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Consumption among Urban Chinese

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From the Editor-in-Chief

This issue of *World Health & Population* presents three original papers plus a paper reprinted from *BMC Public Health* that we feel will be of interest to *WHP* readers. The original papers have all been published online by *WHP* during the last quarter and are selected here as representative of recent outstanding contributions to the journal.

The first two papers relate to alcohol and healthcare issues in China. In “The Association of Metabolic Syndrome with Alcohol Consumption among Urban Chinese,” authors Mark Strand and colleagues provide early reporting of a larger study on alcohol use and the rise of chronic disease in China. Metabolic syndrome is defined as a collection of risk factors that are related to a number of chronic diseases; the authors show rather conclusively the association of these factors with alcohol use, although in a cross-sectional study it is not possible to demonstrate causality. The increase of chronic disease in China and other countries where chronic disease was previously rare is a serious worldwide problem. Given that alcohol use is insinuated in so many of these conditions, governmental and other authorities need to promote awareness and develop effective prevention strategies. This is particularly important for China, which has almost negligible regulation and control related to alcohol.

The second paper with a focus on China in this issue includes authors from Wayne State University who have been regular contributors to *WHP*. “Pro-Alcohol-Use Social Environment and Alcohol Use among Female Sex Workers in China: Beyond the Effects of Serving Alcohol” by Chen Zhang, Xiaoming Li and colleagues strives to answer two questions: (1) what is the prevalence of alcohol use among female sex workers (FSWs) in China? and (2) do aspects of the social environment independently contribute to FSW alcohol problems, beyond just the easily defined alcohol-serving practices of the venues where FSWs work? The research, also part of a much larger study, points conclusively toward the need to “get beyond” just regulation of alcohol in workplaces to address more fundamental social environmental factors such as institutional and peer norms, as well as risk perceptions.

The second two papers in this issue relate to HIV prevention in school-age populations, although in vastly different settings and from different perspectives. The first paper, “Preparing for National Implementation of an Evidence-based, Effective HIV Prevention Program among Bahamian Sixth-Grade Students,” by Valerie Knowles et al., reports pilot results from implementation of a nationwide school-based HIV education and intervention program. The goal of the researchers was to determine (1) the “fidelity” of implementation, that is, how close the final rolled-out program was to the initial design, (2) evidence that the program would be associated with ongoing effectiveness, and (3) barriers to wider implementation and strategies to overcome them. The paper is well grounded in implementation theory and science and should be of wide interest to policy and program managers.

The final paper is the open access reprint referred to earlier, entitled “HIV Prevalence among High School Learners – Opportunities for School-based HIV Testing Programmes and Sexual Reproductive Services” by Ayesha Kharsany, Mukelisiwe Mlotshwa et al. Their paper reports on a very well designed study to determine the HIV prevalence among school-attending children in grades 8 through 12 in the KwaZulu-Natal midlands, South Africa. The authors point out that most HIV detection and prevention activities for youth occur as part of antenatal care, thus excluding males and, largely, all non-pregnant females. The authors’ reported prevalence rate among school-aged children, and the potential for significant school-based testing and prevention programs supported by existing South African policy, indicate the importance of school-based HIV testing and subsequent prevention and treatment services, even for these younger populations.

In conclusion, we hope that you find the papers in this issue interesting and worthwhile, and that you will also consult others recently released online at www.worldhealthandpopulation.com. *WHP* remains committed to its mission to provide a forum for researchers and policy makers worldwide to publish and disseminate health- and population-related research, and to encourage applied research and policy analysis from diverse global and resource-constrained settings. *WHP* is indexed on MEDLINE and is accessible through PubMed.

We look forward to continued enthusiastic submission of manuscripts for consideration, peer review and publication. Finally, the editors and publishers of *WHP* are always interested in any comments or suggestions you might have on the papers or about the journal and our mission. Please feel free to write or e-mail us.

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The Association of Metabolic Syndrome with Alcohol Consumption among Urban Chinese

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Abstract

Background: Along with economic improvement, China is experiencing increasing rates of non-communicable disease and a rise in alcohol consumption. While a modest intake of red wine has been shown to be health enhancing, the pathophysiology associated with excessive alcohol consumption is being increasingly recognized. The purpose of this study is to demonstrate the health consequences of alcohol consumption among middle-aged urban Chinese people.

Methods: This cross-sectional study included 793 subjects aged 44, 48 or 52 years, from urban community health centres and a local hospital, who participated in a survey, anthropometrics and blood chemistry. Multiple logistic regression analysis was used to obtain adjusted odds ratios (OR) between alcohol intake and medical history of diabetes and hypertension, metabolic syndrome and its five component variables.

Results: Metabolic syndrome (MetS) was detected in 53.5% and 42.8% of men and women, respectively, ($p < .05$), and regular alcohol consumption was found among 72.5% and 12.4% of men and women ($p < .00$). A weak association was found between consuming alcohol ≥ 2 times a week (or having quit) and MetS (OR = 1.7, 1.0, 2.9) and elevated blood pressure (OR = 1.8, 1.0, 3.1).

Conclusion: Alcohol consumption is an under-appreciated risk factor found in association with increased rates of metabolic syndrome and associated non-communicable diseases among urban residents in China.

Introduction

The benefits of China's economic growth have been unbalanced. Inequitable access to these benefits have left some portions of the population with unmet health, education and social needs. While increased urbanization has created opportunity for millions of people in China, it has also led to the emergence of an urban underclass, either among disenfranchised migrant workers or among long-time urban dwellers who have not fared well in the restructuring of state-owned enterprises (Zhou et al. 2003). The health status of these urban poor is a matter of great concern.

Among the middle-aged and elderly in China, a more lavish lifestyle has led to increased rates of obesity and sedentary living (Van de Poel et al. 2009). Rates of metabolic syndrome (MetS) and its correlates are increasing in China and other developing countries at an alarming rate (Anoop and Lokesh 2008; Popkin 2009; Strand et al. in press). These "diseases of affluence" are also of great concern as global economic growth is countered by global health declines (Popkin 2008). Along with economic improvement, China is experiencing a rise in alcohol consumption (Caetano and Laranjeira 2006; Cochrane et al. 2003). The pathophysiology associated with excessive alcohol consumption is being increasingly recognized (Schuckit 2009). Alcohol is associated with excess mortality from liver cancer, upper digestive cancer, liver disease and pancreatic disease (Mathurin and Deltenre 2009; Rehm et al. 2003).

The purpose of this study is to determine alcohol consumption patterns among middle-aged Chinese people and the health consequences associated with alcohol consumption.

Methods

Subjects

From August 2008 until January 10, 2009, we conducted a survey among three age cohorts, born in 1956, 1960 and 1964, in Yuci District (population 300,000), Jinzhong City, in Shanxi Province, China. These three birth cohorts were chosen as part of research into the influence of the 1960–61 Chinese famine on chronic disease in middle age. Two-thirds of the subjects were recruited through 16 of 19 community health centres (CHCs) in Yuci District. Subjects were recruited using the health record database of each CHC, which contains the names of all enrolled individuals in their capitulation area of approximately 16,000 persons per CHC. Subjects were recruited by phone invitation, by posters in the community and by word of mouth. Intensity of recruitment varied by centre, as did participation rate, with a high of 80% at one centre but a typical response rate of around 10%. Female response rate was higher because fewer women were employed and were thus available to participate. At the same time, one-third of the subjects were recruited through the Jinzhong hospital health examination centre. People being examined there are primarily healthy individuals whose employer arranges an annual physical exam at the site. Individuals with disease attend the outpatient department of this hospital, not the health examination centre. Verbal informed consent was obtained from each participant before data collection. This research was done under the authority of the Shanxi public health bureau and the Yuci public health bureau. It is a collaboration between the Shanxi Evergreen Service and the Jinzhong People's Hospital, with the cooperation of the Yuci Prefecture Women and Children's Hospital and the Luxi CHC. The research proposal was approved by the Research Ethics Board of the University of Western Ontario and the Jinzhong City Science Commission and Yuci Qu Public Health Bureau.

Survey

After two iterations of pilot-testing, a structured questionnaire with 36 questions was set and administered by trained research staff to all participants, assessing demographic data, personal and family medical history, physical activity habits, smoking, dietary intake, health knowledge about chronic disease (0–4 scale based on answers to four questions about diabetes and hypertension) and self-perceived health. Alcohol intake was surveyed (abstain, occasionally, quit more than a year, or twice a week or more). The quitters were categorized between occasional and frequent consumers, based on the assumption that their health was still affected by their drinking history. Indeed, upon questioning

it was found that the majority had quit because of a health problem (69% of the 26 quitters had done so because of a health problem, 25% to prevent disease and 6% because of a religious change). This classification is further justified by other researchers' observation that former drinkers have hazard rate ratios for several forms of cancer higher than that of current drinkers, suggesting that former drinkers quit primarily because of poor health (Nakashita et al. 2010; Schutze et al. 2011). Furthermore, 65.4% of the quitters reported their health as poor or mediocre and none reported their health as excellent. Although we did not discriminate between beer, spirit and wine, it is known that 45% alcohol spirits (*baijiu*) taken with a meal is the alcohol most commonly consumed.

Biochemistry

Overnight fasting blood samples were drawn by venipuncture to measure serum glucose, total cholesterol, triglycerides, high-density lipoproteins (HDL) and low-density lipoproteins (LDL). No freezing of blood samples was required and all were analyzed within three hours at the Jinzhong People's Hospital Laboratory on a Roche Diagnostics Modular P800 Analyzer (Roche Diagnostics, Germany) using the re-agent imported from Roche Diagnostics.

Anthropometrics

Subjects were weighed (without shoes) with light summer clothing, and, when the season changed, 1 to 2 kg was deducted to adjust for heavier fall and winter clothing. Standing height was measured in metres (without shoes) using the stadiometer attached to the scale (Su Hong Medical Equipment Company, Limited, Jiangsu, China). Measurements were taken to the nearest tenth of a centimetre.

Waist circumference was measured with the participant standing erect, using a standard tape measure (cm). Measurement was taken at the umbilicus, the tape being horizontal and passing just above the iliac crest. Body mass index was calculated as weight (kg) divided by height squared (m²).

After 30 minutes of rest and no smoking, at least two blood pressure measurements were obtained one minute apart by trained nurses and physicians, according to the American Heart Association recommendations (Pickering et al. 2005). All measurements were averaged. A standard mercury sphygmomanometer was used.

Metabolic Syndrome Criteria

Metabolic Syndrome (MetS) was defined using the NCEP ATP III criteria, which require the presence of three or more of the following risk determinants:

1. Increased waist circumference (≥ 90 cm for men, ≥ 80 cm for women)
2. Elevated triglycerides (≥ 1.7 mmol/L [150 mg/dL]) or treatment for this lipid abnormality
3. Low HDL cholesterol (< 1.03 mmol/L [< 40 mg/dL] in men, < 1.29 mmol/L [50 mg/dL] in women) or treatment for this lipid abnormality
4. Hypertension ($\geq 130 / \geq 85$ mmHg) or treatment for hypertension
5. Impaired fasting glucose (≥ 5.6 mmol/L [100 mg/dL]) or treatment for raised blood glucose

Statistical Analysis

A total of 793 subjects with complete data were used in the analysis. Kruskal-Wallis test and Pearson's chi-square test were used to test for differences between alcohol consumption categories and laboratory values (fasting blood glucose [FBG], triglycerides, cholesterol), medical history of diabetes and hypertension, metabolic syndrome and the five variables that constitute the metabolic syndrome. Multiple logistic regression analysis was used to obtain adjusted odds ratios and their 95% confidence intervals between alcohol intake and medical history of diabetes and hypertension, metabolic syndrome and its five component variables. These were adjusted for gender, age, income, cigarette consumption, family history of chronic disease and physical exercise. Analyses were performed using SAS 9.2 for Windows.

Results

The population surveyed represents a north China urban middle- to lower-class population (Table 1a) with a mean age of 48.6 and 48.4 years for men and women, respectively (Table 1b). Subjects are married (men 100%, women 98.1%) and living with two to three others in their home; nearly half have had nine or less years of education. Less than a third work in professional or clerical occupations. Some of the women are retired, mostly from defunct state-owned factories. Over 60% are living on less than five US dollars a day (\$1,825 per year).

Rates of smoking and alcohol consumption are 64.3% and 1.9% and 72.5% and 12.4% for men and women, respectively (Table 1a). Chronic disease knowledge is significantly higher among women than men.

There is a high amount of undiagnosed elevated blood pressure and elevated blood glucose, as shown by the discrepancy between measured blood pressure (in excess of 140/90 mm Hg) and measured blood glucose (FBG > 7.0 mmol/L) and the self-reported rates (Table 1a).

Table 1a. Demographic and clinical characteristics (as a percentage)

Characteristics	Male (n = 269)	Female (n = 524)
Occupation:		
Professional, clerical	29.7	27.2
Retired	1.1	17.4
Manual	49.4	29.7
Unemployed	11.5	21.2
≤ 9 years education*	48.1	43.8
Physical activity more than 150 min per week	40.4	38.1
Regular alcohol consumption**	72.5	12.4
Smoking **		
No	25.7	97.7
Quit (> 1 year)	10.0	0.4
Yes	64.3	1.9
Hypertension (BP > 140/90)**	49.8	31.7
Self-reported hypertension*	27.9	18.9
Diabetes (FBG > 7.0 mmol/L)*	15.2	7.6
Self-reported type 2 diabetes*	12.7	5.0
Metabolic Syndrome (ATPIII criteria)*	53.5	42.8

BP = blood pressure; FBG = fasting blood glucose.

* $p < .05$; ** $p < .0001$.

MetS was detected in 53.5% and 42.8% of men and women, respectively ($p < .05$) (Table 1a), and a positive association was found between consuming alcohol ≥ 2 times a week (or having quit) and MetS (OR = 1.7, 1.0, 2.9). The pathology associated with alcohol consumption and contributing

to the presentation of metabolic syndrome is primarily elevated triglycerides, elevated blood glucose and hypertension (Table 2), while only the latter is found to be statistically significant after controlling for lifestyle variables (Table 3). Increased waist circumference and elevated HDLs show no relationship or pattern with alcohol consumption. Rates of diagnosed diabetes and hypertension also increased with alcohol intake (Table 2), but neither remain significant after adjustment (Table 3).

Table 1b. Demographic and clinical characteristics [mean (SD)]

Characteristics	Male (n = 269)	Female (n = 524)
Age (years)	48.6 (3.1)	48.4 (3.1)
Waist (cm)**	91.6 (8.8)	86.1 (8.9)
Fasting blood glucose (mmol/L)**	6.02 (0.12)	5.54 (0.05)
Chronic disease knowledge score (0–4)*	2.84 (0.63)	2.95 (0.58)

* $p < .05$; ** $p < .0001$.

Table 2. Association between alcohol consumption and risk factors

	Do you drink alcohol on an ordinary day?								P-value ^a
	None (n = 533)		Occasional (n = 123)		Quit (n = 26)		≥ 2 times/week (n = 111)		
Fasting blood sugar (mmol/L)	5.28	(4.99, 5.77)	5.41	(5.03, 5.92)	5.30	(4.85, 5.71)	5.53	(5.18, 5.92)	.0102
Triglycerides (mmol/L)	1.40	(0.96, 2.02)	1.47	(0.98, 2.16)	1.92	(1.16, 2.78)	1.92	(1.32, 2.86)	< .0001
Total cholesterol (mmol/L)	4.54	(3.99, 5.22)	4.56	(4.16, 5.14)	4.56	(4.07, 5.31)	4.64	(4.11, 5.20)	.8693
Diagnosed by doctor to have diabetes	31	(5.8%)	12	(9.8%)	4	(15.4%)	13	(11.7%)	.0425
Diagnosed by doctor to have hypertension	101	(18.9%)	33	(26.8%)	11	(42.3%)	29	(26.1%)	.0076
Metabolic Syndrome	226	(42.4%)	60	(48.8%)	17	(65.4%)	65	(58.6%)	.0028
Triglycerides ≥ 1.7 mmol/L or medication	199	(37.3%)	51	(41.5%)	14	(53.8%)	63	(56.8%)	.0011
HDL (male < 1.03 mmol/L, female < 1.29 mmol/L)	229	(43.0%)	50	(40.7%)	13	(50.0%)	41	(36.9%)	.5425
Waist circumference (male ≥ 90 cm, female ≥ 80 cm)	405	(76.0%)	85	(69.1%)	18	(69.2%)	72	(64.9%)	.0633
SBP ≥ 130 mmHg or DBP ≥ 85 mmHg or medication	243	(45.6%)	68	(55.3%)	20	(76.9%)	73	(65.8%)	< .0001
Blood glucose ≥ 5.6 mmol/L or medication	169	(31.7%)	43	(35.0%)	7	(26.9%)	49	(44.1%)	.0727

Note. For continuous risk factors, entries represent median with 25th and 75th percentiles in parentheses; for binary risk factors, entries represent frequency with percentage in parentheses.

HDL = high-density lipoproteins; SBP = systolic blood pressure; DBP = diastolic blood pressure.

^aKruskal-Wallis test and Pearson's chi-square test were used to test for differences between alcohol consumption category for continuous and binary risk factors, respectively.

Different outcomes for the risk factors for occasional drinkers versus non-drinkers are not significant when adjustment is performed (Table 3). However the odds ratio of 1.7 (CI 1.0, 2.9) for MetS and 1.8 (CI 1.0, 3.1) for hypertension is higher among heavy drinkers or quitters, even after adjustment. The increased risk for elevated triglycerides of 1.2 among heavy drinkers or quitters is not found to be statistically significant.

Table 3. Association between alcohol consumption and risk factors after adjusting for potential confounders

	Occasional vs. None			Quit or ≥ 2 Times/Week vs. None				
	Odds Ratio	95% CI		P-value	Odds Ratio ^a	95% CI		P-value
Diagnosed by doctor to have diabetes	1.227	0.546	2.756	0.6210	1.148	0.485	2.720	0.7532
Diagnosed by doctor to have hypertension	1.504	0.886	2.553	0.1302	1.375	0.740	2.554	0.3140
Metabolic Syndrome	1.234	0.789	1.929	0.3572	1.706	1.007	2.890	0.0468
Triglycerides ≥ 1.7 mmol/L or medication	0.951	0.599	1.511	0.8321	1.225	0.718	2.088	0.4565
HDL (male < 1.03 mmol/L, female < 1.29 mmol/L)	1.047	0.673	1.631	0.8382	1.056	0.625	1.782	0.8393
Waist circumference (male ≥ 90 cm, female ≥ 80 cm)	1.025	0.624	1.685	0.9219	1.134	0.652	1.974	0.6552
SBP ≥ 130 mmHg or DBP ≥ 85 mmHg or medication	1.441	0.918	2.262	0.1125	1.779	1.037	3.053	0.0366
Blood glucose ≥ 5.6 mmol/L or medication	0.916	0.571	1.470	0.7160	1.052	0.615	1.798	0.8531

HDL = high-density lipoproteins; SBP = systolic blood pressure; DBP = diastolic blood pressure.

^aOdds ratios adjusted for gender, age, monthly income, cigarette consumption, family history of chronic diseases and physical exercise.

Discussion

The present study found a MetS prevalence among men of 58.6% among heavy drinkers, compared to 48.8% and 42.4% among occasional drinkers and abstainers, respectively. Regression analysis demonstrated a weak relationship between alcohol intake and both MetS and elevated blood pressure. Heavy drinkers were also found to have higher rates of diabetes and higher mean blood glucose levels than occasional drinkers or non-drinkers, showing a dose-response trend, but the statistical significance of these results declined or disappeared after adjusting for a host of lifestyle variables. This observation suggests that lifestyle variables may be confounding the relationship between alcohol intake and MetS, and that in fact it is lifestyle that determines both alcohol intake and rates of MetS. Our finding of alcohol consumption as one contributor to disease and even mortality in association with other lifestyle variables has been observed in other contexts (Jin et al. 2011).

While not able to demonstrate a causal relationship, these results do elevate the importance of alcohol intake as a significant lifestyle variable associated with MetS and other non-communicable diseases, in particular hypertension, triglycerides and glucose intolerance, among middle-age Chinese populations. This issue will be analyzed presently.

In China's alcohol culture, most drinking takes place with a meal, and solitary drinking is frowned upon (Hao et al. 1999). Alcohol is used to maintain good relations between people and to promote camaraderie among colleagues. These cultural attributes may prevent the development of alcoholism among some, but the social aspect also tends to add significant peer pressure to drinking events

resulting in binge drinking. The combination of consuming spirits of high alcohol content coupled with high volume leads to intoxication.

Alcohol misuse is defined as excess daily consumption (more than four drinks per day for men or more than three for women) or excess total consumption (more than 14 drinks per week for men or more than seven drinks per week for women) or both (National Institute on Alcohol Abuse and Alcoholism 2005). Although this study reports only the frequency of alcohol consumption and not volume, in China 200 mL (90 gm) or more of 48% alcohol is commonly consumed by men at meals and parties; this would be the equivalent of five drinks of spirits. Therefore, many of the 39% of the men in this study who drink more than twice a week were likely exceeding the alcohol misuse criteria of 14 drinks per week. Many Asians possess a genetic polymorphism that confers some protection against alcoholism (Chen et al. 1999), exhibited by the so-called Asian flush. This failure to rapidly metabolize alcohol actually results in faster and more prolonged intoxication, which may worsen the toxic effects that lead to organ damage (Wakabayashi and Masuda 2006).

Reporting on research from Russia, Zaridze et al. (2009) found a dose–response relationship between death due to pancreatic disease in Russian men ages 15–74 years who consumed three or more half-litre bottles of vodka per week, with a relative risk of 6.69, (CI 4.98–9.00). Kristiansen et al. (2008) found a high alcohol intake was associated with a higher risk of pancreatitis and in a dose–response manner. The relationship between alcohol consumption and glucose intolerance is likely chronic pancreatitis.

This recognition of the deleterious effects of alcohol (Schuckit 2009), especially spirits, as is most commonly consumed in Asian countries, challenges the conclusions of research in many Western settings arguing for the protective effects of alcohol consumption on MetS (Fan et al. 2008; Freiberg et al. 2004) at relatively low levels of alcohol intake (Alkerwi et al. 2009). Alcohol intake does increase insulin sensitivity (Avogaro et al. 2004), but it is also known to generate cellular oxidative stress (Dembele et al. 2009) and overwork pancreatic beta cells (Shin et al. 2002), so whatever benefits alcohol may confer seem to be lost at higher levels of alcohol intake. The present research found no harm from occasional alcohol intake compared to none, but also did not find occasional alcohol intake to be protective.

Wine has health-enhancing attributes due to polyphenols found in red wine – especially resveratrol in grape skins – and antioxidant benefits (Agarwal 2002; Opie and Lecour 2007). But there are also health risks in alcohol consumption (Kvaavik et al. 2010), especially binge drinking (Bagnardi et al. 2008; Malyutina 2002) and/or strong liquor (Hata and Nakajima 2000). Asian alcohol consumption favours strong liquor with high alcohol and calorie content. The result has been ignoring the influence of Asian hard liquor consumption habits on cardiovascular health. While light alcohol consumption was somewhat protective against MetS in Korea, there was a dose–response increase in the odds ratio with increasing alcohol consumption (Yoon et al. 2004). Likewise, in a study of Japanese factory workers with a mean age of 44, ethanol intake of 300 g/wk or more had an increased age-adjusted hazard ratio for an increased risk of MetS (Otsuka et al. 2011). Also in a Japanese population, a positive association of alcohol intake was found with blood pressure, triglycerides and HDL cholesterol among men with and without diabetes (Wakabayashi 2011). The work presented here demonstrated an association with alcohol intake and triglycerides, fasting blood glucose and hypertension, but statistical significance was limited, and only the latter was found significant after controlling for confounding factors. This is similar to what Jin et al. have demonstrated in a study in China, where they report that heavy drinkers (≥ 50.0 g/d), compared with non-drinkers, had higher blood pressure, elevated triglycerides and a 53% increased risk of having MetS (Jin et al. 2011). Yokoyama et al. (2007) have shown the risk of hard liquor to cardiovascular disease in Japan, results that concur with the present study. Together these results open up a new area of concern for the health and well-being of people in Asia.

China's economic development has created both possibilities and challenges. A recent report that the age-standardized prevalence of total diabetes in China is now 10.6% and 8.8% among men and women, respectively, highlights the urgency of the problem (Yang et al. 2010). In rural China there

is less chronic disease than in urban China (in 2008 7.9% of rural households reported a chronic disease, compared to 14.9% in urban ones), despite poorer health services and higher rates of premature self-discharge due to inability to pay in rural areas (27.59% vs. 11.58%) (Jian et al. 2010).

The 60% of studied subjects living on less than five US dollars a day (\$1,825 USD per year) actually represent middle- to lower-class status in urban Shanxi Province, where mean per capita disposable income in 2009 was \$2,153 and \$538 USD in urban rural areas, respectively (which is somewhat lower than total per capita income would be) (Zhang 2010). These are the men whom this study has identified as being less educated and poorer, and consuming more alcohol and tobacco, which contributes to compromised health. For men, harmful drinking patterns and alcohol-related morbidity and mortality follow a reversed socio-economic gradient (Schmidt et al. 2010).

Rates of non-communicable diseases are increasing rapidly in China, and strategies for their prevention are needed. Urbanization in China leads to a decrease in physical exercise of 32% (Ng et al. 2009). Remaining non-hypertensive was more likely among rural residents and those who became more physically active and quit drinking alcohol (Ahn et al. 2011). In a country like China, meeting many choices for the first time, creating environments that support behaviour change and providing incentives to reduce lifestyle-related health risks are essential (Maziak and Ward 2009). There is no apparent awareness of the health risks of hard liquor among the Chinese public. Furthermore, access to alcohol has few restrictions and controls, with no legal age limit for purchasing or consuming alcohol and no regulation of where alcohol can be sold. The second round of data collection in this study is currently under way, and will more thoroughly investigate alcohol intake patterns.

This study is limited by the relatively small number of subjects in each age cohort, particularly among men, which compromised statistical power. Selection bias was unavoidable as people self-selected to participate in the survey after being invited by their local community clinic. Recall bias was also present, as questions required recall of habits in the previous month or longer.

References

- Agarwal, D.P. 2002. "Cardioprotective Effects of Light-Moderate Consumption of Alcohol: A Review of Putative Mechanisms." *Alcohol and Alcoholism* 37(5): 409–15.
- Ahn, S., H. Zhao, M.L. Smith and C.D. Phillips. 2011. "BMI and Lifestyle Changes as Correlates to Changes in Self-reported Diagnosis of Hypertension among Older Chinese Adults." *Journal of the American Society of Hypertension* 5(1): 21–30.
- Alkerwi, A., M. Boutsen, M. Vaillant, J. Barre, M.L. Lair, A. Albert et al. 2009. "Alcohol Consumption and the Prevalence of Metabolic Syndrome: A Meta-analysis of Observational Studies." *Atherosclerosis* 204(2): 624–35.
- Anoop, M. and K. Lokesh. 2008. "Obesity and the Metabolic Syndrome in Developing Countries." *Journal of Clinical Endocrinology & Metabolism* 93(Suppl. 1): S9–S30.
- Avogaro, A., R.M. Watanabe, A. Dall'Arche, S.V. De Kreutzenberg, A. Tiengo and G. Pancini. 2004. "Acute Alcohol Consumption Improves Insulin Action without Affecting Insulin Secretion in Type 2 Diabetic Subjects." *Diabetes Care* 27(6): 1369–74.
- Bagnardi, V., W. Zatonski, L. Scotti, C. La Vecchia and G. Corrao. 2008. "Does Drinking Pattern Modify the Effect of Alcohol on the Risk of Coronary Heart Disease? Evidence from a Meta-analysis." *Journal of Epidemiology and Community Health* 62(7): 615–9.
- Caetano, R. and R. Laranjeira. 2006. "A 'Perfect Storm' in Developing Countries: Economic Growth and the Alcohol Industry." *Addiction* 101(12): 149–52.
- Chen, C.C., R.B. Lu, Y.C. Chen, M.F. Wang, Y.C. Chang, T.K. Li and S.J. Yin. 1999. "Interaction between the Functional Polymorphisms of the Alcohol-Metabolism Genes in Protection against Alcoholism." *The American Journal of Human Genetics* 65(3):795–807.
- Cochrane, J., H.H. Chen, K.M. Conigrave and W. Hao. 2003. "Alcohol Use in China." *Alcohol and Alcoholism* 38(6): 537–42.
- Dembele, K., K.H. Nguyen, T.A. Hernandez and B.L. Nyomba. 2009. "Effects of Ethanol on Pancreatic Beta-Cell Death: Interaction with Glucose and Fatty Acids." *Cell Biology and Toxicology* 25(2): 141–52.
- Fan, J.G., X.B. Cai, L. Li, X.J. Li, F. Dai and J. Zhu. 2008. "Alcohol Consumption and Metabolic Syndrome among Shanghai Adults: A Randomized Multistage Stratified Cluster Sampling Investigation." *World Journal of Gastroenterology* 14(15): 2418–24.

- Freiberg, M.S., R.S. Vasan, H.J. Cabral, R.C. Ellison and T.C. Hefren. 2004. "Alcohol Consumption and the Prevalence of the Metabolic Syndrome in the U.S." *Diabetes Care* 27(12): 2954–59.
- Hao, W., Y. Derson, S. Xiao, L. Li and Y. Zhang. 1999. "Alcohol Consumption and Alcohol-Related Problems: Chinese Experience from Six Area Samples, 1994." *Addiction* 94: 1467–76.
- Hata, Y. and K. Nakajima. 2000. "Life-Style and Serum Lipids and Lipoproteins." *Journal of Atherosclerosis and Thrombosis* 7(4): 177–97.
- Jian, W., K.Y. Chan, D.D. Reidpath and L. Xu. 2010. "China's Rural–Urban Care Gap Shrank for Chronic Disease Patients, but Inequities Persist." *Health Affairs* 29(12): 2189–96.
- Jin, L., Y. Huang, Y.F. Bi, L. Zhao, M. Xu, Y. Xu et al. 2011. "Association between Alcohol Consumption and Metabolic Syndrome in 19,215 Middle-Aged and Elderly Chinese." *Diabetes Research and Clinical Practice* 92(3): 386–92.
- Kristiansen, L., M. Grønbaek, U. Becker and J.S. Tolstrup. 2008. "Risk of Pancreatitis According to Alcohol Drinking Habits: A Population-Based Cohort Study." *American Journal of Epidemiology* 168(8): 932–37.
- Kvaavik, E.B., G. David, U. Giske, R. Huxley and C.R. Gale. 2010. "Influence of Individual and Combined Health Behaviors on Total and Cause-Specific Mortality in Men and Women." *Archives of Internal Medicine* 170(8): 711–8.
- Malyutina, S, M. Bobak, S. Kurilovitch, V. Gafarov, G. Simonova, Y. Nikitin and M. Marmot. 2002. "Life-style and Serum Lipids and Lipoproteins." *Lancet* 360(9344): 1448–54.
- Mathurin, P. and P. Deltenre. 2009. "Effect of Binge Drinking on the Liver: An Alarming Public Health Issue?" *Gut* 58(5): 613–7.
- Maziak, W. and K.D. Ward. 2009. "From Health as a Rational Choice to Health as an Affordable Choice." *American Journal of Public Health* 99(12): 2134–9.
- Nakashita, Y., M. Nakamura, A. Kitamura, M. Kiyama, Y. Ishikawa and H. Mikami. 2010. "Relationships of Cigarette Smoking and Alcohol Consumption to Metabolic Syndrome in Japanese Men." *Journal of Epidemiology* 20(5): 391–7.
- National Institute on Alcohol Abuse and Alcoholism. 2005. "Helping Patients Who Drink Too Much: A Clinician's Guide, Updated 2005 Edition." Rockville: National Institutes of Health; 2005. Retrieved May 5, 2012. <<http://pubs.niaaa.nih.gov/publications/Practitioner/CliniciansGuide2005/guide.pdf>>.
- Ng, S.W., E.C. Norton and B.M. Popkin. 2009. "Why Have Physical Activity Levels Declined among Chinese Adults? Findings from the 1991–2006 China Health and Nutrition Survey." *Social Science & Medicine* 68(7): 1305–14.
- Opie, L.H. and S. Lecour. 2007. "The Red Wine Hypothesis: From Concepts to Protective Signalling Molecules." *European Heart Journal* 28(14):1683–93.
- Otsuka, T., T. Kawada, M. Yanai, Y. Kitagawa and H. Kan. 2011. "The Incidence of Metabolic Syndrome and Associated Lifestyle Factors in a Worksite Male Population." *Sangyo Eiseigaku Zasshi. (Journal for the Japan Society for Occupational Health)* 2011 Mar 1. [Epub ahead of print] PMID: 21372516.
- Pickering, T.G., J.E. Hall, L.J. Appel, B.E. Falkner, J. Graves, M.N. Hill et al. 2005. "Recommendations for Blood Pressure Measurement in Humans and Experimental Animals: Part 1: Blood Pressure Measurement in Humans: A Statement for Professionals from the Subcommittee of Professional and Public Research Education of the American Heart Association Council on High Blood Pressure." *Hypertension* 45(1):142–61.
- Popkin, B.M. 2008. "Will China's Nutrition Overwhelm Its Health Care System and Slow Economic Growth?" *Health Affairs* 27(4): 1064–76.
- Popkin, B.M. 2009. "Global Changes in Diet and Activity Patterns as Drivers of the Nutrition Transition." Nestle Nutrition Workshop Series. *Pediatric Programme* 63: 1–10.
- Rehm, J., R. Room, K. Graham, M. Monteiro, G. Gmel and C.J. Sempos. 2003. "The Relationship of Average Volume of Alcohol Consumption and Patterns of Drinking to Burden of Disease." *Addiction* 98: 1209–28.
- Schmidt, L., P. Makela, J.Rehm, and R. Room. 2010. "Alcohol: Equity and Social Determinants." In Blas, E. and A.R. Kurup, eds. *Equity, Social Determinants and Public Health Programmes*, p. 11-29. Geneva: World Health Organization.
- Schuckit, M.A. 2009. "Alcohol-Use Disorders." *Lancet* 373(9662): 492–501.
- Schutze, M., H. Boeing, T. Pischon, J. Rehm, T. Kehoe, G. Gmel et al. 2011. "Alcohol-Attributable Burden of Incidence of Cancer in Eight European Countries Based on Results from Prospective Cohort Study." *British Medical Journal* 342:d1584: 1–10.
- Shin, J.S., J.J. Lee, J.W. Yang and C.W. Kim. 2002. "Ethanol Decreases Basal Insulin Secretion from HIT-T15 Cells." *Life Sciences* 70(17): 1989–97.

Strand, M.A., J.L. Perry, P. Wang, S.F. Liu and H. Lynn. In press. "The Epidemiology of Metabolic Syndrome in an Urban North China Population Age 44–52." *Asia-Pacific Journal of Public Health*.

Van de Poel, E., O. O'Donnell and E. Van Doorslaer. 2009. "Urbanization and the Spread of Diseases of Affluence in China." *Economics and Human Biology* 7(2): 200–16.

Wakabayashi, I. 2011. "Comparison of the Relationships of Alcohol Intake with Atherosclerotic Risk Factors in Men with and without Diabetes Mellitus." *Alcohol and Alcoholism* [Epub ahead of print] PubMed PMID: 21330295.

Wakabayashi, J. and H. Masuda. 2006. "Influence of Drinking Alcohol on Atherosclerotic Risk in Alcohol Flushers and Non-flushers of Oriental Patients with Type 2 Diabetes Mellitus." *Alcohol and Alcoholism* 41(6): 672–7.

Yang, W., J. Lu, J. Weng, W. Jia, L. Ji, J. Xiao et al. 2010. "Prevalence of Diabetes among Men and Women in China." *New England Journal of Medicine* 362(12): 1090–101.

Yokoyama, H., H. Hiroshi, H. Ohgo, T. Hibi and I. Saito. 2007. "Effects of Excessive Ethanol Consumption on the Diagnosis of the Metabolic Syndrome Using its Clinical Diagnostic Criteria." *Internal Medicine* 46(17): 1345–52.

Yoon, Y.S., S.W. Oh, H.W. Baik, H.S. Park and W.Y. Kim. 2004. "Alcohol Consumption and the Metabolic Syndrome in Korean Adults: The 1998 Korean National Health and Nutrition Examination Survey." *American Journal of Clinical Nutrition* 80(1): 217–24.

Zaridze, D., P. Brennan, J. Boreham, A. Boroda, R. Karpov, A. Lazarev et al. 2009. "Alcohol and Cause-Specific Mortality in Russia: A Retrospective Case-Control Study of 48,557 Adult Deaths." *Lancet* 373(9682): 2201–14.

Zhang, Z. 2010. *Inside the Growth Engine. A Guide to China's Regions, Provinces and Cities*. Hong Kong: The Hongkong and Shanghai Banking Corporation Limited (HSBC).

Zhou, B.F., Y. Li, J. Stamler, S. Tao, C.E. Davis, X. Liu, A.R. Folsom and O.D. Williams. 2003. "Relation of Occupational Change to Cardiovascular Risk Factor Levels in Rural Chinese Men." *American Journal of Public Health* 93(12): 2049–51.

Pro-Alcohol-Use Social Environment and Alcohol Use among Female Sex Workers in China: Beyond the Effects of Serving Alcohol

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Abstract

The current study was designed to fill the literature gap by examining the roles of the pro-alcohol social environment in alcohol use among female sex workers (FSWs) in China. In this study, a total of 1,022 FSWs were recruited through community outreach from both alcohol-serving and nonalcohol-serving commercial sex venues in Guangxi, China. The pro-alcohol social environment was measured in four areas: institutional norms, institutional practices, risk perceptions and peer norms. The measures of the pro-alcohol social environment were significantly associated with the venues' alcohol-serving practices, with FSWs from those venues reporting a more positive pro-alcohol social environment

than their counterparts from nonalcohol-serving venues. However, these pro-alcohol social environment measures were independently predictive of alcohol use after controlling for venues' alcohol-serving practices and other demographic characteristics. Public health interventions need to target environmental–structural factors through altering pro-alcohol-use social norms and practices at both institutional and individual levels among FSWs in China.

Introduction

Alcohol use is a context-specific and prevalent behaviour (Li et al. 2010). Generally, alcohol use was associated with personal traits, social contexts and physical milieus (Ahern et al. 2008; Beck et al. 2008; Gruenewald et al. 2002). Personal traits include both demographic characteristics (e.g., sex, ethnicity, socio-economic status, education) and personal characteristics (e.g., psychosocial status, attitude toward alcoholism) (Ahern et al. 2008; Beck et al. 2008; Brennan et al. 1986; Gruenewald et al. 2002). Social context refers to individual, situational and motivational characteristics that influence drinking behaviours (e.g., peer influences and sex seeking) as well as social/environmental correlates (e.g., drinking norms, alcohol-use-related policies) (Ahern et al. 2008; Beck et al. 2008). In addition, availability of alcohol may shape drinking practices and increase incidence, prevalence of alcohol use and other alcohol-use-related problems within communities (Stockwell and Gruenewald 2001).

Alcohol use has been considered an integral part of commercial sex, involving both sex workers and their clients (Kumar 2003; Wojcicki 2002). Both female sex workers (FSWs) and their clients use alcohol as a means to facilitate sexual trades (Li et al. 2010a). Alcohol use among FSWs and clients during their sexual encounters is widespread worldwide, with 81.2% to 100% of FSWs ever using alcohol, and about three quarters of FSWs using alcohol during the past month (Li et al. 2010a). Alcohol use among clients of FSWs is also prevalent. A study conducted in Thailand reported that 76% of clients drank during most commercial sex encounters (VanLandingham et al. 1993).

Risk of alcohol use would be elevated in certain situations or contexts, such as taverns and nightclubs (Wojcicki 2002; World Health Organization [WHO] 2008). Contextual factors are particularly critical to alcohol use in commercial sex (Li et al. 2010a). Existing studies have confirmed that FSWs who worked in alcohol-serving venues (e.g., nightclubs) drank more compared to their counterparts from nonalcohol-serving venues. For instance, de Graaf et al. (1995) reported that FSWs who worked in clubs drank a higher level of alcohol than those working on the street, in brothels and in homes. In Kenya, alcohol problems were more prevalent among FSWs working in nightclubs and bars (Yadav et al. 2005).

Excessive alcohol consumption has also been confirmed as one of the most influential behavioural risk factors for negative health outcomes, including both physical and mental health problems (Li et al. 2010a; WHO 2008). For instance, in a study conducted by Potterat et al. (2004), both acute and chronic alcohol use were among the leading causes of death among FSWs. A review of global literature on alcohol use among FSWs and their clients documented a significant association between alcohol use and mental health problems, including depression, suicidal ideation and post-traumatic stress disorders (PTSD) (Li et al. 2010a).

Despite a growing number of studies on contexts of alcohol use and its negative effect on sexual and other health risks among FSWs, there are some limitations in the existing literature. First, most studies have looked only at the physical environment or physical factors (e.g., whether the venues serve alcohol) that were associated with alcohol-use problems among FSWs (Ao et al. 2011; Wojcicki 2002). Data are scarce regarding the role of the social environment characterized by pro-alcohol use among this at-risk population's alcohol use. We defined this type of environment in the current study as one in which certain conditions may prompt people's alcohol use in their living and working contexts. Second, most studies used some general, simple and often non-standardized measures of alcohol use, such as lifetime and current alcohol use, alcohol use in the past week, or number of drinks per day (Kalichman et al. 2007; Li et al. 2010a). These measures make it difficult to compare

findings across studies. Finally, most studies regarding alcohol use among FSWs were conducted in Western or African countries (Ao et al. 2011; Chersich et al. 2007; de Graaf et al. 1995; Morojele et al. 2006). Limited studies have been conducted in Asian countries including China, where both alcohol use and commercial sex are prevalent (Hong et al. 2007; Morisky et al. 2010).

As in other Asian countries, commercial sex in China is primarily establishment-based. An estimated 10 million FSWs in China operate in a complex commercial sex hierarchy during the first decade of the 21st century (Hong and Li 2008; Huang et al. 2004). Women who work in the higher-level sex venues (nightclubs) are usually able to charge more for their services and work in more favourable places, while women working at the bottom of the hierarchy (the streets) usually earn less pay and face considerably higher risks, including sexually transmitted diseases (STD)/HIV infections (Roger et al. 2002). Under the supervision and arrangement of the gatekeepers (managers or owners of the venues, as well as “mammies, or pimps”), FSWs typically encounter their clients in either entertainment establishments (e.g., karaoke [KTV], nightclubs, dance halls, discos and bars) or personal service sectors (e.g., saunas, hair salons, massage parlours, barbershops, restaurants and mini-hotels) (Fang et al. 2007; Yang et al. 2005). The Chinese government considers commercial sex one of the “social evils” and periodically conducts fierce crackdowns on the sex industry (Roger et al. 1996). FSWs in China face strong discrimination and stigmatization from society. Both FSWs and clients are subject to fines and incarceration if arrested by the police (WHO 2001). Because of the nature of their work, this working cohort is highly mobile and is often engaged in a series of health-risk behaviours, including substance abuse and risky sexual behaviours (Fang et al. 2007; Roger et al. 2002). Although female drinking is strongly condemned in traditional Chinese culture, limited studies have documented the high prevalence of alcohol use among FSWs in China. One study indicated that one third of FSWs had become intoxicated at least once a month in the last six months (Hong et al. 2007).

Despite the general recognition that alcohol availability at work may contribute to higher alcohol-use problems among FSWs, to date few studies have investigated how factors embedding within pro-alcohol use environment (such as institutional norms and practices, risk perceptions and peer norms) affect drinking behaviours among FSWs in China. Therefore, we conducted the current study with the following research questions: (1) What is the prevalence of alcohol use among the FSWs in China? (2) Do measures of the pro-alcohol-use social environment independently contribute to alcohol-use problems among FSWs beyond the alcohol-serving practices of the venues?

Method

Study Site

The current study was conducted in 2008–2009 in two tourist cities (Beihai and Guilin) of the Guangxi Zhuang Autonomous Region (Guangxi). Guangxi is located in southwest China and is one of the five autonomous and multi-ethnic administrative regions in China. Because of Guangxi’s central location, it has historically been a transport hub for trade, commerce and tourism in southwest China. As two of the most famous tourism spots, attracting 4–10 million tourists to each city every year, Beihai and Guilin were selected as our study sites. Beihai is located in the southern coast of Guangxi, with a population of 1.36 million including 550,000 urban residents. Guilin is situated in northeast Guangxi, with a population of 1.34 million including an urban population of 620,000. Because of the booming economy and lucrative tourism industry in Guilin and Beihai, commercial sex flourishes in both cities. An estimated 2000 FSWs work in more than 150 commercial sex venues in each city (Guangxi Center for Disease Control and Prevention [CDC] 2009).

Recruitment and Data Collection Procedure

Prior to data collection, the research team conducted ethnographic mapping to identify commercial sex venues in sampling areas. Identified sexual venues included entertainment establishments (e.g., KTV, nightclubs and bars), personal service sectors (e.g., saunas, hair salons, massage parlours, road-side restaurants and mini-hotels) and the street. Upon the completion of the ethnographic mapping, owners/managers or other gatekeepers of these venues were contacted for their permission

to conduct research in their premises. Once we obtained permission from the gatekeepers, several trained outreach health workers from the local CDC approached the women in these establishments to ask for their participation. Eligible participants were (a) women who worked in these establishments, (b) who did not deny involvement in commercial sex, and (c) who were willing to provide written informed consent to participate in the study. An estimate of 25% of the venues and 30% of the women who were approached refused to participate. A final sample of 1,022 women were recruited from 60 entertainment establishments and completed a self-administered questionnaire. Among the participants, 983 provided valid responses on alcohol-use-related measures.

The survey was conducted in separate rooms or private spaces in the venues or sites where participants were recruited. During the survey, only the interviewer, who provided assistance when necessary, was allowed to stay with the participant. For a small number of women (less than 5%) with a low level of literacy, interviewers read questions to participants. The questionnaire took about 45 minutes to complete. Each participant received a small gift with a cash value equivalent to 4.50 US dollars. The study protocol was approved by the Institutional Review Boards at Wayne State University in the United States and Beijing Normal University in China.

Measures

Demographic information: Participants were asked to provide information on their age, ethnicity, residency (rural or urban household registration), educational attainment, marital status, length of working in the city (in months), working venue and monthly income (in Chinese currency, *yuan*). For the purpose of data analysis in the current study, we categorized ethnicity into Han or non-Han, educational attainment into no more than middle school or at least middle school, marital status into ever married or never married, and home residency into rural or urban. Venues were classified as alcohol-serving or nonalcohol-serving, based on whether the serving of alcohol was part of routine business practices. Alcohol-serving venues in the current study included restaurants, bars, nightclubs and KTVs; nonalcohol-serving venues included mini-hotels, streets, massage parlours, hair salons and saunas.

Pro-alcohol-use social environment: A scale to measure various factors in social environments characterized by pro-alcohol use was developed based on findings in the existing literature regarding social and environmental contexts of alcohol use (Li et al. 2010a; Shuper et al. 2010). The scale consists of four domains with a total of 12 items. The first domain (three items, Cronbach alpha = 0.6) assesses the institutional norms regarding alcohol use with three dichotomous items (clients ask you to drink, mammy [pimp] or other gatekeepers require you drink, and mammy or other gatekeepers have a quota on alcohol sales for you at work). The second domain (Cronbach alpha = 0.6) evaluates institutional practices related to alcohol use with three dichotomous items (part of your work is to drink with clients, FSWs will gain commission from the sales of alcohol, and usually drink at work). The third domain (Cronbach alpha = 0.7) measures the risk perceptions among FSWs with three dichotomous questions (drinking will make clients happier, you will make more money if you drink and clients will tip more if you drink with them). The fourth domain (Cronbach alpha = 0.8) assesses peer norms/influences by asking how many of the FSWs they knew drank alcohol, got intoxicated or drank with clients, on a 5-point scale (none, some, about half of them, most, almost all of them). For the purpose of data analysis in the current study, responses were dichotomized into two groups: "less than half of them" versus "at least half of them." A composite score was calculated for each of these four subscales of the "pro-alcohol-use social environment" by summing up all positive responses to items in each subscale, with a higher composite score indicating a more positive measure of the pro-alcohol social environment. The Cronbach alpha for the pro-alcohol-use social environment was 0.9 for the current study sample.

Alcohol use: Women's alcohol use in the past year was measured by the Alcohol Use Disorders Identification Test (AUDIT) (Babor et al. 2001; Saunders et al. 1993). The AUDIT has been developed from a WHO six-country collaborative project with ten items covering three domains of drinking behaviors (hazardous alcohol use, dependence symptoms and harmful alcohol use). The AUDIT is a widely used, standardized screening instrument to assess individuals' hazardous as well

as harmful alcohol consumption and has been validated in the Chinese culture (Gao 2000; Li et al. 2003). The range of AUDIT scores is from 0 to 40, with a higher score indicating more severe alcohol-use problems. The Cronbach's alpha for the ten AUDIT items was 0.8 for the current study sample. To create a categorical measure of alcohol-use problems in the current study, we employed a scoring system with four risk levels of alcohol consumption: level one refers to "low-risk," with AUDIT scores 0–7; level two refers to "risk drinking," with AUDIT scores 8–15; level three refers to "heavy drinking" with AUDIT scores 16–19; and level four refers to "hazardous drinking," with AUDIT scores 20–40 (Babor et al. 2001). For the purpose of data analysis, we further dichotomized AUDIT scores by a cut-off point of eight (Babor et al. 2001; Steinbauer et al. 1998) to separate women who had problematic alcohol use (AUDIT scores ≥ 8) versus those who did not (AUDIT scores < 8).

Data Analysis

First, a chi-square (for categorical variables) and an independent t-test (for continuous variables) were employed to assess the differences in participants' demographic characteristics, alcohol-use behaviours, and measures of the pro-alcohol-use social environment between the alcohol-serving venues and nonalcohol-serving venues (Tables 1 and 2). Second, a chi-square test was employed to assess the association between various dichotomous measures of the pro-alcohol-use social environment and four risk levels of alcohol use (as determined by the ranges of AUDIT scores) (Table 3). Third, a multivariate binary logistic regression model was employed to further examine the independent association between alcohol use and the social environment characterized by pro-alcohol use. The dichotomized AUDIT scores served as the dependent variable in the regression model. The independent variables included composite scores of four subscales of measures of the pro-alcohol-use social environment (institutional norms, institutional practices, risk perceptions and peer norms), alcohol-serving practices of the venues and key demographics (age, education, income and marital status). Adjusted odd ratios (aORs) for the logistic regression model and their 95% confidence intervals (95% CIs) were used to depict independent relationships between dependent and independent variables (Table 4). All statistical analyses were performed using SAS 9.2.

Results

Key Demographic Characteristics by Alcohol-Serving Practices

As shown in Table 1, the average age of the participants ($N = 983$) was 24.4 ($SD = 6.1$), and most of them (62.7%) had less than a middle school education. Most were of Han ethnicity (84.0%), more than half were from rural areas (55.2%) and 73.8% were never married. They had worked in the cities on average of 44.0 (median = 36.0; $IQR = 42.0$) months, and earned 2,720 (median = 2,000; $IQR = 2,000$) yuan (approximately 380 US dollars at the time of survey) a month. About 60% (588/983) of FSWs worked in venues that served alcohol (restaurants, bars, nightclubs, KTVs). FSWs who worked in alcohol-serving venues were more likely to be younger, never married, have a higher educational attainment and earn lower incomes ($p < .05$).

Pro-Alcohol-Use Social Environment by Alcohol Serving Practice

Table 2 showed associations between measures of the pro-alcohol-use social environment and alcohol-serving practices of the venues. For items in the institutional norms subscale, 65.2% of FSWs had ever been asked by clients to drink, and 89.8% worked in alcohol-serving venues compared to 27.7% working in nonalcohol-serving venues ($p < .0001$). Nearly one half (46.3%) of the FSWs reported being required to drink alcohol by their mummies or other gatekeepers, and 11.0% reported that their mummies or other gatekeepers had a quota for them on alcohol sales at work. In the institutional practice subscale, nearly half of participants reported that they drank during working time, or part of their work was to drink with clients. Significantly more FSWs who worked in alcohol-serving venues than those working in nonalcohol-serving venues (17.9% vs. 8.6%; $p < .0001$) reported that they would gain a commission from sales of alcohol. On the risk perception subscale, nearly one third of FSWs believed that they could make more money by

drinking, and 55.4% believed that clients would tip them more for drinking with them. Similarly, more than half of FSWs reported that drinking would make their clients happier. All items on the peer norm scale in the alcohol-serving venues had statistically significantly higher rates than those in the nonalcohol-serving venues ($p < .0001$). About 60.4% of FSWs reported that at least half of FSWs they knew drank alcohol at work, one third reported that at least half of FSWs they knew became intoxicated, and half indicated that at least half of FSWs they knew also drank with clients during work. The mean AUDIT score was 9.1 (SD = 7.4) for the study sample. FSWs who worked in alcohol-serving venues had a significantly higher AUDIT score compared to FSWs who worked in nonalcohol-serving venues (13.1 vs. 3.9; $p < .0001$).

Table 1. Demographic information among FSWs by whether serving alcohol at work

	Alcohol-Serving Venue ^a		
	Total	Yes	No
N (%)	983 (100.0%)	588 (59.8%)	395 (40.2%)
Age (Mean, SD)	24.4 (6.1)	22.7(4.6)	27.0 (7.1)****
Ethnicity			
Han	84.0%	83.2%	85.3%
Non-Han	16.0%	16.8%	14.7%
Residency			
Urban	44.8%	47.4%	40.9%
Rural	55.2%	52.6%	59.1%
Marital status			
Never	73.8%	81.3%	62.5%****
Ever	26.2%	18.7%	37.5%
Education			
≤Middle school	62.7%	58.2%	69.4%****
>Middle school	37.3%	41.8%	30.6%
Income (1,000 yuan ^b , mean, SD)	2.7 (2.4)	2.5 (1.6)	3.1 (3.1)****
Length of working (in months, mean, median, IQR)	44.0 (36.0, 42.0)	42.1 (36.0, 42.0)	46.7 (36.0, 44.0)

FSWs = female sex workers; SD = standard deviation; IQR = interquartile range; KTVs = karaoke.

^aAlcohol-serving venues in the current study included restaurants, bars, nightclubs and KTVs; nonalcohol-serving venues included mini-hotels, streets, massage parlours, hair salons and saunas.

^b1,000 yuan is equivalent to 153.85 US dollars.

* $p < .05$. ** $p < .01$. *** $p < .001$. **** $p < .0001$.

Pro-Alcohol-Use Social Environment and Alcohol Use

As shown in Table 3, all measures of the pro-alcohol-use social environment significantly differed by the four risk levels of alcohol use, as determined by the AUDIT scores ($p < .0001$). For instance, among FSWs who reported drinking at work, only 18.0% were in the low-risk category, but 67.8% fell in the risk drinking category, 71.5% fell in the heavy-drinking category, and 77.8% were considered as

hazardous-drinkers ($p < .0001$). The same pattern has been seen in all other items, with statistically significant associations between these measures and risk levels of alcohol-use problems ($p < .0001$).

Table 2. Pro-alcohol-use social environment among FSWs by whether serving alcohol at work

		Alcohol-Serving Venue ^a		
		Total	Yes	No
N (%)		983 (100.0%)	588 (59.8%)	395 (40.2%)
Pro-alcohol-use social environment				
Institutional norms	Clients ask me to drink	65.2%	89.8%	27.7%****
	Mammies require the FSWs to drink alcohol	46.3%	68.6%	12.5%****
	Mammies have the quota on alcohol for the FSWs	11.0%	14.6%	5.6%****
Institutional practices	Part of my work is to drink with clients	57.4%	90.3%	8.4%****
	Drinking during working time	47.7%	76.8%	1.9%****
	FSWs will gain a percentage from the sales of alcohol	14.1%	17.9%	8.6%****
Risk perceptions	Drink will make clients happier	54.3%	76.8%	20.0%****
	Making more money by drinking	32.4%	45.0%	13.2%****
	Clients will give the FSWs tips for drinking with them	55.4%	75.3%	25.8%****
Peer norms	At least half of the FSWs they know...			
	Drink alcohol	60.4%	83.0%	26.5%****
	Become intoxicated	32.5%	49.0%	7.8%****
	Drink with other clients	51.3%	79.7%	9.0%****
AUDIT (score) (mean, SD)		9.1 (7.4)	13.1 (6.3)	3.9 (4.7)****

FSWs = female sex workers; SD = standard deviation; KTVs = karaoke.

^aAlcohol-serving venues in the current study included restaurants, bars, nightclubs, and KTVs; nonalcohol-serving venues included mini-hotels, streets, massage parlours, hair salons and saunas.

* $p < .05$. ** $p < .01$. *** $p < .001$. **** $p < .0001$.

As Table 4 depicts, when accounting for the alcohol-serving practice and key demographic characteristics (age, marital status, income and education), problematic alcohol use remained significantly associated with measures of the pro-alcohol-use social environment, including institutional practices (aOR = 1.40; 95% CI = 1.06, 1.85; $p = .02$), risk perceptions (aOR = 1.35; 95% CI = 1.05, 1.74; $p = .02$) and peer norms (aOR = 1.26; 95% CI = 1.02, 1.56; $p = .04$). Institutional norms showed a marginally statistically significant association with alcohol use in the model (aOR = 1.28; 95% CI = 1.00, 1.65; $p = .06$). In addition, women who worked in alcohol-serving venues were six times more likely to report problematic alcohol use (Table 4).

Discussion

Our study is one of the first attempts to examine the association between factors of working environment and alcohol use among FSWs in China. Our data indicate that the measures of the pro-alcohol social environment had good validity, as they were significantly associated with both the

Table 3. The pro-alcohol-use social environment by AUDIT among FSWs

		Risk Levels by AUDIT Score				
		Total	0–7	8–15	16–19	20–40
N (%)		983 (100.0%)	438 (44.6%)	332 (33.8%)	123 (12.5%)	90 (9.2%)
Pro-alcohol-use social environment						
Institutional norms	Clients ask me to drink	65.2%	38.7%	83.7%	87.8%	89.8%****
	Mammies require the FSWs to drink alcohol	46.3%	20.0%	62.8%	65.8%	83.3%****
	Mammies have the quota on alcohol for the FSWs	11.0%	6.5%	12.3%	12.2%	23.3%****
Institutional practices	Part of my work is to drink with clients	57.4%	24.7%	79.2%	83.7%	90.0%****
	Drinking during working time	47.7%	18.0%	67.8%	71.5%	77.8%****
	FSWs will gain a percentage from the sales of alcohol	14.1%	8.6%	17.2%	17.1%	22.2%****
Risk perceptions	Drink will make clients happier	54.3%	27.9%	72.8%	74.0%	83.3%****
	Making more money by drinking	32.4%	14.8%	40.2%	54.1%	57.3%****
	Clients will give the FSWs tips for drinking with them	55.4%	67.8%	82.9%	77.8%	53.5%****
Peer norms	At least half of the FSWs they know...					
	Drink alcohol	60.4%	33.0%	78.5%	85.4%	91.1%****
	Become intoxicated	32.5%	13.2%	41.9%	51.6%	65.9%****
	Drink with other clients	51.3%	21.6%	69.7%	80.5%	87.6%****

FSWs = female sex workers.

* $p < .05$. ** $p < .01$. *** $p < .001$. **** $p < .0001$.

alcohol-serving practices of the venues and the various risk levels of alcohol use among FSWs. The finding that alcohol use was significantly associated with the alcohol-serving practices of commercial sex venues is consistent with global literature (Agha and Nchima 2004; Li et al. 2010a; Yadav et al. 2005). Compared to women in other occupations as well as the general population of China (Tomasson et al. 2004; Xiang et al. 2009), FSWs in the current study had much higher rates of alcohol use. Our findings also confirm the importance of a number of social environmental correlates that were related to FSWs' drinking behaviours. These findings indicate alcohol use is a major health concern for FSWs, and a call for effective interventions should go beyond individual FSWs to address structural-level determinants of alcohol use among FSWs.

The data in the current study suggested that clients play an important role in FSWs' drinking behaviours. For instance, direct pressure from clients is one of the most frequently reported reasons (65.2%) for alcohol use among FSWs in the current study. Similar results were also found in studies conducted in both developed and developing countries (Gossop et al. 1995; Nishigaya 2002). A study conducted in Cambodia showed clients played an important role in both physically and monetarily forcing FSWs to use alcohol during their sexual practice (Nishigaya 2002). Such findings

Table 4. Multivariate regression on association between the pro-alcohol-use social environment and alcohol use

	Problematic Alcohol Use ^a (aOR, 95% CIs)	P-values
Alcohol-serving venues ^b	5.96 (3.49, 10.17)	.00
Pro-alcohol-use social environment		
Institutional norms	1.28 (1.00, 1.65)	.06
Institutional practices	1.40 (1.06, 1.85)	.02
Risk perceptions	1.35 (1.05, 1.74)	.02
Peer norms	1.26 (1.02, 1.56)	.04
Demographic information		
Age	1.00 (0.97, 1.05)	.77
Marital status	0.99 (0.59, 1.65)	.95
Income	1.03 (0.96, 1.11)	.46
Education	1.19 (0.83, 1.70)	.35

^aOR = adjusted odds ratio; CI = confidence interval; KTVs = karaoke.

^bProblematic alcohol use in the current study employed a cut-off point of 8 of AUDIT scores: AUDIT score <8 points was non-problematic alcohol use; AUDIT score ≥8 points was problematic alcohol use.

^cAlcohol-serving venues in the current study included restaurants, bars, nightclubs and KTVs; nonalcohol-serving venues included mini-hotels, streets, massage parlours, hair salons and saunas.

suggested that the interventions involving clients of FSWs could be an effective strategy in reducing alcohol-use-associated commercial sex.

Furthermore, our data revealed gatekeepers (e.g., mammy, manager, and owner) who supervise FSWs at commercial sex venues played a critical role in FSWs' drinking behaviours. This finding is consistent with existing studies indicating influential impacts of gatekeepers on venue-based FSWs' sexual behaviours and alcohol use (Li et al. 2010b; Hong et al. 2008; Morisky et al. 2006; Yang et al. 2005). In the current study, nearly half of the FSWs reported drinking alcohol at the request of their mummies or other gatekeepers. As the key persons who provide employment opportunities, business connections and possibly safety and protection for FSWs, the mammy or other gatekeepers may have a direct impact on alcohol use among FSWs, especially at venues where alcohol sales are a significant source of income for the venues or key stakeholders (e.g., mammy, FSWs). In addition, given the high mobility of FSWs, training for gatekeepers may be a feasible and sustainable strategy for reducing alcohol-use problems among this high-risk population. Therefore, interventions targeting gatekeepers could be critical for changing drinking norms as well as establishing an alcohol risk reduction working environment for FSWs.

Our data revealed that both institutional norms and institutional practices are intricately related to alcohol-use problems in venues where FSWs work. More than half of the FSWs reported that part of their work was to drink with clients, or that they could drink at work. Alcohol use has become part of the routine of daily work and an occupational risk factor for some FSWs. Such institutional norms and practices have shaped current alcohol consumption patterns among FSWs in China. Consistent with global literature regarding the positive effect of peer norms on alcohol use among general populations (Brennan et al. 1986), our data also showed that peer norms play a considerable role in alcohol use among FSWs.

In the current study, some FSWs in the nonalcohol-serving venues reported on-job alcohol use. For instance, 9.4% (25/267) of FSWs who work in saunas reported their venues were served alcohol. There are two possible explanations for this finding. First, some nonalcohol-serving venues in fact did serve alcohol without permits or allowed clients to bring alcoholic beverages to the venues. Second, some FSWs recruited from nonalcohol-serving venues actually worked in multiple venues that included alcohol-serving venues. Therefore, their reporting of on-the-job alcohol use might not necessarily reflect only the alcohol use practices of the venues where they were recruited. In addition, our findings showed that women who worked in nonalcohol-serving venues earned significantly higher incomes than those who worked in alcohol-serving venues. It is possible that the job description of FSWs who worked in alcohol-serving venues tended to involve more activities related to drinking other than having sex with clients, whereas women who worked in nonalcohol-serving venues tended to have commercial sex as their primary business focus. As a result, income disparities between two types of venues have been detected.

There are several limitations in the current study. First, our study was conducted in Guangxi, a multi-ethnic region of China. The findings may not be generalizable to other areas of China. Second, the nature of cross-sectional design prevents us from making a causal conclusion regarding the association between the pro-alcohol-use social environment and alcohol use among the FSWs. Future studies with a longitudinal design are needed to examine the temporal relationships. Third, the current study may be subject to self-selection bias because FSWs who drank may choose to work at alcohol-serving venues, and the presence of a pro-alcohol-use social environment may not shape their drinking behaviours. However, for most FSWs, they may not have much “choosing power” in terms of selecting work places, given their stigmatized social status and the illegality of commercial sex in China. Fourth, due to the illegal status and highly stigmatized and marginalized nature of sex work in China, our data were subject to volunteer bias and socially desirable reporting. Fifth, the sample in the current study was recruited through venue-based sampling, which might have resulted in under-sampling FSWs who work on the streets or “freelance” (less than 5%). Finally, some measures of the pro-alcohol social environment had relatively low consistency estimates.

Despite these limitations, the findings of the current study have several important implications for future alcohol-use risk reduction interventions among FSWs in China and other developing countries. First, the high rates of alcohol use among FSWs call for effective alcohol risk reduction efforts among this at-risk population, especially among FSWs who work in alcohol-serving venues. Work-related alcohol use can be considered as one of the occupational hazards for FSWs. Alcohol-use screening protocols should be incorporated with existing healthcare practices in order to address such a prevalent and severe problem among FSWs. Accessible and affordable alcohol-risk reduction health services are necessary for this at-risk and marginalized population. Second, future health promotion efforts should focus on changing social norms as well as reducing peer influence. Interventions that change social norms to reduce alcohol consumption among vulnerable populations have proved to be effective in the United States and other Western countries (Borsari and Carey 2001), and these interventions can be culturally adapted for FSWs in China and other developing countries. In addition, considering alcohol-use problems among FSWs varied with different demographic characteristics (e.g., age, types of working environments, residency), these interventions need to be tailored to meet the unique needs of different subgroups of FSWs (Hong et al. 2008). Third, alcohol risk reduction intervention programs also need to take FSWs’ socially marginalized status into consideration. If women cannot afford to lose their clients by refusing to drink alcohol, or they are under threat of violence, they may have no choice in deciding whether to drink with their clients or not. Without taking the power inequality associated with commercial sex into consideration, alcohol risk reduction programs among FSWs may not be effective. Empowerment for these socially marginalized women would be a promising strategy. Fourth, considering social contexts of commercial sex in China, a venue-based multi-level alcohol risk reduction intervention approach may work effectively. Our data revealed multiple factors of social environment that may shape FSWs’ drinking behaviours, such as availability of alcohol, pressure from gatekeepers, clients’

demands, peer influence and social norms of drinking. Furthermore, these factors interacted in venues where FSWs work. Such findings suggest that effective interventions should incorporate physical, social and policy elements. Interventions addressing individual levels (personal knowledge, risk perceptions, refusal and negotiation skills) as well as environmental and structural levels (discouraging alcohol use in these establishments, training gatekeepers to communicate with their employees regarding their risks, and delivering prevention messages to both FSWs and their clients in the venues) targeting all stakeholders including FSWs, gatekeepers and clients in these venues can create a supportive social and working environment for the vulnerable group and reduce their alcohol use as well as related health problems.

In summary, our findings underscore the role of the pro-alcohol-use social environment in alcohol-use problems among FSWs in China. Culturally appropriate venue-based multi-level alcohol risk reduction interventions are urgently needed to target both individual alcohol use and the pro-alcohol-use social environment associated with commercial sex. Future efforts to establish an alcohol risk reduction environment will help FSWs to reduce their alcohol use as well as related health problems.

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References

- Agha, S. and M.C. Nchima. 2004. "Life-Circumstances, Working Conditions and HIV Risk among Street and Nightclub-Based Sex Workers in Lusaka, Zambia." *Culture, Health and Sexuality* 6(4): 283–99.
- Ahern, J., S. Calea, A. Hubbard, L. Midanik and S.L. Syme. 2008. " 'Culture of Drinking' and Individual Problems with Alcohol Use." *American Journal of Epidemiology* 167(9): 1041–9.
- Ao, T. T., N. Sam, I. Kiwelu, A. Mahal, S.V. Subramanina, G. Wyshak and S. Kapiga. 2011. "Risk Factors of Alcohol Problem Drinking among Female Bar/Hotel Workers in Moshi, Tanzania: A Multi-level Analysis." *AIDS and Behavior* 15(2): 330–9.
- Babor, T.F., J.C. Biddle-Higgins, J.B. Saunders and M.G. Monteiro. 2001. "AUDIT: The Alcohol Use Disorders Identification Test: Guidelines for Use in Primary Health Care." Geneva: World Health Organization.
- Beck, K.H., A.M. Arria, K.M. Caldeira, K.B. Vincent, K.E. O'Grady and E.D. Wish. 2008. "Social Context of Drinking and Alcohol Problems among College Students." *American Journal of Health Behavior* 32(4): 420–30.
- Brennan, A.F., S. Walfish and P. AuBuchon. 1986. "Alcohol Use and Abuse in College Students. II. Social/Environmental Correlates, Methodological Issues, and Implications for Intervention." *The International Journal of Addiction* 21(4–5): 475–93.
- Chersich, M.F., S.M. Luchters, I.M. Malonza, P. Mwarogo, N. King'ola and M. Temmerman. 2007. "Heavy Episodic Drinking among Kenyan Female Sex Workers Is Associated with Unsafe Sex, Sexual Violence and Sexually Transmitted Infections." *International Journal of STD and AIDS* 18(11): 764–9.
- de Graaf, R., I. Vanwesenbeeck, G. van Zessen, C. Straver and J. Visser. 1995. "Alcohol and Drug Use in Heterosexual and Homosexual Prostitution, and Its Relation to Protection Behaviour." *AIDS Care* 7(1): 35–47.
- Fang X., X. Li, H. Yang, Y. Hong, R. Zhao, B. Dong et al. 2007. "Profile of Female Sex Workers in a Chinese County: Does It Differ by Where They Came from and Where They Work?" *World Health & Population* 9(1): 46–64. Retrieved February, 14, 2011. < <http://www.longwoods.com/content/18695>>.
- Gao, B. 2000. "AUDIT Test for Workers in Winery." *Occupation and Health* 4: 34–5 [in Chinese].
- Gossop, M., B. Powis, P. Griffiths and J. Strang. 1995. "Female Prostitutes in South London: Use of Heroin, Cocaine and Alcohol, and Their Relationship to Health Risk Behaviours." *AIDS Care* 7(3): 253–60.

- Gruenewald, P.J., L. Remer and R. Lipton. 2002. "Evaluating the Alcohol Environment: Community Geography and Alcohol Problems." *Alcohol Research and Health* 26(1): 42–8.
- Guangxi Center for Disease Control and Prevention. 2009. *Update on HIV/AIDS Epidemic in Guangxi*. Guilin, Guangxi.
- Hong, Y., X. Fang, X. Li, Y. Liu and M. Li. 2008. "Environmental Support and HIV Prevention Behaviors among Female Sex Workers in China." *Sexually Transmitted Diseases* 35(7): 662–7.
- Hong, Y. and X. Li. 2008. "Behavioral Studies of Female Sex Workers in China: A Literature Review and Recommendation for Future Research." *AIDS and Behavior* 12(4): 623–36.
- Hong, Y., X. Li, X. Fang and R. Zhao. 2007. "Depressive Symptoms and Condom Use with Clients among Female Sex Workers in China." *Sexual Health* 4(2): 99–104.
- Huang, Y., G.E. Henderson, S. Pan and M. S. Cohen. 2004. "HIV/AIDS Risk among Brothel-Based Female Sex Workers in China: Assessing the Terms, Content, and Knowledge of Sex Work." *Sexually Transmitted Diseases* 31(11): 695–700.
- Kalichman, S.C., L.C. Simbayi, M. Kaufman, D. Cain and S. Jooste. 2007. "Alcohol Use and Sexual Risks for HIV/AIDS in Sub-Saharan Africa: Systematic Review of Empirical Findings." *Prevention Science* 8(2): 141–51.
- Kumar, M. 2003. *A Rapid Situation Assessment of Sexual Risk Behaviour and Substance Use among Sex Workers and Their Clients in Chennai (Madras), South India*. Retrieved August 5, 2011. <http://www.who.int/entity/mental_health/evidence/sexual_behaviour_assessment_chennai.pdf>.
- Li, B., Y. Shen, B. Zhang, X. Zheng and X. Wang. 2003. "The Test of AUDIT in China." *Chinese Mental Health Journal* 17(1): 74.
- Li, Q., X. Li and B. Stanton. 2010a. "Alcohol Use in the Context of Commercial Sex: An Integrated Review of Global Literature." *Alcohol and Alcoholism* 45(2): 188–99.
- Li, Q., X. Li, B. Stanton, X. Fang and R. Zhao. 2010b. "A Multilevel Analysis of Gatekeeper Characteristics and Consistent Condom Use among Establishment-Based Female Sex Workers in Guangxi, China." *Sexually Transmitted Diseases* 37(11): 700–5.
- Morojele, N.K., M.A. Kachieng'a, E. Mokoko, M.A. Nkoko, C.D. Parry, A.M. Nkowane et al. 2006. "Alcohol Use and Sexual Behaviour among Risky Drinkers and Bar and Shebeen Patrons in Gauteng Province, South Africa." *Social Science and Medicine* 62(1): 217–27.
- Morisky, D.E., C. Chiao, K. Ksobiech and R. Malow. 2010. "Reducing Alcohol Use, Sex Risk Behaviors, and Sexually Transmitted Infections among Filipina Female Bar Workers: Effects of an Ecological Intervention." *Journal of Prevention & Intervention in the Community* 38(2): 104–17.
- Nishigaya, K. 2002. "Female Garment Factory Workers in Cambodia: Migration, Sex Work and HIV/AIDS." *Women & Health*, 35(4): 27–42.
- Potterat, H.H., D.D. Brewer, S.Q. Muth, R.B. Rothenberg, D.E. Woodhouse, J.B. Muth et al. 2004. "Mortality in a Long-term Open Cohort of Prostitute Women." *American Journal of Epidemiology* 159(8): 778–85.
- Roger, S.J., L. Ying, T.X. Xin, K. Fung and J. Kaufman. 2002. "Reaching and Identifying the STD/HIV Risk of Sex Workers in Beijing." *AIDS Education and Prevention* 14(3): 217–27.
- Saunders, J.B., O.G. Aasland, T.F. Babor, J.R. de la Fuente and M. Grant. 1993. "Development of the Alcohol Use Disorders Identification Test (AUDIT): WHO Collaborative Project on Early Detection of Persons with Harmful Alcohol Consumption – II." *Addiction* 88(6): 791–804.
- Shuper, P.A., M. Neuman, F. Kanteres, D. Baliunas, N. Joharchi and J. Rehm. 2010. "Causal Considerations on Alcohol and HIV/AIDS – A Systematic Review." *Alcohol and Alcoholism* 45(2): 159–66.
- Stockwell, T. and T. Gruenewald. 2001. "Control on the Physical Availability of Alcohol." In N. Heather, T.J. Peters and T. and Stockwell, eds., *International Handbook of Alcohol Dependence and Problems* (pp. 699–720). New York: John Wiley and Sons.
- Tomasson, K., H. Gunnarsdottir, G. Rafnsdottir and B. Helgadóttir. 2004. "Correlates of Probable Alcohol Abuse among Women Working in Nursing Homes." *Scandinavia Journal of Public Health* 32(1): 47–52.
- VanLandingham, M.J., S. Suprasert, W. Sittitai, C. Vaddhanaphuti and N. Grandjean. 1993. "Sexual Activity among Never-Married Men in Northern Thailand." *Demography* 30(3): 297–313.
- World Health Organization. 2001, July. *Sex Work in Asia*. World Health Organization Regional Office for the Western Pacific. Retrieved September 7, 2011. <http://www.wpro.who.int/entity/hiv/documents/docs/Sex_Work_in_Asia_July2001.pdf>.
- World Health Organization. 2008, March 28. *Strategies to Reduce the Harmful Use of Alcohol*. Sixty-first World Health Assembly. Retrieved September 8, 2011. <http://www.who.int/gb/ebwha/pdf_files/A61/A61_13-en.pdf>.

Wojcicki, J. 2002. " 'She Drank His Money': Survival Sex and the Problem of Violence in Taverns in Gauteng Province, South Africa." *Medical Anthropology Quarterly* 16(3): 267–93.

Xiang, Y.T., X. Ma, J.Y. Lu, Z.J. Cai, S.R. Li, Y.Q. Xiang et al. 2009. "Alcohol-Related Disorders in Beijing, China: Prevalence, Socio-demographic Correlates, and Unmet Need for Treatment." *Alcoholism: Clinical and Experimental Research* 33(6): 1111–8.

Yadav, G., R. Saskin, E. Ngugi, J. Kimani, F. Keli, K. Fonck et al. 2005. "Associations of Sexual Risk Taking among Kenyan Female Sex Workers after Enrollment in an HIV-1 Prevention Trial." *Journal of Acquired Immune Deficiency Syndromes* 38(3): 329–34.

Yang, H., X. Li, B. Stanton, X. Chen, H. Liu, X. Fang et al. 2005. "HIV-Related Risk Factors Associated with Commercial Sex among Female Migrants in China." *Health Care for Women International* 26(2): 134–48.

Preparing for National Implementation of an Evidence-based, Effective HIV Prevention Program among Bahamian Sixth-Grade Students

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Abstract

Using data from the preparatory phase prior to national implementation of an effective HIV prevention program (Focus on Youth in the Caribbean; FOYC) in all Bahamian government sixth-grade classes, we describe (1) actual FOYC implementation, (2) factors that influenced implementation, and (3) the relationship of implementation with intervention outcome. Six elementary schools (with 17 grade six classrooms) were selected to participate in the preparatory phase. The 17 teachers were invited to attend a training workshop, coordinate administration of questionnaires to the students, teach the 10 sessions of FOYC and complete self-assessment checklists. A total of 395 students submitted baseline and 311 students submitted year-end questionnaires. Thirteen teachers initiated FOYC; five completed all 10 sessions. Implementation of FOYC was not related to teacher FOYC workshop experience but did cluster by school. There were significant positive correlations between improved student knowledge of HIV/AIDS, protective health skills, perceived parental monitoring and reduced risk behaviours with the number of FOYC sessions delivered. Implementation was impeded by logistics issues, structural issues with the measures, and comfort-level issues, most of which can be addressed for national implementation. Degree of FOYC implementation is correlated with positive student outcomes.

Introduction

The field of human immunodeficiency virus (HIV) prevention has advanced considerably over the last several decades. Forty-one “best evidence” effective HIV prevention programs have been identified by the Centers for Disease Control and Prevention’s (CDC) Prevention Synthesis Project (CDC 2009). Our increased understanding of the processes of *diffusion* and *dissemination* of effective behavioural interventions has led to an increased recognition of the need to focus on the related but unique issues of

implementation of effective interventions (Dearing 2008; Green et al. 2009). Toward this end, another program within the CDC, the “Diffusion of Effective Behavioral Interventions” (DEBI) project, selected “best evidence programs” and packaged them to enable communities to implement them in a fashion most likely to retain their effectiveness (CDC 2008; Dworkin et al. 2008; Lyles et al. 2007).

One of the DEBI programs is “Focus on Youth with Informed Parents and Children Together” (FOY with ImPACT). As the DEBI project is committed to implementing effective programs in areas most likely to benefit from effective HIV prevention efforts, the US researchers who developed FOY with ImPACT have been collaborating with researchers from the Bahamian Ministry of Health (MOH) and Ministry of Education (MOE) to adapt the intervention for use in Bahamian government schools.

It has been reported that The Bahamas, with an estimated population of 353,658 individuals on over 700 islands, has the highest estimated adult HIV prevalence rate (3%) in the Caribbean (The Joint United Nations Program on HIV/AIDS; UNAIDS 2010). Heterosexual activity is the predominant mode of transmission. The Bahamas has focused considerable resources toward decreasing the epidemic; in 2010 there were only 59 AIDS-related deaths in The Bahamas, the lowest number since the beginning of the epidemic. However, the epidemic has been especially prominent among young adults; 57% of non-AIDS HIV cases are among individuals aged 15 to 34 years, who represent less than 20% of the population. HIV is the leading cause of death among young adults aged 25 to 44 years in The Bahamas (Maura 2011; MOH 2011; UNAIDS 2010;).

For more than ten years, the US–Bahamian team evaluated the Bahamian adaptation of FOY (a ten-session – plus two booster sessions – adolescent HIV prevention intervention entitled “Focus on Youth in The Caribbean” [FOYC] and a one-hour parental monitoring intervention entitled “Caribbean Informed Parents and Children Together” [CImPACT]). A randomized, controlled, three-celled effectiveness trial involving 15 elementary schools in The Bahamas was conducted. Based on the effectiveness of the intervention through 36 months, the MOE decided to incorporate FOYC into the sixth-grade curriculum within the government school system (Deveaux et al. 2011).

The need to move science to practice has inspired countless publications and serves as the foundation for the National Institutes of Health (NIH) Roadmap Initiative (Zerhouni 2006, 2007). The principle focus of implementation science is on the process of delivery and how this process affects expected outcomes (based on prior effectiveness research) (Dearing 2009). Implementation science may occur in an experimental setting but may also be conducted during natural or real-life implementation. National implementation of an evidence-based behavioural intervention offers a unique opportunity to contribute to the emerging field of behavioural implementation science (McKleroy et al. 2006; Rogers 1995). Given the scope of a national implementation effort, the process generally entails several phases. Implementation research from one phase may be used to inform implementation efforts in a subsequent phase.

Factors Influencing Fidelity of Implementation

Fidelity of behavioural implementation refers to the degree to which program implementers (“trainers” or, in the current situation, grade six teachers) implement programs and implement them as intended by the program developer (in this case, the developers of FOYC) (Dearing 2009). Dating back at least to the mid-1970s with the Rand Report entitled “Implementation of Educational Innovation” (Berman and McLaughlin 1976), concerns have been raised regarding the fidelity of implementation; the consensus of multiple evaluations of implementation of education and behavioural interventions is that some degree of alteration is unavoidable (Bell et al. 2007; Bellg et al. 2004; Dusenbury et al. 2003; Galbraith et al. 2009; Hallfors and Godette 2002; Ringwalt et al. 2004; Rohrbach et al. 2005). In describing the literature regarding implementation of behavioural interventions, Rohrbach et al. (2005) observed:

Previous research has shown that decisions to adopt, or initiate the use of, innovative programs and practices in schools are often made by school boards, and upper- and mid-level school

district administrators.... In early stages of the process, teachers may give their opinions about the proposed program, but in general they are not the ultimate decision makers about whether the program will be adopted across the school district or within the school. However, when it comes to program implementation, most teachers have considerable autonomy regarding what goes on in their own classroom. Thus, once a school district has adopted a new curriculum, it is typically the teachers who decide whether and how it is actually used (Rohrbach et al. 2005: 515).

Ringwalt and colleagues (2004) reported that among a representative sample of US teachers, 79.8% reported adapting their prevention curricula.

The NIH Behavior Change Consortium has identified five areas to consider in conceptualizing *treatment fidelity* in conducting research: study design, training providers, delivery of treatment, receipt of treatment and enactment of treatment skills (Bellg et al. 2004). These factors can be grouped according to those which potentially could be affected during the training process, those that may be affected by fixed characteristics of the trainers (teachers) or the respondents, and those associated with the intervention itself.

Factors That Could Be Modified During Training

Potentially intervenable characteristics that have been identified as associated with increased fidelity include those that potentially increase trainer confidence, perceived relevance, ownership and relative benefit. Those factors that could be altered and might result in increased *confidence* include (1) intensive in-service training that follows a set curriculum (compared to no training, training that is ad hoc or variable in nature, non-participatory training and/or brief training) (Berman and McLaughlin 1976; Dusenbury et al. 2003; Kelly et al. 2000; Perrin et al. 2006), (2) less curricular discretion (e.g., a more detailed script or lesson plan) (Dusenbury et al. 2003; Perrin et al. 2006), and (3) practice in skills necessary to teach the curriculum and to use interactive methods (Fixsen et al. 2005). Those factors that potentially result in increased *relevance* include a perception that the focus of the intervention applies to the community in which the intervention is being adopted (Rohrbach et al. 1993). The extent to which relevance is more local (as opposed to a global or national relevance), this factor may be a stronger motivator of fidelity. Related to relevance, *ownership* appears to be important (specifically, a sense on the part of the trainees that the intervention addresses a local issue *and* that they or their community had significant input into the development of the intervention). Also relevant to the question of benefit is the perception of the effectiveness of currently available curricula (in this case HIV prevention); if the existing curriculum is perceived as adequate, substitution with a new one is likely to be more difficult (Dusenbury et al. 2003).

Other Characteristics of the Teachers That May Influence Fidelity

Characteristics of the teacher and teaching environment have also been shown to increase fidelity. Examples include shorter duration of time as a teacher, initial feelings about the existing curriculum (in this case the existing HIV prevention program in the schools), and an overall positive attitude toward prevention in general (Dusenbury et al. 2003; Parcel et al. 1995). Likewise, organizational characteristics including receptivity to innovation and decreased turmoil have been associated with increased fidelity (Gottfredson 1984; Wandersman et al. 1988). Evidence that local authority figures (e.g., the school principal and guidance counsellors) support the importance of the intervention being adopted serves to indicate the relative *benefit* to be derived from teaching this curriculum as opposed to more time spent on another subject (such as math or reading) (Dusenbury et al. 2003).

Factors Associated with the Intervention That May Influence Fidelity

Complex programs are less likely to be successfully implemented; as a corollary, programs that are packaged and present the materials in a straightforward manner are more faithfully executed (Dusenbury et al. 2003). Detailed instruction manuals for the trainers increase fidelity (Bauman et al. 1991).

Evidence That Fidelity Is Associated with Sustained Effectiveness

One of the most comprehensive examinations of fidelity and effectiveness to date was conducted by Blakely et al. (1987), assessing seven nationally disseminated education and criminal justice projects. Results indicated that implementations conducted with high fidelity were more effective than low-fidelity implementations. Blakely et al. measured program fidelity as the proportion of finite program components that were implemented and developed detailed process measures that allowed observation of specific program components to measure adoption or implementation by each site to determine fidelity. Multiple methods, including extensive interviews and in-person observations were utilized. Validity was analyzed by comparing data across the various measures obtained. Multiple sources of data were available for 75% of items at each site. Blakely et al. found an exact-agreement convergence rating of .96 for the between-source comparison strategy summed across all 70 sites. They found that high-fidelity adopters tended to be more effective than implementers with low-fidelity, local additions to the model tended to enhance effectiveness, and modifications not distracting from fidelity were unrelated to effectiveness.

As significant as this research is, there are several reasons why additional research on the relationship between fidelity of HIV prevention intervention delivery and HIV risk reduction outcomes is still critically important. As the researchers themselves describe, the outcomes data were left up to the sites to describe and provide and thus were inconsistent in nature and of variable quality. The procedure to examine the relationship between outcomes and fidelity was limited to a ranking procedure, and the relationship itself was suggestive rather than definitive. Finally, both the content and the target audiences of the interventions assessed in the Blakely study differ from HIV prevention among early adolescents.

In summary, the national implementation of FOYC throughout the sixth-grade classes among all 78 of the government primary schools in The Bahamas affords HIV prevention efforts a unique opportunity to explore issues arising in the implementation of an effective intervention. This is also an opportunity to increase our understanding of factors affecting implementation and to test the relationship between implementation and replication of intervention outcomes. The data and observations acquired during the preparatory phase described herein offer guidance both for the wider Bahamian national implementation effort to follow and for the general field of implementation science.

Materials and Methods

In the spring of 2010, the MOE selected six elementary schools to participate in the first phase of national implementation. Four of the schools were located in New Providence (NP) (the four schools are heretofore referred to as NPA, NPB, NPC and NPD) and two on one of the neighbouring islands, locally referred to as the Family Islands (heretofore referred to as FI).

The six selected schools housed 17 sixth-grade classes and teachers: NPA, five teachers; NPB, four teachers; NPC, three teachers; NPD, three teachers; and the two schools from the FI each had one teacher. NPB and NPC had participated in the original sixth-grade effectiveness study and had been randomized to FOYC; NPD had also participated in the prior study but had been randomized to the control condition. NPA and the two NI schools had not been in the prior study.

The research protocol was approved by the Wayne State University Human Investigation Committee and the Institutional Review Board of the Bahamian Public Hospitals Authority.

Guiding Theoretical Model

The national HIV prevention intervention in the Bahamas is guided by social cognitive theory, which provides a conceptual framework for understanding human behavioural change. The theory posits that human behaviour is the product of the dynamic interplay of personal factors, behaviour and environmental influences (Bandura 1986). Behaviour can be changed through new learning experiences, guidance in protective perceptions and support for the development of capacities (Glanz et al. 2008). In the context of HIV prevention and sexual risk reduction, prevention knowledge and skills to exercise self-protective behaviour are necessary but not sufficient for behaviour change.

Behavioral change is mediated by a process of cognitive appraisal by which people integrate knowledge and outcome expectancies from a judgment of their ability to perform the protective behaviour (e.g., practice abstinence). Change in HIV-related behaviours results from the joint functions of increased HIV prevention knowledge and skills, parental monitoring and well-established self-efficacy. The model has been empirically confirmed in multiple populations and communities (CDC 1999; O' Leary et al. 2000).

Teacher Training

The MOE established a teacher training workshop format following the protocol utilized during the effectiveness trial of FOYC and used by the DEBI program to train future interventionists in the delivery of FOY. The teacher training covered (1) a review of the need for HIV prevention in The Bahamas, (2) an overview of FOYC, including research showing its effectiveness, (3) a walk-through of each of the ten sessions of FOYC with full participation and “teach-backs” of the activities considered to be critical to the success of FOYC, and (4) a didactic question-and-answer period regarding methods of protection. All 17 teachers (regardless of attendance at a workshop) were given a copy of the FOYC teacher training manual.

Five of the schools (both of the FI schools and three of the four NP schools) were represented at the training by seven teachers (see Table 1). Among the ten remaining teachers scheduled to participate in the FOYC national implementation, six had attended a prior FOYC workshop and participated in the original FOYC training as part of the effectiveness evaluation; four received no training.

Table 1. Preparation for teaching Focus on Youth in the Caribbean (FOYC) among the 17 sixth-grade teachers in Phase One of national implementation

Individual schools	Number of teachers who were:		
	Present at FOYC Workshop	Received prior FOYC Training	Received no FOYC Training
New Providence (NP) Schools			
NPBa	2	1	1
NPDa	1	1	1
NPCb	0	2	1
NPA	2	2	1
Family Island (FI) Schools			
#FI#1	1	0	0
#FI#2	1	0	0

^aSchool was part of original FOYC study and was randomized to receive FOYC; ^bSchool was part of original FOYC study and was randomized to receive the control condition.

Two team members (US and Bahamian) were present for observations. Detailed notes were maintained regarding each activity covered during the training.

Expectations of the Teachers in the Classrooms

The teachers were told by the MOE that they would be expected to (1) coordinate the administration of an anonymous baseline knowledge, skills and practice questionnaire to their sixth-grade students at the beginning of the school year (prior to teaching FOYC) and again at the end of the year, (2) teach all ten sessions of FOYC, (3) complete a self-assessment checklist after delivering each session

and permit observer assessments as described in next section, (4) complete a pre- and post-implementation questionnaire assessing factors contributing to implementation and fidelity (see next section), and (5) communicate with project staff regarding completion or lack thereof of these activities.

Self-assessments and Observer Assessments

A critical component of implementation research involves assessing whether the curriculum was taught and the extent to which it was consistent with the training components and with the form of delivery that was originally found to be effective. Implementation “fidelity” was to be assessed by both a teacher self-assessment and independent observer assessments of two of the ten sessions taught by each teacher. These assessments were conducted using a pre-formatted “checklist” (yes/no and multiple-choice format) and a written explanation of observations/self-reflections. These forms were derived from the measures successfully used in the prior FOYC effectiveness trial and used in the DEBI rollout of FOY.

In order to assess the factors described earlier in this manuscript that prior research has suggested may influence likelihood of implementation (Bauman et al. 1991; Berman and McLaughlin 1976; Dusenbury et al. 2003; Perrin et al. 2006), each teacher was asked to complete a 14-item pre- and post-implementation survey regarding their perceptions of the importance and appropriateness of the contents of FOYC for sixth-grade youth as well as their ability to teach it, the importance of the curriculum compared to other topics, their comfort level with FOYC, and so forth. Finally, a brief, one-on-one open-ended interview was conducted with each teacher regarding his or her experiences with implementation (or lack thereof) of FOYC.

Student Questionnaires

To assess student response to the intervention, a shortened version the Bahamian Youth Health Risk Behavioral Inventory (BYRHB) (Chen et al. 2011; Deveaux et al. 2011;) was administered at the beginning of sixth grade before delivery of FOYC and at the end of sixth grade, in the classroom by the sixth-grade teachers (or their surrogates). The questionnaires were anonymous and confidential. An 18-item scale including true and false statements was used to assess level of knowledge regarding HIV/AIDS. Correct responses were scored 1 and incorrect 0, resulting in a mean score of 0–18 for each participant. Knowledge of specific skills regarding protected sex were assessed using a published skills checklist scale whose internal consistency, construct validity and criterion-related validity have been validated through comparison of responses to a knowledge questionnaire and an actual demonstration of condom-use skills (Stanton et al. 2009). The checklist scale includes correct steps and incorrect steps; correct responses were scored 1 and incorrect 0.

A six-items scale was used to assess self-efficacy regarding protected sex; agreement was measured through a five-point Likert scale (1 = strongly disagree to 5 = strongly agree). Intentions/expectations regarding several risk and protective behaviours (including sexual intercourse) in the next six months were assessed by self-reported likelihood (1 = very unlikely to 5 = very likely). For each of these categories, a mean score was derived using individuals’ responses to the items, with higher scores indicating higher levels of knowledge of protective skills, self-efficacy and behavioural intentions, respectively. The students were asked if they had engaged in certain risk behaviours (including sexual intercourse in the last six months). Youth were administered Silverberg’s six-item Parental Monitoring Scale, in which youth perception of parental awareness of their activities along a five-point Likert scale (1 = never to 5 = always) was assessed (Silverberg and Small 1991).

Analysis

The pre-intervention/post-intervention student self-report data were entered into IBM SPSS Statistics 19. After data cleaning, the data were converted to SAS format. All the statistical analyses were performed using SAS 9.2 statistical software package (SAS Institute Inc., Cary, NC, USA).

Descriptive statistics (mean and standard deviation) of knowledge and attitudes and frequency distribution of demographics, intentions and behaviours were calculated. Baseline comparisons were

made between schools and between sexes to examine potentially significant differences at baseline, using ANOVA and student's *t*-test. When ANOVA results indicated statistical significance, post hoc comparisons using Tukey's HSD (honestly significant difference) test were made to determine which groups differed. Similar analyses were conducted for the end-of-school-year questionnaires collected. Using student's *t*-test and Pearson's χ^2 test, pre-intervention and post-intervention data were compared overall and by the number of educational sessions taught by each teacher.

To adjust for the clustering effects (classroom and/or school), the intraclass correlation coefficient (ICC) and variance inflation factor (VIF) were calculated for all outcome variables, including knowledge, attitudes, intention and behaviours (Wears 2002). ICC values ranged from 0 to 0.03. All test statistics (*t*, *F*, χ^2) were adjusted using VIFs; corresponding *p*-values to the adjusted test statistics are displayed in Tables 2 and 3.

Table 2. Teachers' assessment pre- and post-implementation of the Focus on Youth in the Caribbean (FOYC) curriculum

Teachers' Assessment	Pre-implementation	Post-implementation
Total number of teachers	5	9
Number (%) of teachers endorsing the following statements:		
Prevention programs are very important for youth	5 (100%)	9 (100%)
HIV prevention is very important for youth in general	5 (100%)	9 (100%)
HIV prevention is very important for grade 6 youth in general	5 (100%)	7 (77.8%)
HIV prevention is very important for the Bahamian community	5 (100%)	9 (100%)
"Focus on Youth" is very important for the grade 6 youth in our school	4 (80%)	7 (77.8%)
The time I spent teaching "Focus on Youth" is about the same compared to the time I spent teaching reading skills in grade 6	4 (80%)	7 (77.8%)
I feel comfortable in teaching the materials in "Focus on Youth"	3 (60%)	NA
Grade 6 students benefited very much from "Focus on Youth"	NA	6 (66.7%)

NA = not available.

Results

Implementation

Thirteen (76%) of the 17 eligible sixth-grade teachers initiated FOYC; 11 of the 13 had received training (five had attended the July workshop and six had received prior FOYC training). Five (29%) of the teachers fully implemented the ten FOYC sessions; three teachers had attended the July workshop, one had received prior FOYC training and the other had neither. All of the four teachers who did not implement FOYC had attended previous FOYC training (but not the most recent July workshop). Two of the teachers who initiated and completed all ten sessions did not complete any of the measures and did not administer the student questionnaire to their students.

Implementation clustered by school. None of the four teachers at NPB initiated FOYC, while all of the teachers in the remaining schools initiated implementation. Of the eleven teachers who initiated the classes, all three from NPD completed all ten sessions; four teachers from NPA completed > 4 sessions, and four teachers (three from NPC and one from NPA) completed two.

Teacher Assessments: Pre- and Post-implementation Surveys and Year-End Interviews (data available from the authors)

Only five teachers completed the pre-implementation survey, and all five subsequently implemented

at least the first two sessions of FOYC. Three teachers had attended a prior FOYC training workshop and had taught FOYC.

Table 3. Baseline knowledge and perceptions regarding risk and protective factors among sixth-grade students in The Bahamas

Variable	Overall	Primary Schools				adj. F	Post hoc test	Gender		adj. t
		NPB (1)	NPD (2)	NPC (3)	NPA (4)			Male	Female	
Sample size (n)	395	99	100	90	106					
Gender^a										
Male	44.6%	45.3%	46.5%	50.0%	37.5%	3.15				
Female	55.4%	54.7%	53.5%	50.0%	62.5%					
AIDS knowledge (score range 0–15)	9.15 (3.08)	10.29 (2.13)	9.43 (2.97)	8.66 (3.09)	8.20 (3.55)	6.74***	(1,3) (1,4) (2,4)	8.97 (2.95)	9.05 (3.23)	–0.20
Reproductive health skills (score range 4–15)	9.36 (1.83)	9.30 (1.77)	9.52 (1.92)	9.27 (1.90)	9.34 (1.77)	0.29		9.26 (1.87)	9.49 (1.73)	–1.08
Self-efficacy (score range 1–5)	2.34 (1.28)	2.29 (1.29)	2.55 (1.30)	2.42 (1.23)	2.11 (1.25)	1.85		2.52 (1.31)	2.31 (1.26)	1.36
Parent monitoring (score range 1–5)	4.17 (0.93)	4.03 (0.93)	4.01 (1.04)	4.36 (0.76)	4.30 (0.91)	3.32*	(2,3)	3.92 (1.02)	4.40 (0.76)	4.50***
Expectations to engage in risk behaviours^a										
Smoke marijuana ^b	2.8%	4.0%	3.0%	1.1%	2.8%	–		4.7%	1.6%	–
Drink alcohol	15.9%	15.3%	21.4%	21.6%	6.7%	6.33		22.3%	12.6%	4.17*
Involve in pregnancy	10.7%	15.2%	10.1%	12.5%	5.7%	2.97		18.9%	3.8%	15.13***
Have sex	14.0%	18.6%	15.5%	17.2%	5.8%	8.44*		23.5%	6.0%	20.78***
Have protected sex if I have sex	39.9%	45.9%	42.9%	50.6%	21.6%	19.35***		41.7%	38.1%	0.43

Note. All test statistics (*t*, *F*, χ^2) were adjusted using the variance inflation factors (VIFs).

^aPearson's χ^2 test; ^bFisher's Exact Test.

p* < .05; *p* < .01; ****p* < .001.

All five teachers reported that “prevention programs are very important for youth” and endorsed the statements that HIV prevention is “very important for youth in general,” “for grade six youth,” and for “the grade six youth in their communities.” Four teachers said that FOYC (as opposed to other HIV curricula) “is very important for the grade six students in their school,” while one said that it is “somewhat important.” Four teachers said that “the time spent teaching FOYC is about the same compared to the time spent teaching reading skills in grade six,” while one teacher (who went on to complete ≥ 4 sessions) said, “teaching FOYC is less important.” Three of the teachers (all of whom completed only two sessions) felt that they would be very comfortable teaching FOYC, while the other two (one of whom had taught four sessions and the other had taught all ten) felt that they would be “somewhat comfortable.”

Nine teachers (all from NP) completed the *post-implementation survey*; three of these had also completed the pre-implementation survey. Among the nine, two teachers completed two sessions, four teachers complete six to seven sessions and three teachers completed all ten. All endorsed the two statements that HIV prevention is “very important for youth” and for “the Bahamian community.” As well, all endorsed the importance of prevention programs in general for youth, while seven teachers said that HIV prevention programs are “very important for grade six youth in general” and for “grade six youth in their school.” The remaining two teachers responded that it is “somewhat important” for both categories (both of these teachers taught six to seven sessions of FOYC). Six teachers said that “the grade six students benefited ‘very much’ from FOYC” (two of the three who completed all ten sessions, three of the four who completed six to seven sessions, and one of the two who completed two sessions), while the remaining three said students benefited “somewhat” from it. Seven teachers said that “the time spent teaching FOYC was ‘about the same’ compared to the time spent teaching reading skills,” and two (one who taught four to six sessions and one who taught two sessions) said “teaching FOY was ‘less important.’”

Interviews were successfully conducted with 15 of the teachers, including the 11 who initiated implementation. All 11 of the implementing teachers expressed the view that the FOYC content was important. However, because the curricular material was not incorporated into the Bahamian national formal testing program, it received less emphasis in the curriculum than subjects that would be the focus of the national testing. All 11 expressed concerns that teaching FOYC required considerable preparation time compared to other subject areas. Teachers reported that preparation of the material for each session, which previously had been performed by a research project team, now resided with the teacher. Further, many of the teachers found it difficult to accommodate the presentation of the material within the allotted time frame. Three teachers expressed concern that the materials were too graphic for the youth. All of the teachers, regardless of level of FOYC training, expressed discomfort presenting the contraceptive information to grade six students. Two teachers felt that although the materials should be taught, the classroom teacher should not teach it both because of their lack of expertise and because of the discomfort the students might feel.

The four teachers at NPB who did not implement FOYC expressed commitment to the program but encountered a variety of logistic issues, including the need to replace a teacher who transferred in the fall.

Observer Assessments and Teacher Self-assessment

Scheduling the observations was problematic. Despite appointments being made on several occasions, completion of two observed sessions for all 11 classes in which implementation occurred was not possible; ultimately, one observation per class was completed for all classes. Since few teachers completed their teacher checklists, a comprehensive comparison of teacher self-report with observations was not possible, although in general the teachers appeared to be reliably reporting what they had taught.

Student Data: Pre- and Post-intervention

Baseline and year-end questionnaires were administered to the students in all 15 classrooms in the four NP schools but were not administered in the two FI schools. Among the 15 classes completing the baseline questionnaires, there were 395 students (219 females and 176 males) with a median age of 11 years. The four schools did not differ with respect to gender distribution. HIV-related knowledge varied considerably by school, with a high score of 10.29 at one school compared to a low of 8.20. As shown in Table 3, perceived parental monitoring was high overall (4.17 on a scale of 1 to 5) and reflected gender differences, with girls indicating significantly higher perceived monitoring. At baseline, the overwhelming majority of youth (370, or 94%) had not engaged in sex during the prior six months; males (17, or 10%) were more likely than females (8, or 4%; $p < .05$) to report sexual activity. There was considerable variation in anticipated involvement in risk behaviours by school.

In Table 4, we examine the pre–post test data overall and according to number of classes

completed. As shown in the first two columns, overall, AIDS/HIV knowledge and protective sexual health skills increased significantly. Intentions to use protection if a youth were to have sex increased significantly, while expectations to engage in sex did not change. Self-reported sexual activity within the last six months increased significantly. The four sets of columns to the right of the overall data display pre–post data by number of sessions of FOYC completed, including no sessions (four classes), two sessions (four classes), four to nine sessions (four classes) and all ten sessions (three classes). These data reveal a pattern of increased knowledge, protective sexual health skills and perceived parental monitoring with increased numbers of sessions. Intention to use protection if engaging in sex increased significantly among all youth in all groups, irrespective of receipt of classes. Reported expectation to consume alcohol increased significantly among youth who received four to nine sessions. Reported sexual activity in the last six months increased significantly among youth who received no, or only one or two, FOYC sessions; reported sexual activity did not increase among youth who received four or more FOYC sessions.

Discussion

The rollout of implementation of an effective HIV risk-prevention program across a nation offers a unique opportunity to both inform the science of implementation and to improve the implementation process of the national effort. The findings from the preparatory phase of national implementation in The Bahamas identified many logistic issues encountered by teachers as they attempted to implement a curriculum and employ measures that had been used previously but in a highly supported research setting and/or smaller more centralized efforts (CDC 2008; Deveaux et al. 2011). The overall low rate of full implementation (18%) is consistent with rates previously reported in the literature (Ringwalt et al. 2004).

Recommendations from the teachers and our observations have been used to modify subsequent training workshops and measures for future phases of national implementation. Moreover, the findings from this first phase that implementation is possible and can be effective in a real-world setting will be used to increase the likelihood of implementation in subsequent phases. In particular, the improvements in knowledge and skills and the suggestion of lower risk participation among youth who received more FOYC sessions should serve as encouragement to teachers in subsequent stages of national implementation to implement as much of the curriculum as possible.

The logistic issues began with workshop attendance. In contrast to the earlier effectiveness trial of FOYC in which all teachers participated in the workshops, in this first phase of national implementation only seven of the 17 teachers asked to implement FOYC attended. Likewise, in contrast to the effectiveness trial of FOYC in which all sessions of the curriculum were delivered to all classes, six of the teachers never began implementation, and only three completed all ten sessions. The teachers discussed the many implementation issues, some of which (e.g., starting too late in the year) could be easily addressed in the future. Others will require intervention from school administrators or the MOE (class cancellations, changing teachers, and/or including questions from the FOYC curriculum in the Bahamian national formal testing program) in subsequent phases. Although with reminders and prompting from the research staff, many of the teachers had completed the self-checklist in the FOYC effectiveness trial, in this real-life setting, few teachers completed it, commenting that the format was cumbersome. As a result, we have simplified the measure, employing a more user-friendly format. Finally, in response to the legitimate concerns about time required to prepare materials for teaching FOYC, the MOE has altered the manuals to reduce this time commitment.

Somewhat surprising, given the extant literature (Green et al. 2009; CDC 2008; Hallfors and Godette 2002) and our own experience with FOYC, was the lack of correlation between teacher-training workshops and delivery of FOYC. However, in view of the evidence from some studies of the importance of detailed teacher training manuals (Dusenbury et al. 2003), it is possible that since all of the teachers received a detailed teacher manual the lack of exposure to a training workshop was less important. A contrary explanation is suggested by the experience of Kelly and colleagues (2000), who found that the training workshop was less important in implementation than an ability to confer with

Table 4. Knowledge, perceptions and behaviours regarding risk and protective factors among sixth-grade students in The Bahamas at baseline and six-months' follow-up, by number of sessions of the Focus on Youth in the Caribbean (FOYC) curriculum implemented in their classes

Variable	Overall		No sessions (4 classes)		2 sessions (2 classes)		4-9 sessions (6 classes)		All sessions (3 classes)		adj. t
	Baseline	Follow-up	Baseline	Follow-up	Baseline	Follow-up	Baseline	Follow-up	Baseline	Follow-up	
Sample size (n)	395	311	99	85	103	77	93	66	100	83	
AIDS knowledge (score range 0-15)	9.15 (3.08)	10.48 (2.94)	10.29 (2.13)	9.72 (2.96)	8.63 (2.97)	10.23 (2.95)	8.16 (3.73)	11.33 (2.35)	9.43 (2.97)	10.82 (3.16)	2.59**
Protective health skills (score range 0-8)	4.89 (1.33)	5.14 (1.70)	4.82 (1.12)	4.86 (1.77)	4.97 (1.46)	5.13 (1.57)	4.99 (1.37)	5.20 (1.59)	4.79 (1.38)	5.39 (1.84)	2.20*
Parent monitoring (score range 1-5)	4.17 (0.93)	4.19 (0.79)	4.03 (0.93)	4.15 (0.78)	4.32 (0.78)	4.14 (0.87)	4.33 (0.91)	4.17 (0.82)	4.01 (1.04)	4.30 (0.70)	2.11*
Expectations to engage in risk behaviours^a											
Smoke marijuana	2.8%	0.7%	4.0%	2.4%	2.0%	0.0%	2.2%	0.0%	3.0%	0.0%	1.45
Drink alcohol	15.9%	22.1%	15.3%	13.1%	20.8%	22.4%	5.4%	25.8%	21.4%	28.1%	0.61
Involve in pregnancy	10.7%	7.8%	15.2%	7.2%	13.9%	5.2%	3.2%	9.1%	10.1%	9.8%	0.01
Have sex	14.0%	16.1%	18.6%	19.5%	16.2%	18.2%	5.4%	12.7%	15.5%	13.4%	0.15
Have protected sex if I have sex	40.0%	66.7%	45.9%	75.0%	46.4%	66.7%	22.4%	54.6%	42.9%	68.3%	11.65***
Engage in risk behaviours^a	Overall		χ^2		≤2 sessions		χ^2		≥4 sessions		χ^2
	Base-line	Follow-up	Baseline	Follow-up	Baseline	Follow-up	Baseline	Follow-up	Baseline	Follow-up	
Had sex in the last 6 months	6.4%	10.6%	4.06*	4.06*	6.5%	12.7%	3.86*	3.86*	6.2%	8.5%	0.64
Ever had anal sex	2.5%	6.9%	7.68**	7.68**	2.0%	6.3%	4.30*	4.30*	3.1%	7.6%	3.53

Note. All test statistics (t, F, χ^2) were adjusted using the variance inflation factors (VIFs).

^aPearson's χ^2 test.

* $p < .05$; ** $p < .01$; *** $p < .001$. Numbers in parentheses are standard deviations.

skilled facilitators after the workshop, during field implementation. This phenomenon may explain the strong correlations between performances within a school; for example, the six teachers who did not initiate implementation represented 100% of the teachers at two schools, and no other teacher failed to initiate implementation. The three teachers who implemented all sessions were in one school, and the teachers in the remaining three schools all implemented some but not all sessions. It may be that the teachers at “high implementing schools” used each other as encouraging think tanks to discuss problematic issues as they arose. These findings underscore the importance of encouraging teachers, whether or not they are able to attend the training workshop, to support each other and to share materials and experiences in their efforts to implement FOYC. This advice has been written in the training manual that all teachers will receive whether or not they attend the workshop. The clustering of implementation by school may also reflect the previously described positive correlation between implementation and supportive local authorities (Dusenbury et al. 2003).

The positive correlation between number of sessions of FOYC completed and changes in several key outcome indicators is encouraging. This is consistent with the finding in the Blakely study (Blakely et al. 1987), indicating a positive correlation between implementation and outcome. Given the low rate overall of intervention implementation (only three teachers among 17), this direct correlation between delivery and outcome offers an important opportunity for future training workshops. We anticipate that if teachers are confident their efforts will have an impact, they may be more likely to overcome logistic hurdles impeding delivery of FOYC in the classroom. The observation that risk behaviours increased between the pre- and post-implementation surveys is consistent with the well-documented increase in risk-taking behaviour during adolescence (Galbraith et al. 2009).

Potential limitations

This is the first phase of national implementation; in contrast to an effectiveness trial, each phase of the national implementation will be used to influence (and improve) subsequent phases. Because of the relatively low number of self-checklists returned and observations completed for the same session, we are not able to confirm the accuracy of the self-reports or to comment on whether the exercises that were completed were taught as intended by the developers.

Conclusions

The data obtained from this first phase of national implementation are being used by the MOE to inform the rollout of subsequent implementation phases in all grade six classes throughout the Bahamas. Particularly important findings from this study are the cohort (school) effect of implementation and the strong correlation between the amount of curriculum implemented and behavioural outcomes. Although the measures had been employed in a study setting previously, application in a “real life” setting in the pilot study revealed many issues that had not previously been problematic and required addressing. Prior research regarding teacher workshops and subsequent implementation success has underscored the need for more than content and exposure if teachers are expected to follow through on implementation (Deveaux et al. 2007; Fixsen et al. 2005; Joyce 1992). Given the findings from the first phase of implementation, structured work on the comfort level of teachers with the subject matter is needed in the training. In addition, efforts will be made by the MOE to afford more time during training for discussing teacher concerns about the curriculum and to provide more assistance to teachers throughout the year as they teach the curriculum. These findings underscore the unique opportunities offered by a national implementation effort to both implementation science and to the national effort itself.

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References

Bandura, A. 1986. *Social Foundations of Thought and Action: A Social Cognitive Theory*. Englewood Cliffs, NJ: Prentice-Hall.

Bauman, L.J., R.E.K. Stein and H.T. Ireys. 1991. "Reinventing Fidelity: The Transfer of Social Technology among Settings." *American Journal of Community Psychology* 19(4): 619–39.

Bell, S.G., S.F. Newcomer, C. Bachrach, E. Borawski, J.L. Jemmott, D. Morrison et al. 2007. "Challenges in Replicating Interventions." *Journal of Adolescent Health* 40(6): 514–20.

Bellg, A.J., B. Borrelli, B. Resnick, J. Hecht, D.S. Minicucci, M. Ory et al. 2004. "Enhancing Treatment Fidelity in Health Behavior Change Studies: Best Practices and Recommendations from the NIH Behavior Change Consortium." *Health Psychology* 23(5): 443–51.

Berman, P. and M. McLaughlin. 1976. "Implementation of Educational Innovation." *Education Forum* 40(3): 344–70.

Blakely, C.H., J.P. Mayer, G.G. Rand, N. Schmitt, W. Davidson, D. Roitman and J. G. Emshoff. 1987. "The Fidelity–Adaptation Debate: Implications for the Implementation of Public Sector Social Programs." *American Journal of Community Psychology* 15(3): 253–68.

Centers for Disease Control and Prevention (AIDS Community Demonstration Projects Research Group). 1999. "Community-Level HIV Intervention in Five Cities: Final Outcome Data from the AIDS Community Demonstration Projects." *American Journal of Public Health* 89(3): 336–45.

Centers for Disease Control and Prevention (CDC). 2008. "Diffusion of Effective Behavioral Interventions." Retrieved April 7, 2008. <www.effectiveinterventions.org>.

Centers for Disease Control and Prevention (CDC). 2009. *2009 Compendium of Evidence-Based HIV Prevention Interventions*. Retrieved March 2, 2009. <www.cdc.gov/hiv/topics/research/prs/evidence-based-interventions.htm>.

- Chen, X., V. Dinaj-Koci, N. Brathwaite, L. Cottrell, L. Deveaux, P. Gomez et al. 2011. "Development of Condom-Use Self-efficacy over 36 Months among Early Adolescents: A Mediation Analysis." *The Journal of Early Adolescence*. [Epub ahead of print, October 25, 2011]
- Dearing, J.W. 2008. "Evolution of Diffusion and Dissemination Theory." *Journal of Public Health Management and Practice* 14(2): 99–108.
- Dearing, J.W. 2009. "Applying Diffusion of Innovation Theory to Intervention Development." *Research on Social Work Practice* 19(5): 503–18.
- Deveaux, L., B. Stanton, S. Lunn, L. Cottrell, S. Yu, N. Brathwaite et al. 2007. "Reduction in Human Immunodeficiency Virus Risk among Youth in Developing Countries." *Archives of Pediatrics & Adolescent Medicine* 161(12): 1130–9.
- Deveaux, L.C., S. Lunn, R.M. Bain, P. Gomez, T. Kelly, N. Brathwaite et al. 2011. "Focus on Youth in the Caribbean: Beyond the Numbers." International Association of Physicians in AIDS Care. Published online Mar 23, 2011.
- Dusenbury, L., R. Brannigan, M. Falco and W.B. Hansen. 2003. "A Review of Research on Fidelity of Implementation: Implications for Drug Abuse Prevention in School Settings." *Health Education Research* 18(2): 237–56.
- Dworkin, S.L., R.M. Pinto, J. Hunter, B. Rapkin and R.H. Remien. 2008. "Keeping the Spirit of Community Partnerships Alive in the Scale Up of HIV/AIDS Prevention: Critical Reflections on the Roll Out of DEBI (Diffusion of Effective Behavioral Interventions)." *American Journal of Community Psychology* 42 (1–2): 51–9.
- Fixsen, D.L., S.F. Naoom, K.A. Blasé, R.M. Friedman and F. Wallace. 2005. *Implementation Research: A Synopsis of the Literature*. Tampa, FL: University of South Florida, Louis de la Parte Florida Mental Health Institute, The National Implementation Research Network (FMHI Publication #231).
- Galbraith, J., B. Stanton, B. Boekeloo, W. King, S. Desmond, D. Howard et al. 2009. "Exploring Implementation and Fidelity of Evidence-Based Behavioral Interventions for HIV Prevention: Lessons Learned from the Focus on Kids Diffusion Case Study." *Health Education and Behavior* 36(3): 532–49.
- Glanz, K., B.K. Rimer and K. Viswanath, eds. 2008. *Health Behavior and Health Education: Theory, Research, and Practice*, Fourth Edition. San Francisco: Jossey-Bass, Inc.
- Gottfredson, G.D. 1984. "A Theory-Ridden Approach to Program Evaluation: A Method for Stimulating Researcher–Implementer Collaboration." *American Psychologist* 39(10): 1101–12.
- Green, L.W., J.M. Ottoson, C. Garcia and R.A. Hiatt. 2009. "Diffusion Theory and Knowledge Dissemination, Utilization, and Integration in Public Health." *Annual Review of Public Health* 30: 151–74.
- Hallfors, D. and D. Godette. 2002. "Will the 'Principles of Effectiveness' Improve Prevention Practice? Early Findings from a Diffusion Study." *Health Education Research* 17(4): 461–70.
- Joyce, B. 1992. "Cooperative Learning and Staff Development: Teaching the Method with the Method." *Cooperative Learning* 12(2): 10–3.
- Kelly, J.A., T.G. Heckman, L.Y. Stevenson, P.N. Williams, T. Ertl, R.B. Hays et al. 2000. "Transfer of Research-Based HIV Prevention Interventions to Community Service Providers: Fidelity and Adaptation." *AIDS Education and Prevention* 12(5 Suppl.): 87–98.
- Lyles, C.M., L.S. Kay, N. Crepaz, J.H. Herbst, W.F. Passin, A.S. Kim et al. 2007. "Best-Evidence Interventions: Findings from a Systematic Review of HIV Behavioral Interventions for US Populations at High Risk, 2000–2004." *American Journal of Public Health* 97(1): 133–43.
- Maura, M. 2011, June 8. "AIDS-Related Deaths in the Bahamas at an 'All-Time Low'." *The Tribune*. Retrieved August 15, 2011. <http://www.tribune242.com/searchresults/06082011_EP-AIDS_news_pg5>.
- McKleroy, V.S., J.S. Galbraith, B. Cummings, P. Jones, C. Harshbarger, C. Collins et al. 2006. "Adapting Evidence-Based Behavioral Interventions for New Settings and Target Populations." *AIDS Education and Prevention* 18(4 Suppl. A): 59–73.
- Ministry of Health (MOH), Nassau, The Bahamas. The Health Information and Research Unit, 2011.
- O'Leary, A., E. Maibach, T.K. Ambrose, J.B. Jemmott and D.D. Celentano. 2000. "Social Cognitive Predictors of Sexual Risk Behavior Change among STD Clinic Patients." *AIDS and Behavior* 4(4): 309–16.
- Parcel, G.S., N.M. O'Hara-Tompkins, R.B. Harest, K.M. Basen-Engquist, L.K. McCormick, N.H. Gottlieb and M.P. Eriksen. 1995. "Diffusion of an Effective Tobacco Prevention Program: II. Evaluation of the Adoption Phase." *Health Education Research* 10(3): 297–307.
- Perrin, K.M., S.G. Burke, D. O'Connor, G. Walby, C. Shippey, S. Pitt et al. 2006. "Factors Contributing to Intervention Fidelity in a Multi-site Chronic Disease Self-management Program." *Implementation Science* 1: 26.

Ringwalt, C., A. Vincus, S. Ennett, R. Johnson and A. Rohrbach. 2004. "Reasons for Teachers' Adaptation of Substance Use Prevention Curricula in Schools with Non-white Student Populations." *Prevention Science* 5(1): 61–7.

Rogers EM. *Diffusion of Innovations*. 4th Edition. 1995. New York: Free Press.

Rohrbach, L.A., J.W. Graham and W.B. Hansen. 1993. "Diffusion of a School-Based Substance Abuse Prevention Program: Predictors of Program Implementation." *Preventive Medicine* 22(2): 237–60.

Rohrbach, L.A., C.L. Ringwalt, S.T. Ennett and A.A. Vincus. 2005. "Factors Associated with Adoption of Evidence-Based Substance Use Prevention Curricula in US School Districts." *Health Education Research* 20(5): 514–26.

Silverberg, S.B. and S.A. Small. 1991. "Parenting Monitoring, Family Structure and Adolescent Substance Use." Paper presented at the meeting of the Society of Research in Child Development, Seattle, WA.

Stanton, B., L. Deveaux, S. Lunn, S. Yu, N. Brathwaite, X. Li et al. 2009. "The Condom Use Skills Checklist (CUSC): A Proxy for Assessing Condom Use Knowledge and Skills When Direct Observation Is Not Possible." *Journal of Health, Population, and Nutrition* 27(3): 406–13.

USAID. 2011: *HIV/AIDS Health Profile for the Caribbean Region*. Accessed August 8, 2011. <http://www.usaid.gov/our_work/global_health/aids/Countries/lac/caribbeanregion.html>.

Joint United Nations Programme on HIV/AIDS. Global report: UNAIDS report on the global AIDS epidemic 2010. WHO Library Cataloguing-in-Publication Data, 2010.UNAIDS. 2010.

Wandersman, A., E. Morrissey, K. Davino, D. Seybolt, C. Crusto, M. Naton et al. 1988. "Comprehensive Quality Programming and Accountability: Eight Essential Strategies for Implementing Successful Prevention Programs." *The Journal of Primary Prevention* 19(1): 3–30.

Wears, R.L. 2002. "Advanced Statistics: Statistical Methods for Analyzing Cluster and Cluster-Randomized Data." *Academic Emergency Medicine* 9(4): 330–41.

Zerhouni, E. 2006. "Clinical Research at a Crossroads: the NIH Roadmap." *Journal of Investigative Medicine* 54(4): 171–3.

Zerhouni, E. 2007. "Translational Research Moving Discovery to Practice." *Clinical Pharmacology and Therapeutics* 81(1): 126–8.

HIV Prevalence among High School Learners – Opportunities for School-based HIV Testing Programmes and Sexual Reproductive Health Services*

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Abstract

Background: Young girls in sub Saharan Africa are reported to have higher rates of human immunodeficiency virus (HIV) infection compared to boys in the same age group. Knowledge of HIV status amongst high schools learners provides an important gateway to prevention and treatment services. This study aimed at determining the HIV prevalence and explored the feasibility of HIV testing among high school learners.

Methods: Between September 2010 and February 2011, a linked, anonymous cross-sectional survey was conducted in two public sector high schools in the rural KwaZulu-Natal midlands. Following written informed consent, dried blood spot samples (DBS) were collected and tested for HIV. The overall and age-specific HIV prevalence were compared with select demographic variables.

Results: The HIV prevalence in learners aged 12 to 25 in school A was 4.7% (95% CI 2.8-6.5) compared to 2.5% (95% CI 1.6-3.5) in school B, ($p=0.04$). Whilst the HIV prevalence was similar for boys at 1.3% (95% CI 0-2.8) in school A and 1.7% (95% CI 0.5-2.8) in school B, the prevalence in girls was consistently higher and was 7.7% (95% CI 4.5-10.9) in school A and 3.2% (95% CI 1.8-4.6) in school B. The age-specific HIV prevalence in girls increased 1.5 to 2 fold for each two year age category, while for boys the prevalence was stable across all age groups.

Conclusions: The high HIV prevalence in female learners underscores the importance of sexual reproductive health and schools-based HIV testing programs as an important gateway to prevention and treatment services.

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Background

In generalized HIV epidemic settings, anonymous testing of pregnant women attending public sector antenatal clinic (ANC) remain the mainstay for monitoring epidemic trends and are important for measuring the magnitude of the epidemic in the general population.¹ The Joint United Nations Programme on HIV/AIDS (UNAIDS) recommends the importance of understanding the HIV epidemic locally and customizing responses accordingly.² As part of the ongoing research conducted by the Centre for the AIDS Programme of Research in South Africa (CAPRISA) in the sub-district of Vulindlela we have monitored the trends in HIV prevalence in this rural community through the annual ANC HIV seroprevalence surveys in the seven primary health care clinics.³ These surveys have coincided with the national department of health ANC surveys⁴ and have revealed a disturbing increase in HIV prevalence among young women below 20 years of age. The overall HIV prevalence in this age group increased from 16.6% in 2006 to 20.8% in 2008 and the HIV prevalence in this age group serves as a reliable proxy marker for incident HIV infections.^{1,3,4}

Whilst South Africa is one of few countries that has a supportive legal framework to enable young children to access sexual reproductive health services autonomously from age 12⁵, there are many ethical and programmatic challenges to HIV testing of young children for care and support or for surveillance. In recognition of the fact that children are sexually active at a very young age the risk of HIV acquisition increases through complex individual behaviours and through sexual networks within a broader context of political, economic and social powers. To understand the evolving HIV epidemic in this rural setting and to establish whether the prevalence in young pregnant girls is similar to that in other non-pregnant young people in this age group we undertook an anonymous survey in high school learners in Vulindlela, KwaZulu-Natal.

Methods

Setting

The study was conducted in the rural district of Vulindlela, located 150 km north-west of Durban between September 2010 and February 2011. The community has limited infrastructure and few employment opportunities, resulting in high levels of poverty. Health services are provided by seven public sector primary health care clinics and the closest referral hospitals are approximately 30 kilometres away.

There are a total of 75 schools in this sub-district with a learner population of 42,152. Of these, 51 (68%) are primary schools with a learner population of 25,606 from grades R to 7. The remaining 24 (32.0%) are secondary schools with a learner population of 16,546 in grades 8 to 12. In preparation for the survey several consultative meetings were held with the Department of Education at the provincial, district and school level. At the school level, discussions were held with principals and educators, schools governing bodies, parents and learners prior to implementation.

Study design

This cross-sectional, anonymous, linked survey was undertaken in two, randomly selected high schools in Vulindlela. Each school was visited over a three week period by a team of trained nurses and counsellors. Information on the purpose of the study, the implications of participation, the informed consent process, sample collection procedures, use of the results and confidentiality of data were provided to learners in small groups of 10 to 15. Following individual informed consent, learners willing to participate in the survey provided specimens for HIV testing. Blood was collected through finger-prick onto blotting paper [Dried blot specimen (DBS)]⁶. A limited set of demographic information, identified only by a unique study code, was linked to the DBS sample. No personal identifying information was used to ensure confidentiality. The HIV test results were matched to demographic data by their unique codes.

All learners were provided with information on how to access HIV testing and care services and HIV risk reduction counselling including access to medical male circumcision for male learners. Learners were encouraged to inform family members on the availability of HIV counselling and testing services and where to access these in the district.

Study approvals

The Biomedical Research Ethics Committee of the University of KwaZulu-Natal (E179/04) and the KwaZulu-Natal Departments of Health and Education reviewed and approved the study.

HIV serological testing

HIV testing was undertaken using HIV ELISA testing performed on DBS samples for detecting antibodies to HIV using the Vironostika Uni-Form 11 plus O Assay, Biomerieux, with results being recorded as negative or positive.

Data management and statistical analysis

The survey was undertaken in the schools among all registered learners to minimize selection and participation bias. Data were collected on standardized case report forms (CRFs) and faxed to a dedicated study database using DataFax (Clinical DataFax Systems Inc., Hamilton, Canada). HIV and demographic data analysis were undertaken using the SPSS software version 18.0. Individual sample weights were weighted to generate a final weighted sample that closely matched the 2010 mid-year population estimates for the province of KwaZulu-Natal provided by Statistics South Africa.⁷ The Fisher's exact test was used to test for differences in HIV prevalence. The 95% confidence interval (CI) for the crude and weighted HIV prevalence assumed a Poisson distribution.

Results

A total of 492/696 learners in school A and 1074/1150 learners in school B participated in the study giving a response rate of 71.0% and 93.4% respectively. The mean age of learners at both schools was similar and ranging from 12 to 25 years. At both schools more girls were attending school than boys and the number of learners in each grade varied per school. The majority of learners were in grades 8, 9 and 10 with a substantial decline in number of girls and boys in grades 11 and 12 (Table 1).

Table 1. Demographic characteristics and HIV prevalence among learners in rural KwaZulu-Natal, South Africa

Variable	School A (N = 492)				School B (N = 1074)				
	Boys		Girls		Boys		Girls		
Demographic characteristics									
Age									
Age (Mean; \pm SD; range)	16.4; \pm 2.2; 13-24		16.6; \pm 2.4; 12-25		15.7; \pm 2.2; 12-23		15.1; \pm 2.0; 12-22		
Age groups	n	%	n	%	n	%	n	%	
12-14 years	40	17.4	62	23.8	151	31.7	265	44.6	
15-16 years	89	38.7	76	29.2	172	36.1	186	31.3	
17-18 years	62	27.0	70	26.9	100	21.0	102	17.2	
19-25 years	39	17.0	50	19.2	54	11.3	41	6.9	
Overall	230	(46.9)	258*	(53.1)	477*	(44.5)	594*	(55.5)	
Grade distribution									
Grade 8	62	27.0	74	28.5	105	22.0	141	23.7	
Grade 9	66	28.7	46	17.7	125	26.2	139	23.3	

Table 1. Continued

Grade 10	57	24.8	48	18.5		119	24.9	156	26.2	
Grade 11	28	12.2	37	14.2		88	18.4	109	18.3	
Grade 12	17	7.4	37	21.2		41	8.6	51	8.6	
Overall	230	(46.7)	260*	(52.8)		478	(44.5)	596	(55.5)	
HIV prevalence										
	n	%95%CI	n	%95%CI		n	%95%CI	n	%95%CI	
Age specific prevalence										
12-14 years	2	5.0(0.4-18.2)	1	1.6(0.1-9.8)		0	0(0.1-3.1)	5	1.9(0.7-4.6)	
15-16 years	1	1.1(0.1-7.0)	2	2.6(0.5-10.1)		2	1.2(0.2-4.6)	5	2.7(1.0-6.5)	
17-18 years	0	0(0.2-7.3)	5	7.1(2.7-16.6)		4	4.0(1.3-10.5)	4	3.9(1.3-10.5)	
19-25 years	0	0(0.2-11.2)	12	24.0(13.5-36.5)		2	3.7(0.6-13.8)	5	12.2(4.6-27.0)	
Grade specific prevalence										
Grade 8	3	4.8(1.3-14.4)	2	2.7(0.5-10.3)		1	1.0(0.1-6.0)	2	1.4(0.3-5.6)	
Grade 9	0	0(0.1-6.9)	3	6.5(1.7-18.9)		2	1.6(0.3-6.2)	5	3.6(1.3-6.6)	
Grade 10	0	0(0.2-7.9)	0	0(-)		1	0.8(0.1-5.3)	6	3.8(1.6-8.6)	
Grade 11	0	0(0.3-15.0)	7	18.9(8.6-35.7)		3	3.4(0.9-10.3)	6	5.5(2.3-12.1)	
Grade 12	0	0(0.5-22.9)	8	14.6(6.9-27.2)		1	2.4(0.1-14.4)	0	0(0.2-8.7)	
Crude HIV prevalence	1.3% (95% CI 0-2.8)		7.7% (95% CI 4.5-10.9)		P < 0.001	1.7% (95% CI 0.5-2.8)		3.2% (95% CI 1.8-4.6)		P = 0.12
Weighted HIV prevalence**	1.4% (95% CI 0-2.8)		12.7% (95% CI 7.5-19.3)			2.5% (95% CI 0.1-5.0)		7.0% (95% CI 2.4-12.2)		
Crude HIV prevalence	4.7% (95% CI 2.8-6.5)					2.5% (95% CI 1.6-3.5)				
Weighted HIV prevalence**	7.6% (95% CI 4.3-10.9)					4.5% (95% CI 2.1-6.9)				

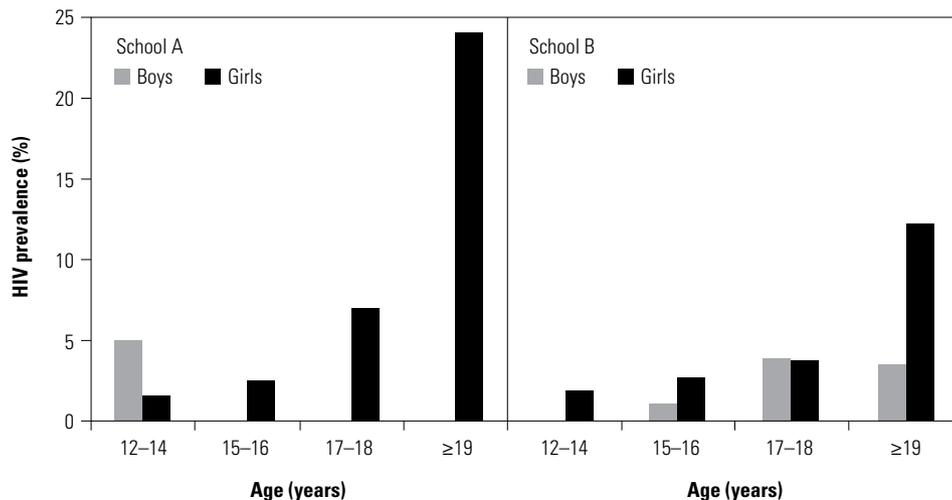
* Missing values were excluded from percentage calculation

** weighted to the 12-24 year old 2010 mid-year population estimates for the province of KwaZulu-Natal provided by Statistics South Africa.⁷

The overall HIV prevalence in learners in school A was 4.7% (95% CI 2.8-6.5), which was significantly higher than the prevalence of 2.5% (95% CI 1.6-3.5) in school B, ($p = 0.04$). The overall HIV prevalence in girls was consistently higher at 7.7% (95% CI 4.5-10.9) in school A and 3.2% (95% CI 1.8-4.6) in school B compared to the prevalence in boys at 1.3% (95% CI 0-2.8) in

school A and 1.7% (95% CI 0.5-2.8) in school B. While the prevalence in girls at the two schools differed significantly (7.7% versus 3.2%; $p = 0.0006$), the age-specific HIV prevalence increased 1.5 to 2 fold for each two year age category. For boys, however, the HIV prevalence remained stable across all age categories (Figure 1).

Figure 1. Age-specific HIV prevalence for boys and girls in School A and in School B in rural KwaZulu-Natal, South Africa



<http://www.biomedcentral.com/1471-2458/12/231/figure/F1>

Discussion

The HIV prevalence among high-school learners in this rural district is concerning and underscores the importance of targeted HIV risk reduction and sexual reproductive health service efforts in high schools. It is also important to better understand why these young girls are having sex, with whom and when they are having sex to better inform efforts to reduce their HIV risk. Early sexual debut is associated with higher teenage pregnancy rates, sexually transmitted infections and poor school completion rates leading to poor health and economic outcomes in young women.⁸⁻¹²

South Africa is one of few countries that has a supportive legal framework to enable young children to access sexual reproductive health services autonomously from age 12⁵. The Children's Act of 2005 (Act No. 38 of 2005) which came into effect in 2007 explicitly allows children 12 years and older access to contraceptives, information on sexuality and reproduction, and the right of consent to HIV/AIDS testing and treatment. This is in recognition of the fact that children are sexually active at a very young age and that there is a high burden of HIV infection in young people¹³, despite the legal age of consent for sex being 16 years.

The high HIV prevalence among girls identified through this study suggests that these infections are likely to remain undiagnosed, sustaining the networks for HIV transmission. In spite of high levels of awareness on the benefits of HIV testing, fear of HIV-related stigma from parents, caregivers and teachers could be barriers preventing learners from being tested.¹⁴⁻¹⁶ In high HIV prevalence settings, there is a need for more comprehensive information and support on HIV-related issues, including the importance of prevention.

The large gender disparity in the sample surveyed showed that the HIV prevalence was substantially lower in young boys compared to young girls. Young boys were significantly less likely to be HIV infected than their female counterparts; however, the prevalence in older boys was high. The patterns of infection observed in young girls are similar to trends observed throughout southern Africa,

although these are restricted to age groups of 15 years and older.^{6,9,17} Several large studies focusing on knowledge of HIV and behavioural risk factors for sexually transmitted infections and HIV have been conducted in the absence of biological measurements. These studies have demonstrated increasing risk taking behaviour predisposing to infections.^{18,19} As early adolescence marks a critical time of physical, developmental and social changes, interventions must focus on the needs of young people from as early as 10 years of age. These interventions need to be effective in shaping healthy attitudes and behaviours while most learners are still at school and less likely to have begun sexual activity.

As young people in this country are becoming sexually active at younger ages, it is important that they are taught that regular HIV testing should be an important part of their routine healthcare. While many social barriers are expected, by engaging each other openly, honestly and directly, young people would have an opportunity to impact on sexual health choices. The HIV and STI risk reduction programmes at schools are crucial in moulding and developing young people's identities and characters to enhance self esteem and thereby reduce or delay early sexual debut. Furthermore these choices would enable young people to reduce their anxiety, fear and stigma associated with HIV testing especially as they move into adulthood and the risk of infection increases, even before they are sexually active.

These results demonstrate the growing need and the opportunities for HIV testing and sexual reproductive health services within the school setting. South Africa has a high teenage pregnancy rate and in 2003 an estimated 12% of teenage girls between the ages of 15 and 19 years had ever been pregnant or were pregnant at the time of the survey.²⁰ The most recent reports show that the learner pregnancy rate in KwaZulu-Natal was 62.2 per 1000.²¹ Despite a decade of increased spending on sex education and HIV/AIDS awareness campaigns, there has been little impact on pregnancy rates and HIV incidence.

Learners as young as 12 years were included in this study because early age of sexual debut is considered a crucial factor affecting the vulnerability of young people to HIV infection. Several studies have found that sexual debut before the age of 15 years to be approximately 10% for both boys and girls.²²⁻²⁵ This figure increases substantially following experimentation with alcohol, substance abuse, pressure from mixing with older peer groups, coercion or sexual abuse. Young people initiating sex at an early age has major implications for HIV and STI infection and associated with higher HIV exposure due to it being linked to more frequent sexual intercourse, more lifetime sexually transmitted infections, less consistent contraceptive use, and more sexual partners.²⁶

The National Minister of Health of South Africa recently announced the prioritization of schools for the HIV counselling and testing (HCT) campaigns.²⁷ The close partnerships between the government departments and the community that will be necessary to successfully implement this campaign will go a long way towards addressing the challenges of obtaining consent, maintaining confidentiality, and providing the psychological and emotional support for young people to deal with an HIV-positive diagnosis. The magnitude of the epidemic demands more HIV risk reduction efforts in schools with evidence based programs.

There are several limitations to our study. The small sample size limits representativeness and generalizability to the larger school population in the district. Furthermore, the schools learner populations may differ by schools and the geographic variability in the prevalence of HIV infection is likely to be different across the district. Nevertheless this study is the first to report on the prevalence of HIV in high school learners in Vulindlela. These learners represent a population of young people with emerging HIV epidemic. Therefore, surveillance is a necessary tool to understand the transmission dynamics and the evolving epidemic in this vulnerable group. Another limitation was the absence of behavioural data collection which limited our understanding of risk behaviours and on the modes of HIV transmission. Despite these limitations, our findings indicate that additional larger studies are required to determine the full meaning of the alarming HIV prevalence in the sample of young women.

Conclusions

Knowledge of HIV status provides an important gateway to prevention and care efforts and the HCT campaign in schools could provide a narrow window of opportunity to reduce HIV risk in young girls and stem the tide of HIV for this and future generations.

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References

- ¹ Ghys PD, Kufa E, George MV: Measuring trends in prevalence and incidence of HIV infection in countries with generalised epidemics. *Sex Transm Infect* 2006, 82(Suppl 1):i52-56.
- ² Joint United Nations Programme on HIV/AIDS (UNAIDS) and World Health Organization (WHO): Practical Guidelines for Intensifying HIV Prevention: Towards Universal Access In ISBN 978 92 9173 557 0 (NLM classification: WC 5032). UNAIDS, Geneva; 2007.
- ³ MacQueen KM, Karim QA: Practice brief: adolescents and HIV clinical trials: ethics, culture, and context. *J Assoc Nurses AIDS Care* 2007, 18:78-82.
- ⁴ South African Department of Health: *The National antenatal sentinel HIV & syphilis prevalence survey in South Africa, 2010*. Pretoria: National Department of Health; 2011. South Africa Department of Social Development: Commencement of certain sections of the Children's Act. [<http://www.info.gov.za/speeches/2007/07062915151003.htm>] 2007. Accessed 2 May 2011
- ⁵ Shisana O, Rehle T, Simbayi LC, Zuma K, Jooste S, Pillay-van-Wyk V, Mbelle N, Van Zyl J, Parker WZN, Pezi S, The SABSSM III Implementation Team: South African national HIV prevalence, incidence, behaviour and communication survey 2008: A turning tide among teenagers? In *Cape Town*. HSRC Press; 2009.

- ⁶ Statistics South Africa: [<http://www.statssa.gov.za>] website SA Mid-year population estimates; Statistical release PO 302. Pretoria: Statistics South Africa; 2010.
- ⁷ Pettifor AE, van der Straten A, Dunbar MS, Shiboski SC, Padian NS: Early age of first sex: a risk factor for HIV infection among women in Zimbabwe. *AIDS* 2004, 18:1435-1442.
- ⁸ Pettifor AE, Rees HV, Kleinschmidt I, Steffenson AE, MacPhail C, Hlongwa-Madikizela L, Vermaak K, Padian NS: Young people's sexual health in South Africa: HIV prevalence and sexual behaviors from a nationally representative household survey. *AIDS* 2005, 19:1525-1534.
- ⁹ Pettifor AE, Levandowski BA, Macphail C, Padian NS, Cohen MS, Rees HV: Keep them in school: the importance of education as a protective factor against HIV infection among young South African women. *Int J Epidemiol* 2008, 37:1266-1273.
- ¹⁰ Diclemente RJ, Wingood GM, Sionean C, Crosby R, Harrington K, Davies S, Hook EW, Oh MK: Association of adolescents' history of sexually transmitted disease (STD) and their current high-risk behavior and STD status: a case for intensifying clinic-based prevention efforts. *Sex Transm Dis* 2002, 29:503-509.
- ¹¹ Coates TJ, Richter L, Caceres C: Behavioural strategies to reduce HIV transmission: how to make them work better. *Lancet* 2008, 372:669-684.
- ¹² Cowan F, Pettifor A: HIV in adolescents in sub-Saharan Africa. *Curr Opin HIV AIDS* 2009, 4:288-293.
- ¹³ Petersen I, Bhana A, Myeza N, Alicea S, John S, Holst H, McKay M, Mellins C: Psychosocial challenges and protective influences for socio-emotional coping of HIV + adolescents in South Africa: a qualitative investigation. *AIDS Care* 2010, 22:970-978.
- ¹⁴ Ehiri JE, Anyanwu EC, Donath E, Kanu I, Jolly PE: AIDS-related stigma in sub-Saharan Africa: its contexts and potential intervention strategies. *AIDS Public Policy J* 2005, 20:25-39.
- ¹⁵ Young SD, Hlavka Z, Modiba P, Gray G, Van Rooyen H, Richter L, Szekeres G, Coates T: HIV-related stigma, social norms, and HIV testing in Soweto and Vulindlela, South Africa: National Institutes of Mental Health Project Accept (HPTN 043). *J Acquir Immune Defic Syndr* 2010, 55:620-624.
- ¹⁶ Gouws E, Stanecki KA, Lyerla R, Ghys PD: The epidemiology of HIV infection among young people aged 15-24 years in southern Africa. *AIDS* 2008, 22(Suppl 4):S5-16.
- ¹⁷ Johnson BT, Scott-Sheldon LA, Huedo-Medina TB, Carey MP: Interventions to reduce sexual risk for human immunodeficiency virus in adolescents: a meta-analysis of trials, 1985-2008. *Arch Pediatr Adolesc Med* 2011, 165:77-84.
- ¹⁸ Harrison A, Newell ML, Imrie J, Hoddinott G: HIV prevention for South African youth: which interventions work? A systematic review of current evidence. *BMC Public Health* 2010, 10:102.
- ¹⁹ Department of Health, Medical Research Council, OrcMacro: *South Africa Demographic and Health Survey 2003*. Pretoria: Department of Health; 2007.
- ²⁰ Panday S, Makiwane M, Ranchod C, Letsoala T: Teenage pregnancy in South Africa: with a specific focus on school-going learners. [http://www.hsra.ac.za/Research_Publication-21277.phtml] website *Human Sciences Research Council* 2009. (Date accessed 15 June 2011)
- ²¹ Peltzer K: Early sexual debut and associated factors among in-school adolescents in eight African countries. *Acta Paediatr* 2010, 99:1242-1247.
- ²² Pettifor A, O'Brien K, Macphail C, Miller WC, Rees H: Early coital debut and associated HIV risk factors among young women and men in South Africa. *Int Perspect Sex Reprod Health* 2009, 35:82-90.
- ²³ Harrison A, Cleland J, Gouws E, Frohlich J: Early sexual debut among young men in rural South Africa: heightened vulnerability to sexual risk? *Sex Transm Infect* 2005, 81:259-261.
- ²⁴ Manzini N: Sexual initiation and childbearing among adolescent girls in KwaZulu Natal, South Africa. *Reprod Health Matters* 2001, 9:44-52.
- ²⁵ Malow RM, Rosenberg R, Donenberg G, Devieux JG: Interventions and Patterns of Risk in Adolescent HIV/AIDS Prevention. *Am J Infect Dis* 2006, 2:80-89.
- ²⁶ South African Department of Health: The schools based HCT campaign: special provisions for learners announced, 24 January 2011. [<http://www.info.gov.za/speech/DynamicAction?pageid=461&sid=15958&tid=27548>] website (Date accessed 15 June 2011) Pre-publication history

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