducting a meta-analysis that more clearly tested the *temporal* association between alcohol consumption and HIV incidence. Ten studies were included in their meta-analysis, encompassing three types of

alcohol consumption risk: consumption; binge drinking; and consumption prior to, or at the time of, sexual relations. Overall alcohol consumption (any of the three types) increased the (relative) risk of HIV (RR 1.98; 95% CI 1.59-2.47). Alcohol consumers were at 77% higher risk (RR 1.77; 95% CI 1.43-2.19); persons consuming alcohol prior to, or at the time of, sexual relations were at an 87% increased risk of HIV (RR 1.87; 95% CI 1.39-2.50); and for binge drinkers, the risk of HIV was over double that of non-binge drinkers (RR 2.20; 95% CI 1.29-3.74) (Baliunas et al., 2009).

Also in 2009 members of the same team published the results of a parallel study to quantify the relationship between alcohol consumption and unprotected sexual behavior among PLWHA (Shuper, Joharchi, Irving & Rehm, 2009). Three separate meta-analyses were conducted to investigate associations between unprotected sex and any alcohol use, problematic drinking, and alcohol use in sexual contexts. They found that there is a significant link between PLWHA's use of alcohol and their engagement in high-risk sexual behaviour, with any alcohol consumption (OR 1.63; 95% CI 1.39-1.91), problematic drinking (OR 1.69; 95% CI 1.45-1.97) and alcohol use in sexual contexts (OR 1.98; 95% CI 1.63-2.39) being found to be significantly associated with unprotected sex in this population.

More recently Townsend and colleagues have reported on a study conducted in and around Cape Town that showed that problem drinkers were more likely than non-problem drinkers to report having any symptom of a sexually transmitted infection (STI), not using condoms due to drinking, inconsistent condom use with all partner types, that their most recent once-off partner was unemployed, having met their most recent partner at an alcohol-serving venue, and having had a once-off sexual relationship. What was new about this study was that it demonstrated the link between the amount of alcohol consumed and the choice of sexual partner (Townsend, Rosenthal, Parry, Yanga, Mathews, & Flisher, in press).

Together these and other studies (not reported here) demonstrate a very strong association

between alcohol use, and particularly problematic alcohol use, and a variety of HIV risk behaviours and HIV status itself. As a group they demonstrate several elements that are needed to prove causality (English et al., 1995) such as the consistency of the association across multiple studies, temporality (that is, that alcohol use precedes the sexual risk behaviour), that there is a dose-response relationship (that is, that more drinking increases the risk), and reversibility of effects (that is, that stopping drinking reduces HIV risk).

Other research has shown that alcohol consumption reduces the strength of a person's immune system thereby causing increased biological susceptibility to HIV infection (Friedman, Pros & Klein, 2006). However, as stated earlier, what has not been ruled out is that there are not third variables such as personality factors or psychiatric disorders that underlie both the problematic drinking and the risky sex (Shuper et al., 2010). Nevertheless, given the high levels of HIV in SSA, policy makers and practitioners in SSA and elsewhere need to take cognizance of this strong association between alcohol and the risk of acquiring HIV and should take steps to intervene, while at the same time supporting efforts to fill in some of the gaps in our understanding of the existence (or not) of a causal relationship between alcohol and HIV.

Alcohol and the progression of HIV/AIDS

As set out by Shuper et al. (2010) in their systematic review, there is much stronger evidence to demonstrate that alcohol alone is responsible for worsening the disease course (e.g. in terms of death and re-infection) for HIV/AIDS than there is for demonstrating a causal relationship between alcohol and the acquisition of HIV. There are well-established pathways to explain the causal relationship between alcohol use and the progression of HIV disease, including lower adherence to medications schedules plus a weakening of the immune system. In terms of the former, Hendershot, Stoner, Pantalone, & Simoni (2009) in a review and meta-analysis involving 40 studies found that alcohol drinkers were 50% to 60% as likely to be classified as adherent (OR 0.548; 95% CI 0.490 – 0.612)

to HIV medications compared to abstainers or persons who drank relatively less. They also reported a dose-response relationship indicating that more problematic alcohol consumption and abuse are linked to worse courses in the progression of disease. Effect sizes for problem drinking were greater (OR 0.470; 95% CI 0.408 – 0.550) compared to any or global drinking (OR 0.604; 95% CI 0.531 – 0.687). According to research conducted in South Africa, adherence of less than 80% is associated with significantly lower survival (Nachega et al., 2006).

In terms of the biological effect of alcohol on worsening the course of existing infections, it has been demonstrated that alcohol affects the immune system through both impacting on innate immune system deterioration and through impacting on the deterioration of the acquired immune system. Shuper et al. (2010) report that alcohol, among other things, may cause functional abnormalities in T and B lymphocytes, depresses levels of CD4 counts, effect CD8 T-lymphocyte functions, and decreases the ability of lymphocytes to produce inter-leukin 2 and soluble immune response suppressors.

BURDEN ATTRIBUTABLE TO ALCOHOL USE IN SOUTH AFRICA WITH SPECIFIC REFERENCE TO HIV/AIDS

The above sections have highlighted the strong association between alcohol use and the acquisition of HIV and outlined the ways in which alcohol use is causally related to the progression of this disease. The section that follows outlines an attempt to quantify this linkage and how the burden from alcohol in terms of HIV/AIDS compares to that of other alcohol-related conditions in both males and females.

The burden attributable to alcohol use in South Africa (deaths)

According to Rehm et al. (2009b), 6.3% of all deaths in South Africa in 2004 can be attributed to alcohol, 10.0% of all deaths in

males and 2.6% of all deaths in females (see Table 1). Of all alcohol attributable deaths in males, the largest proportion (34.0%) comes from alcohol-related intentional injuries. Alcohol-attributable HIV/AIDS deaths account for 12.0% of all alcohol-attributable deaths in males (ranking 4th in terms of the contribution to alcohol-attributable deaths). In determining alcohol-attributable HIV/AIDS deaths, only the impact of alcohol on the progression of the disease was taken into account, not the effect of alcohol on contracting the virus, as the causal pathway has not yet been conclusively demonstrated. Of all alcohol-attributable deaths in females, the largest proportion (32.8%) comes from alcohol-attributable HIV/AIDS deaths.

The burden attributable to alcohol use in South Africa (DALYs)

According to Rehm et al. (2009b), 6.3% of all disability adjusted life years (DALYs) lost in terms of years lost through death attributable to alcohol or years lost through living with an alcohol-attributable disability in South Africa in 2004 can be attributed to alcohol, 10.0% of all DALYs lost in males and 2.4% of all DALYs lost in females (see Table 2). Of all alcohol attributable DALYs lost in males,

the largest proportion (29.0%) comes from alcohol-related intentional injuries. Alcohol-attributable HIV/AIDS DALYs lost account for 9.7% of all alcohol-attributable DALYs lost in males (ranking 5th in terms of the contribution to alcohol-attributable DALYs lost). In determining alcohol-attributable HIV/AIDS DALYs lost only the impact of alcohol on the progression of the disease was taken into account. Of all alcohol-attributable DALYs lost in females, the largest proportion (27.8%) comes from alcohol-attributable HIV/AIDS DALYs lost.

IMPLICATIONS FOR POLICY AND PRACTICE

Broad interventions and those targeting high risk drinkers in the general population

In general, policies that reduce alcohol consumption and especially heavy drinking are likely to impact on the incidence and progression of alcohol-specific infectious diseases, especially those that regulate the availability, price and marketing of alcohol (Rehm et al., 2009a). The WHO *Global Strategy to reduce the harmful use of alcohol* sets out various

Table 1: Alcohol-attributable deaths in South Africa

Disease category	Male	Female	Total	Male %	Female %
TB	7,529	1,028	8,557	20.3	11.2
HIV/AIDS	4,439	3,002	7,441	12.0	32.8
Lower resp. infections	714	355	1,069	1.9	3.9
Maternal/perinatal conditions	19	15	34	.1	.2
Cancer	1,585	634	2,219	4.3	6.9
Diabetes mellitus	7	-59	-53	0	-6
Neuropsychiatric disorders	733	195	927	2.0	2.1
Cardiovascular diseases	1,657	2,115	3,771	4.5	23.1
Liver cirrhosis	851	311	1,162	2.3	3.4
Unintentional injuries	6,881	630	7,512	18.6	6.9
Intentional injuries	12,595	919	13,514	34.0	10.0
All alcohol-attributable net deaths	37,010	9,144	46,154		
All deaths	371,702	358,488	730,191		
% All net DALYS attributable to alcohol	10.0%	2.6%	6.3%		

Source: Rehm et al., 2009b

Table 2: Alcohol-attributable DALYS in South Africa (in '000)

Disease category	M	F	T	M%	F%
TB	216	27	243	20.4	10.5
HIV/AIDS	102	71	173	9.7	27.8
Lower resp. infections	17	8	25	1.6	3.3
Maternal/perinatal conditions	0.5	0.4	0.9	0.0	0.2
Cancer	37	15	52	3.5	5.9
Diabetes mellitus	0.2	-1	-1	0.0	-0.6
Neuropsychiatric disorders	126	31	158	11.9	12.4
Cardiovascular diseases	41	51	91	3.8	20.0
Liver cirrhosis	22	9	30	2.0	3.4
Unintentional injuries	191	20	211	18.0	8.0
Intentional injuries	307	23	330	29.0	9.1
All alcohol-attributable net DALYS	1059	253	1312		
All DALYS	10559	10429	20988		
% All net DALYS attributable to alcohol	10.0%	2.4%	6.3%		

Source: Rehm et al., 2009b

strategies under each of the areas for which there has been shown to be some evidence of effectiveness (WHO, 2010). For example, under *strategies to reduce the availability of alcohol* it lists regulating the number and location of on-premise and off-premise alcohol outlets; regulating days and hours of retail sales; establishing an appropriate minimum age for purchase or consumption of alcoholic beverages; adopting policies to prevent sales to intoxicated persons; setting policies regarding drinking in public places; and adopting policies to reduce or eliminate availability of illicit production, sale and distribution of alcoholic beverages as well as to regulate or control informal alcohol (WHO, 2010, p. 9-10). Under *pricing policies* the *Draft Global Strategy* proposes strategies such as establishing a system for domestic taxation on alcohol that is linked to the alcoholic content of the beverage; regularly reviewing prices in relation to inflation; banning or restricting discount sales; and establishing a minimum price for alcohol where applicable (p. 11). Regarding restrictions on the marketing of alcoholic beverages, some of the strategies proposed include regulating the content and volume of marketing; regulating marketing in certain or all media; restricting

or banning promotions in connection with activities targeting young people; regulating alcohol marketing via social media; developing effective systems of surveillance of marketing of alcohol products; and setting up effective administrative and deterrence systems for infringements on marketing restrictions (p. 10).

In addition, consideration should be given to targeted interventions in high risk venues/high risk populations, focusing on persons frequenting drinking venues or persons owning, managing or serving alcohol within such establishments. The most compelling evidence of intervention efficacy comes from the peer-education (popular opinion leader) model and its variations. Two studies showing efficacy were conducted in the United States, more than a decade ago, with a target population of gay men (Kegeles, Hays & Coates, 1996; Kelly et al., 1997). However, the intervention model proved ineffective in gay bars in Scotland (Flowers, Hart, Williamson, Frankis, & Der, 2002; Williamson, Hart, Flowers, Frankis, & Der, 2001). Regarding server interventions a link has not been established between server behaviour and behaviour change among patrons among any of the interventions, but Peltzer, Ramlagan, & Gliksmann

(2006) conducted a server intervention in bars in Cape Town townships which showed some promise. The intervention had positive effects on server knowledge and attitudes, as well as some indications of positive changes in server behaviours, but it did not have positive effects on bar patrons' levels of intoxication. Regarding bar-based brief intervention programmes, Van Beurden, Reilly, Dight, Elayne, and Beard, (2002) conducted a brief intervention study to reduce risky alcohol consumption in bars in Australia, and Kalichman et al. (2008) conducted a brief intervention study in bars in Cape Town townships in South Africa to reduce levels of sexual risk behaviour and found it to be effective. Van Beurden and his colleagues showed reductions in alcohol consumption after twelve months. In summary there does not appear to be any single approach that is effective in reducing alcohol-use related sexual risk behaviours among patrons of drinking venues. Instead, what is likely to be effective is a combined intervention model that would include elements of each of the three intervention approaches, as follows:

1. Training of servers to encourage responsible drinking and sexual risk reduction, and assisting bar owners/managers to establish physical conditions that foster responsible drinking and risk reduction.
2. Identification and training of suitable bar patrons to serve as peer educators or 'change agents'.
3. Deploying counsellors to drinking venues to provide education, counselling and self-assessment, and referrals to outside counselling and treatment services.

In all cases, the provision of affordable and free condoms in drinking sites would be an important strategy, and the efficacy of the approaches (individually and in combination) would need to be established.

HIV/AIDS treatment and prevention

Early detection and brief interventions are effective methods for the prevention of alcohol-related health problems and the opportunity

to provide such services across the primary health care system is within reach (Anderson, Chisholm, & Fuhr, 2009). To specifically address negative health consequences such as alcohol-related risky sex or alcohol-related non-adherence to antiretroviral medications, health personnel working in HIV, TB, and STI clinics should screen their patients for alcohol problems using instruments such as the Alcohol Use Disorders Identification Test (AUDIT) (Babor, Higgins-Biddle, Saunders, & Monteiro, 2001) or the Alcohol, Smoking and Substance Involvement Screening Test (ASSIST) (WHO ASSIST Working Group, 2003). Patients found to be at low risk should then be given information about drinking risks (if the score is below 8 on the AUDIT) and simple advice (if they score between 8 and 15). Patients found to be at medium risk (e.g. 16-19 on the AUDIT) should then be provided with simple advice, brief counselling and continued monitoring at follow up visits. Patients at high risk for alcohol problems (e.g. AUDIT scores of 20 and above) should be referred to a specialist for diagnostic evaluation and treatment (Babor et al., 2001). Patients at high risk who are HIV positive should also be referred to active case management to reduce the risk of reinfection or non-adherence to antiretroviral or other medications (if applicable). Regarding strategies to improve adherence, it may even be useful to consider setting up some form of Daily Observed Treatment (DOTS) involving patients' family or friends. Depending on capacity at a country level these kind of interventions could subsequently be rolled out to patients at all primary health care facilities.

Furthermore, alcohol issues need to be included in HIV prevention approaches. This should include taking cognizance of how alcohol affects the immune system, the effectiveness of medications, medication adherence, and sexual risk behaviour. This should be done in such a way as to take account of the complexity of the relationship between alcohol use and sexual risk behaviour, rather than a simplistic message that alcohol increases sexual risk. It should be shown that alcohol use is related to condom negotiation, proper application of condoms,

having multiple partners and the choice of partners. Such interventions should also be sensitive to setting issues (Morojele et al., 2006).

Alcohol treatment and prevention

Conversely, alcohol (and drug) prevention workers should be encouraged to include HIV/AIDS-related issues as part of their prevention activities. Patients in treatment for alcohol problems should be screened to assess for alcohol-related HIV risk and different interventions should be instituted depending on their level of risk. Screening could include asking questions about drinking before/during sex and drinking in high risk contexts (e.g. in bars when they are not accompanied by their regular sexual partner). If risk is absent, they should be provided information by brochures and/or given simple advice. If risk is low-medium then it might be advisable to offer them voluntary counselling and testing (VCT) and to include alcohol-related HIV risk reduction as part of their intervention package. For patients found to be at high risk, then interventions could be the same as for patients at low-medium risk but they may require more active case management to address alcohol-related sexual risk or more intensive treatment for their alcohol problems. If patients report that they are HIV positive, or if they come out with a positive status after being tested, then they should be informed about the ways in which alcohol can affect a person's immune system, medications (where applicable), and medication adherence. If necessary more active case management to ensure ARV medication compliance should be instituted.

Broader policy/systemic issues

In terms of broader policy/systemic issues, greater emphasis should be given to advocacy around alcohol and HIV. This could include encouraging more articles about the links between alcohol and HIV-related sexual risk behaviours and around alcohol's effect on HIV medications and adherence to such medications to be written in publications with a broad readership such as medical and nursing journals and popular magazines. Ministries/departments of

health should also prepare pamphlets on this to be distributed as part of continuing education efforts. Consideration should also be given to better integration of alcohol and HIV (and TB services) over time to reduce the vertical nature of programmes and to ensure that patients can be seen in a 'one-stop' service. Staff working in health care settings (particularly HIV, STI and TB clinics) and staff working in alcohol/drug treatment settings (including mental health in- and out-patient clinics and specialist alcohol/drug treatment centres) need to be cross-trained in various areas. These include screening for alcohol risk; providing education and brief advice on how to reduce drinking risk and where to make referrals to treatment for alcohol problems (in HIV, TB and STI and other health settings); and screening for alcohol-related sexual risk, to provide education and brief interventions to reduce alcohol-related sexual risk and referrals to VCT; and more active case management (in substance abuse settings). This could be provided through general training and as part of continuing education programmes. It will also be important to address stigma associated with alcohol misuse (in general health settings) and with HIV (in substance abuse settings).

RESEARCH NEEDS

While there is increasing knowledge regarding the linkages between alcohol and HIV (which should not delay taking action), as suggested above, there are still gaps in our understanding of the causal pathways through which alcohol impacts on the incidence of HIV and in terms of the best ways to intervene to reduce the impact of alcohol on the acquisition of HIV and the progression of the disease (Parry et al., 2009, Rehm et al., 2009a).

In terms of epidemiological and etiological research, there is a need for research to test for problem alcohol consumption among newly incident HIV cases, to assess risk, and particular sub-groups at risk, and compare them to controls (i.e. patients who do not drink at problematic levels). In terms of filling gaps in our understanding of causal linkages, research

is needed to determine whether condoms are applied less correctly after heavy drinking episodes than otherwise, whether persons with alcohol use disorders or who drink heavily are more likely to have concurrent sexual partners than other persons, and whether there are differences in the choice of partners between heavy drinkers/persons with AUDs and others.

In terms of operational and intervention research, there is a need to test the effectiveness (and feasibility, including costs) of interventions to reduce alcohol-related HIV risk behaviour in patients with high risk (e.g. STI clinic patients) in such a way that the effect of an alcohol-related intervention can be measured apart from a broader intervention to reduce HIV risk behaviours. There is also a need for studies that compare brief interventions versus more intensive interventions to reduced alcohol-related non-adherence among HIV patients and explore feasibility issues, including costs.

CONCLUSION

Unless we more proactively and effectively address problem drinking in sub-Saharan countries like South Africa, we are likely to find that the number of AIDS deaths will not stabilize as quickly as it could and that there will be a slowing of the decrease or leveling off of the incidence of HIV infection that has started to occur. Conversely, if we intensify targeted efforts to reduce consumption of alcohol and particularly heavy drinking episodes (especially in contexts of particular risk), and if we intervene more proactively with HIV patients who drink, we will potentially accelerate the drop off in HIV acquisition in the region, reduce non-adherence to ARVs (and consequently AIDS deaths), and more rapidly reduce the burden of HIV on individuals, the public health system and society at large.

ACKNOWLEDGEMENTS

We acknowledge the U.S. President's Emergency Fund for AIDS Relief (PEPFAR) through

the US Centers of Disease Control and Prevention (CDC) (PO S-SF750-06-M-0781), the Swedish Ministry of Health and Social Affairs, the Norwegian Ministry of Health and Care Services, and the Afro Regional Office of the World Health Organization for funding some of the activities that informed this manuscript. Its contents, however, are solely the responsibility of the authors and do not necessarily represent the official views of the CDC, PEPFAR or other organizations referred to above.

REFERENCES

- Anderson, P., Chisholm, D., & Fuhr, D.C. (2009). Effectiveness and cost-effectiveness of policies and programmes to reduce the harm caused by alcohol. *Lancet*, 373, 2234-2246.
- Baliunas, D., Rehm, J., Irving, H., & Shuper, P. (2009). Alcohol consumption and risk of incident human immunodeficiency virus infection: a meta-analysis. *International Journal of Public Health*, 55, 159-166. doi: 10.1007/s00038-009-0095-x.
- Babor, T.F., Higgins-Biddle, J.C., Saunders, J.B., & Monteiro, M.G. (2001). *AUDIT The Alcohol Use Disorders Identification Test: guidelines for use in primary care*. Geneva: World Health Organization, Department of Mental Health and Substance Dependence.
- Clausen, T., Rossow, I., Naidoo, N., & Kowal, P. (2009). Diverse alcohol drinking patterns in 20 African countries. *Addiction*, 104: 1147-1154. doi: 10.1111/j.1360-0443.2009.02559.x
- English, D.R., Holman, C.D.J., Milne, E., Winter, M.G., Hulse, G.K., Bower, C.I., Codde, J.P., Corti, B., Dawes, V., de Klerk, N., Knuiman, M.W., Kurinczuk, J.J., Lewin, G.F., & Ryan, G.A. (1995). *The quantification of drug caused morbidity and mortality in Australia 1995*. Canberra, Australia: Commonwealth Department of Human Services and Health.
- Flowers, P., Hart, G.J., Williamson, L.M., Frankis, J.S., & Der, G.J. (2002). Does bar-based,

- peer-led sexual health promotion have a community-level effect amongst gay men in Scotland? *International Journal of STD & AIDS*, 13, 102-108.
- Fisher, J.C., Bang, H., & Kapiga, S.H. (2007). The association between HIV infection and alcohol use: a systematic review and meta-analysis of African studies. *Sexually Transmitted Diseases*, 34, 856-63. doi: 10.1097/OLQ.0b013e318067b4fd.
- Friedman, H., Pros, S., & Klein, T.W. (2006). Addictive drugs and their relationships with infectious diseases. *FEMS Immunology & Medical Microbiology*, 47,330-342.
- Hendershot, C.S., Stoner S.A., Pantalone, D.W., & Simoni, J.M. (2009). Alcohol use and antiretroviral adherence: review and meta-analysis. *Journal of Acquired Immune Deficiency Syndrome*, 52, 180-202.
- Kalichman, S.C., Simbayi, L.C., Jooste, S., & Cain, D. (2007b). Frequency, quantity, and contextual use of alcohol among sexually transmitted infection clinic patients in Cape Town, South Africa. *American Journal of Drug and Alcohol Abuse*, 33, 687-698.
- Kalichman, S.C., Simbayi, L.C., Vermaak, R., Cain, D., Smith, G., Mthebu, J., & Jooste, S. (2008). Randomized trial of a community-based alcohol-related HIV risk-reduction intervention for men and women in Cape Town South Africa. *Annals of Behavioral Medicine*, 36, 276-279.
- Kegeles, S.M., Hays, R.B., & Coates T.J. (1996). The Mpowerment Project: A Community-Level HIV Prevention Intervention for Young Gay Men. *American Journal Public Health*, 86, 1129-1136.
- Kelly, J., Murphy, D., Sikkema, K., McAuliffe, T., Roffman, R., Solomon, L., Winnett, R., & Kalichman, S. (1997). The Community HIV Prevention Research Collaborative. Randomised, controlled, community-level HIV-prevention intervention for sexual-risk behavior among homosexual men in US cities. *Lancet*, 350, 1500-05.
- Kiene, S.M., Simbayi, L.C., Abrams, A., Cloete, A., Tennen, H., & Fisher, J.D. (2008). High rates of unprotected sex occurring among HIV-positive individuals in a daily diary study in South Africa: The role of alcohol use. *Journal of Acquired Immune Deficiency Syndromes*, 49, 219-226.
- Morojele, N.K., Kachieng'a, M.A., Mokoko, E., Nkoko, M.A., Parry, C.D.H., Nkowane, M.A., Moshia, K.M., & Saxena, S. (2006). Alcohol use and sexual risk behaviour among risky drinkers and bar and shebeen patrons in Gauteng province, South Africa. *Social Science & Medicine*, 62, 217-227.
- Morojele, N.K., Kachieng'a, M.A., Nkoko, M.A., Moshia, K.M., Mokoko, E., Parry, C.D.H., Nkowane, M.A., & Saxena, S. (2004). Perceived effects of alcohol use on sexual encounters among adults in South Africa. *African Journal of Drug & Alcohol Studies*, 3, 1-20.
- Nachega, J.B., Hislop, M., Dowdy, D.W., Lo, M., Omer, S.B., Regensberg, L., ... Maartens, G. (2006) Adherence to highly active antiretroviral therapy assessed by pharmacy claims predicts survival in HIV-infected South African Adults. *Journal of Acquired Immune Deficiency Syndrome*, 43, 78-84.
- Parry, C.D.H., Plüddemann, A., Steyn, K., Bradshaw, D., Norman, R., & Laubscher, R. (2005). Alcohol use in South Africa: Findings from the First Demographic and Health Survey. *Journal of Studies on Alcohol*, 66, 91-97.
- Parry, C.D.H., Rehm, J., Poznyak, V., & Room, R. (2009). Alcohol & Infectious Diseases: An overlooked causal linkage? *Addiction*, 104, 331-332. doi: 10.1111/j.1360-0443.2008.02500.x.
- Peltzer, K., Ramlagan, S., & Gliksman, L. (2006). Responsible Alcoholic Beverages Sales and Services Training Intervention in Cape Town: A Pilot Study. *Journal of Psychology in Africa*. 16, 45-52.
- Rehm, J., Anderson, P., Kanteres, F., Parry, C.D., Samokhvalov, A.V., & Patra J. (2009a). *Alcohol, social development and infectious disease*. Toronto, Canada: Centre for Addiction and Mental Health.

- Rehm, J., Kehoe, T., Rehm, M., & Patra, J. (2009b). *Alcohol consumption and related harm in WHO Africa region in 2004*. Toronto, Canada: Centre for Addiction and Mental Health.
- Roerecke, M., Obot, I.S., Patra, J., & Rehm, J. (2008). Volume of alcohol consumption, patterns of drinking and burden of disease in sub-Saharan Africa, 2002. *African Journal of Drug & Alcohol Studies*, 7, 1-15.
- Shuper, P.A., Joharchi, N., Irving, H., & Rehm, J. (2009). Alcohol as a correlate of unprotected sexual behavior among people living with HIV/AIDS: review and meta-analysis. *AIDS and Behavior*, 13, 1021-1036. doi: 10.1007/s10461-009-9589-z.
- Shuper, P.A., Neuman, M., Kanteres, F., Baliunas, D., Joharchi, N., & Rehm, J. (2010). Causal considerations on alcohol and HIV/AIDS - a systematic review. *Alcohol and Alcoholism*, 45, 159-166. doi: 10.1093/alcalc/agg091.
- Townsend, L., Rosenthal, S.R., Parry, C.D.H., Yanga, Z., Mathews, C., & Flisher, A.J. (in press). Associations between alcohol misuse and risks for HIV infection among men who have multiple female sexual partners in Cape Town, South Africa. *AIDS Care*.
- UNAIDS and WHO. (2009). *AIDS epidemic update: December 2009*. Geneva: Author. data.unaids.org/pub/Report/2009/jc1700_epi_update_2009_en.pdf (accessed 7 June 2010).
- Van Beurden, E., Reilly, D., Dight, R., Elayne, M.E., & Beard, J. (2000). Alcohol brief intervention in bars and taverns: a 12-month follow-up study of Operation Drinksafe in Australia. *Health Promotion International*, 15, 293-302.
- WHO. (2010). *Global Strategy to reduce the harmful use of alcohol*. Geneva: Author.
- WHO ASSIST Working Group. (2002). The Alcohol, Smoking and Substance Involvement Screening Test (ASSIST): development, reliability and feasibility. *Addiction*, 97, 1183-1194.
- WHO, UNAIDS and UNICEF (2008). *Epidemiological fact sheet on HIV and AIDS: South Africa*. Geneva: Author. http://www.unaids.org/en/CountryResponses/Countries/south_africa.asp (accessed 7 June 2010).
- Williamson, L.M., Hart, G.J., Flowers, P., Frankis, J.S., & Der, G.J. (2001). The Gay Men's Task Force: the impact of peer education on the sexual health behaviour of homosexual men in Glasgow. *Sexually Transmitted Infections*, 77, 427-432.