2011

Density of Drinking Establishments and Hiv Prevalence in a Migrant Town in Namibia

Brooke E. Nichols
University of Massachusetts Amherst

DENSITY OF DRINKING ESTABLISHMETNS AND HIV PREVALENCE IN A MIGRANT TOWN IN NAMIBIA

A Thesis Presented

by

BROOKE ELIZABETH NICHOLS

Submitted to the Graduate School of the
University of Massachusetts Amherst in partial fulfillment
of the requirements for the degree of

MASTER OF SCIENCE

February 2011

Public Health

DENSITY OF DRINKING ESTABLISHMETNS AND HIV PREVALENCE IN A MIGRANT TOWN IN NAMIBIA

A Thesis Presented

By

BROOKE ELIZABETH NICHOLS

Approved as to style and content by:

____
Brian W. Whitcomb, Chair

____
Renée Turzanski Fortner, Member

____
Raji Balasubramanian, Member

____
Edward J. Stanek, Department Head
Public Health

ACKNOWLEDGEMENTS

I would like to thank my thesis advisor, Brian Whitcomb, for his guidance, support, patience, and willingness to explain anything I did not understand on his whiteboard- and always explain it until I understood.

I would also like to thank Mount Holyoke College for funding this research with the Margaret Andrews Winters award for a research opportunity in the sciences.

DENSITY OF DRINKING ESTABLISHMETNS AND HIV PREVALENCE IN A MIGRANT TOWN IN NAMIBIA

FEBRUARY 2011

BROOKE ELIZABETH NICHOLS, B.A., MOUNT HOLYOKE COLLEGE

M.S., UNIVERSITY OF MASSACHUSETTS AMHERST

Directed by: Professor Brian W. Whitcomb

Given the established link between alcohol consumption and risk taking behavior, it is plausible that neighborhoods with higher density of drinking establishments will be associated with increased prevalence of HIV. We conducted an ecological study comparing neighborhoods in Luderitz, Namibia, to evaluate this relationship. We observed increased prevalence of HIV comparing high densities of registered and unregistered shebeens, bars, and total number of drinking establishments, as compared with low densities, were associated with increased prevalence of HIV (PR=3.02, 95% CI: 2.04-4.47; PR=1.71, 95% CI: 1.42-2.07; PR=1.55, 95% CI: 1.19-2.02). Our observation of increased prevalence associated with higher densities of drinking establishments merits consideration.

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER 1

INTRODUCTION

Among modifiable factors for transmission of HIV, alcohol is of interest in the developing world due to its high consumption and detrimental effect at both the individual and community level. Detrimental alcohol consumption is defined as a pattern of heavy drinking that could lead to negative health outcomes such as liver problems, pancreatitis, gastritis, cardiovascular, cancer and neurological problems, as well as violent behavior [1]. One potential risk factor for this pattern of alcohol abuse is when men live on their own without their families. Alcohol consumption may lead to increased risky sexual behavior and perception of risky sexual behavior [2]. Drinking establishments, as a gathering point, can affect the neighborhood environment by late hours and high alcohol consumption, possibly promoting opportunity to engage in risky sexual behavior. In a town with a high HIV prevalence, this behavior can lead to HIV transmission.

A South African review article has shown that two of the most at-risk groups of individuals for HIV transmission are migrant workers and miners [3]. Luderitz, Namibia is largely a migrant town, with an HIV prevalence in 2008 of 20.1% [4], and with most residents working in the fishing or mining industries. Fishermen generally work in Luderitz for 11 months of the year, and return to their homes in northern Namibia for the month of October every year. Miners' schedules vary depending on the current diamond and zinc market demands, and thus could be in the town for just a few months to several years without returning home. The town has a high ratio of men to women, 1.3:1, so there are many men living on their own.

There are four types of drinking establishments in Luderitz and throughout Namibia— the bottle store, bar, registered shebeen, and unregistered shebeen. The bottle store is a formal, registered establishment. They generally sell only bottled alcohol with known alcohol percentages, open only during traditional business hours, 9:00AM-5:00PM, and are not likely to be open late into the night as compared to bars and informal drinking establishments. Bars are formal, registered establishments with regular hours. Most bars will open in the afternoon, serve until approximately 2AM and are not likely to be open past their advertised closing time. Bars usually serve alcohol in a small pint glass or a 340ml bottle of beer, and the cost is high, therefore less alcohol is generally consumed at bars as compared to informal bars. A registered shebeen (informal bar) is a new type of establishment that has been increasingly common in 2009; the Luderitz Town Council encourages shebeens to register with the town as part of a business registration initiative. As part of the registration process, owners are made aware of alcohol laws and potential consequences, and late hours are discouraged. The approximate hours of registered shebeens are like those of bars, but are sometimes open late into the night. Unregistered shebeens are informal establishments known to be open at any hour of the day, depending on the owner. At shebeens, both registered and unregistered, the quantity of alcohol consumed tends to be much greater than quantity consumed in a bar; instead of serving pints of beer, 750mL bottles of beer are sold, usually for the same price for a pint of beer in a formal bar setting. Therefore a person can consume a large amount of alcohol for a relatively low price. The combination of large amounts of alcohol consumed and the late hours, shebeens are likely to affect neighborhood environment. Types of alcohol served and bar hours are modifiable through effective regulation, which has the power to change the environment of a neighborhood.

To our knowledge, the association of density of drinking establishments with HIV prevalence has not been evaluated, particularly in the setting of a migrant town where high rates of alcohol consumption are observed. Prior research has evaluated density of drinking establishments and STI prevalence and drinking-related problems [5,6]. Cohen and colleagues [5] examined the relation between drinking establishment density and gonorrhea rates and found a significant correlation between the two ($r=0.956$, p-value <0.01). Weitzman and colleagues [6] examined drinking establishment density and risk of drinking and drinking related problems and found significant correlations between outlet density and heavy drinking: ($r=0.82$, $p=0.01$), frequent drinking ($r=0.73$, $p=0.04$), and drinking-related problems ($r=0.79$ $p=0.02$). These studies were both based in the U.S.; generalizability to other populations may be limited for reasons of social context and differences in types of drinking establishments.

The relation between alcohol consumption and exposures related to HIV, such as unprotected sex has been evaluated [7, 8]. In a study that compared patterns of problem alcohol use with regard to risk of testing HIV positive or having HIV risk factors, problem drinking was associated with having two or more sex partners in the last three months as compared to not having problem drinking (OR=3.0, 95% CI 1.9-4.4) [7]. Other research has suggested an association between having met sex partners at shebeens and unprotected vaginal sex (OR=1.1, 95% CI 1.1-1.2), as compared to those who did not meet partners at shebeens [8].

Given the prior literature, our main hypothesis was that density of drinking establishments is positively associated with HIV prevalence than neighborhoods with a low density of drinking establishments. Our secondary hypothesis was that areas with higher densities of unregistered shebeens will have higher HIV prevalence in comparison with areas of high densities of other types of drinking establishments. We evaluated these hypotheses in Luderitz, Namibia, a migrant worker town.

CHAPTER 2

METHODS

Study Population

To examine the relationship between density of drinking establishments and HIV prevalence, we conducted an ecological study comparing neighborhoods with respect to the town of Luderitz, Namibia. Luderitz is a large town in southern Namibia, with a population of approximately 15,000 residents. Luderitz is largely a migrant town, with most migrants working in the mining or fishing industries. There are nine very socially and ethnically diverse neighborhoods in the town. Total population size was ascertained from neighborhoods that are >75% residential, because if a neighborhood is any less residential than that, it becomes too difficult to accurately count the number of residential dwellings and distinguish from businesses. This method excluded only one out of ten neighborhoods.

Measures

Exposure Assessment- Density of Drinking Establishments

Density of drinking establishments, registered shebeens, unregistered shebeens, bars, and bottle stores was calculated by neighborhood for purposes of the current study. In order to calculate population by neighborhood, and number of drinking establishments by neighborhood, maps created for the study were used, and physical boundaries to neighborhoods were marked by local residents of the town. Neighborhood designations were evaluated separately by three volunteers, and differences in designations were then resolved amongst the three residents in a group discussion.

The number of houses and shacks were counted in each neighborhood over the course of a week during July 2009. The approximate number of people per household in each neighborhood was determined through random sampling of residential dwellings per neighborhood. Fifty percent of dwellings in neighborhoods with less than 500 dwellings and 30% of dwellings in neighborhoods with greater than 500 dwellings were assessed for number of people per household. The average number of people per household was then taken and extrapolated to estimate the number of residents per neighborhood.

The number of drinking establishments by neighborhood was determined by counting registered and unregistered shebeens, bars, and bottle stores, over the course of a week during July 2009. The same three volunteers assessed number and type of drinking establishments by neighborhood separately. The differences in counts were then resolved amongst the three residents in a group discussion. The population by neighborhood and number of drinking establishments by neighborhood was used to calculate the density of registered and unregistered shebeens, bars, and bottle stores separately by neighborhood. Density of drinking establishments was categorized into tertiles of low, medium, and high density.

Outcome Assessment- HIV prevalence

HIV prevalence by neighborhood was abstracted from medical record data from the town registry of all persons that tested positive for HIV in the Luderitz Hospital between 2005 and 2009. The Uni-Gold Recombigen HIV rapid test was used to assess HIV status with ELISA confirmatory testing. Positive tests were systematically assigned to one of the designated neighborhoods based on the address listed with the hospital.

HIV prevalence by neighborhood was determined as the ratio of the number of HIV cases to the total population of each neighborhood and was used as a continuous variable in analyses.

Socioeconomic Status Assessment

We assessed socioeconomic status (SES) as a potential confounding factor, as SES has been linked to alcohol use and abuse, and also to HIV infection [9]. Neighborhood level SES data is usually dealt with by identifying income levels by census tracts in the United States. This type of data, however, is not available in Namibia. Because there is no population level or individual level data on income or employment status, we used the percentage of formal housing out of all housing by neighborhood as a proxy variable for SES. A formal house was defined as a house that is made primarily of concrete. Informal housing was defined as those homes that are made mostly of tin and scrap metal. Formal housing percentage of a neighborhood was categorized into four levels: 100% formal housing, 75-99% formal housing, 50-74% formal housing, and <50% formal housing, for the purposes of inclusion in multivariable analyses.

Statistical Analysis

We modeled the relationship between density of drinking establishments and HIV prevalence by neighborhood using Poisson regression analysis (PROC GENMOD) to model the variability expected for count data. Using these models, we calculated the unadjusted and the multivariable prevalence ratios (PR) and 95% confidence intervals (CI) (Table 1). Low density of total drinking establishments (<3 establishments per 1,000 people) was defined as the referent group to which we compared the medium density (3-10 per 1,000 people) and high density (>10 per 1,000 people) of drinking establishment categories. In unadjusted analysis, separate regression models were run with densities of each drinking establishment type as the sole independent variable. Multivariable models where run that included all drinking establishment types as well as SES in order to estimate adjusted prevalence ratios. All analyses were conducted in Statistical Analysis Software (SAS) 9.1.3.

CHAPTER 3

RESULTS

There were 1,466 cases of HIV diagnosed at the Luderitz Hospital from January, 2005 until June, 2009 that resided in the nine main neighborhoods of Luderitz at the time of diagnosis. The population that gave rise to these cases was considered the 13,833 residents of the same nine neighborhoods that were present and living in Luderitz on June 25th, 2009.

The nine neighborhoods of Luderitz range from 534 to 3,118 residents. The proportion of total houses comprised by formal housing, our measures of neighborhood level socioeconomic status, ranged from 0% formal houses in a neighborhood to 100% formal houses. Neighborhood population was not related to the socioeconomic status of a neighborhood; the two most populous neighborhoods, represent both the lowest and highest socioeconomic status (p=0.30).

Table 1. Prevalence Ratios of density of drinking establishments and HIV prevalence by neighborhoods, Luderitz, Namibia, 2005-2009.

	Unadjusted		Multivariable	
	Prevalence Ratio	95% CI	Prevalence Ratio	95% CI
Unregistered shebeens (density per 1,000 residents), n				
Low density (0), n=4	1.00	-ref-	1.00	-ref-
Medium density (>0-10), n=3	4.94	4.18-5.85	1.46	1.09-1.95
High density (>10), n=2	5.74	4.75-6.95	1.84	1.38-2.45
Registered shebeens (density per 1,000 residents)				
Low density (0), n=6	1.00	-ref-	1.00	-ref-
Medium density (>0-5), n=2	1.27	1.11-1.45	0.92	0.78-1.09
High density (>5), n=1	2.60	2.30-2.95	3.02	2.04-4.47
Bars (density per 1,000 residents)				
Low density (<1), n=4	1.00	-ref-	1.00	-ref-
Medium density (1-5), n=3	0.66	0.57-0.77	0.59	0.46-0.76
High density (>5), n=2	2.16	1.93-2.42	1.71	1.42-2.07
Bottle stores (density per 1,000 residents)				
Low density (0), n=4	1.00	-ref-	1.00	-ref-
Medium density (>0-1.5), n=3	0.46	0.40-0.53	0.99	0.82-1.19
High density (>1.5), n=2	0.61	0.54-0.69	0.81	0.69-0.95
Total number of drinking establishments (density per 1,000 residents)				

Low Density (<3), n=2	1.00	-ref-	1.00	-ref-
Medium density (3-10), n=4	2.00	1.61-2.48	1.15	0.91-1.45
High density (>10), n=3	4.57	3.68-5.66	1.55	1.19-2.02

The highest density of unregistered shebeens was 32.7 per 1,000 people. That neighborhood also has the highest density of total number of drinking establishments with 33.7 per 1,000 people. The neighborhood with the highest density of registered shebeens (7.6 per 1,000 people) also had the highest density of bars (11.4 bars per 1,000 people). The highest density of bottle stores is 2.3 per 1,000 people.

Results of regression models of HIV prevalence are shown in table 1. In unadjusted analyses, density of unregistered shebeens was significantly positively associated with HIV prevalence. Specifically, in comparison with low density of unregistered shebeens, medium density was related to a 5-fold increased risk of HIV prevalence (PR = 4.94, 95% CI: 4.18-5.85), and high density conveyed an almost 6-fold increased risk of HIV prevalence (PR= 5.74, 95% CI: 4.75-6.95). Registered shebeen density was significantly associated with HIV prevalence, with medium density of registered shebeens versus low density PR=1.27 (95% CI: 1.11-1.45), and high density versus low density PR=2.60 (95% CI: 2.30-2.95). Higher total drinking establishment density was also related to a significant increase in risk, with medium density of total drinking establishments PR=2.00 (95% CI: 1.61-2.48), and high density versus low density PR=4.57 (95% CI: 3.68-5.66).

In unadjusted analyses, density of bars was associated with HIV prevalence. High density of bars had higher prevalence than low density (PR=2.16, 95% CI: 1.93-2.42), and medium density had higher prevalence than low density (PR=0.66, 95% CI: 0.57-0.77). Density of bottle stores also showed an inverse relationship, with medium density of bottle stores versus low density PR=0.46 (95% CI: 0.40-0.53), and high density versus low density PR=0.61 (95% CI: 0.54-0.69).

In multivariable analyses adjusting for socioeconomic status as well as density of drinking establishments, attenuated estimates were observed. With density of unregistered shebeens, HIV prevalence was associated with medium density versus low density and high density versus low density remained significant (PR=1.46, 95% CI: 1.09-1.95 and PR=1.84, 95% CI: 1.38-2.45, respectively). Density of bottle stores remained significant for high density versus low density (PR=0.81, 95% CI: 0.69-0.95), but were no longer statistically significant for medium density versus low density (PR=0.99, 95% CI: 0.82-1.19).

With density of registered shebeens, bars, and total number of drinking establishments, a significant positive association is seen between high density of drinking establishments and the outcome (PR=3.02, 95% CI: 2.04-4.47; PR=1.71, 95% CI: 1.42-2.07; and PR=1.55, 95% CI: 1.19-2.02, respectively), but not between medium density of establishments and the outcome (PR=0.92, 95% CI: 0.78-1.09; PR=0.59, 95% CI: 0.46-0.76; and PR=1.15, 95% CI: 0.91-1.45, respectively).

CHAPTER 4

DISCUSSION

We found medium and high density of unregistered shebeens to be associated with as much as two-fold increased prevalence of HIV as compared with low density of unregistered shebeens in multivariable Poisson regression analysis adjusting for neighborhood SES. High densities of registered shebeens, bars, and total number of drinking establishments were associated with increased prevalence of HIV by neighborhood (shebeens PR=3.02, 95% CI: 2.04-4.47; bars PR=1.71, 95% CI: 1.42-2.07; total drinking establishments PR=1.55, 95% CI: 1.19-2.02). These results suggest that density of drinking establishments is associated with increased HIV prevalence. Additionally, our findings also suggest a greater importance of unregistered shebeens on HIV prevalence, as the strongest associations were observed for this drinking establishment type.

Our study evaluated an uncommonly considered aspect of alcohol as a risk factor for HIV transmission; by evaluating how density of different types of drinking establishments can influence a neighborhoods' environment, we have considered group level effects of an individual level behavior. In resource-limited settings, it is important to determine the most effective opportunities for intervention. In many cases there are not enough resources to provide informational materials and condoms to all drinking establishments, so it is important to determine where such materials could make the biggest impact. Our study suggests that information regarding density of drinking establishments in a neighborhood may contribute to making such determinations.

To our knowledge, this is the first study looking at density of drinking establishments and HIV prevalence by neighborhood. However, our results are in agreement with prior related research. Studies looking at density of drinking establishments in U.S. populations have also found a significant relationship between density of drinking establishment and risk of STDs and drinking related problems [5,6].

The results from our study also generally support results of studies based in Africa looking at alcohol consumption and risk of HIV. A significant association between having met sex partners at a shebeen and unprotected vaginal sex versus those who did not meet partners at shebeens has been previously observed demonstrated [8]. Problem drinking was associated with having two or more sex partners in the last three months compared to those not having problem drinking [7]. Both of these findings help support our mechanism between density of drinking establishments and HIV prevalence. Our study builds on these findings by considering additional drinking establishment types in a non-clinic setting.

Our findings must be interpreted with caution for a number of reasons. Among these reasons is the ecological study design [10]. Ecological studies are impacted by the absence of individual level data, limiting the ability to address confounding. Control for confounding in ecological studies requires use of group level variable to proxy for the confounding factor of interest. In this study, we included a proxy variable for SES in models to address confounding; however, uncontrolled confounding is possible. An additional potential weakness of the ecological study design is in the ability to draw inference regarding individual level relations based on group-level. However, in our study our interest is explicitly in the group level exposure variable instead, mitigating this concern. We are not interested in just people who go to shebeens, bars, or bottle stores, but also the people they live with, and how these drinking establishments affect a neighborhoods' environment.

Our study could have been impacted by errors in neighborhood prevalences. This might occur if the number of cases in neighborhoods reflects the level of testing, rather than the actual prevalence in that neighborhood. However, a large proportion of the HIV registry in the town is made up of women who tested positive when going for prenatal care. Ninety-six percent of pregnant women get tested for HIV, and due to ease of access of the medical facilities, most women go to the Luderitz Hospital for a prenatal visit or at least for childbirth. Prevalence estimates also could have been impacted by errors in the population estimates. We conducted sensitivity analyses where drinking establishment density and HIV prevalence was recalculated based on errors in the population estimates; however, we found no substantive changes in risk estimates when looking at +/- 20% change in the population for each neighborhood.

As is often the case in resource-limited settings where few existing data are available, we were also limited by a small sample size, impacting power and the statistical analysis approach. In this small sample, there was minimal variability in drinking establishment densities. Neighborhoods classified as 'high density' had a very high density (22.2-33.7 per 1,000 people), whereas the density for neighborhoods classified as medium density neighborhoods (3.2-8 per 1,000 people) was closer to that of the low density classification (1.4-2 per 1,000 people). The effect of low exposure variability is to decrease power and would tend to lead to underestimates of associations. Additionally, in the limited number of neighborhoods considered, the counterintuitive associations observed for medium vs. low density of bars (PR=0.59, 95% CI 0.46-0.76) and high vs. low density of bottle stores (PR=0.81, 95% CI: 0.69-0.95) may be due to a lack of independence between bottle stores and other types of drinking establishments. Accordingly, in neighborhoods with many bottle stores, there are likely to be fewer of other types of establishments, giving rise to apparently protective effects.

Despite the limitations, our study of density of drinking establishments and HIV prevalence has potential public health implications. Due to the large impact HIV/AIDS has had, particularly in Southern Africa, it is important to consider all potential forms of prevention. Although cross-sectional designs have limited ability to assess causality, HIV prevalence is a known risk factor for HIV transmission. If drinking establishment density is related to HIV prevalence, it may represent an important path for prevention, suggesting enforcement of drinking laws, or by attempting to modify the drinking culture.

In conclusion, our results suggest a relationship between density of drinking establishments and HIV prevalence by neighborhood, particularly density of unregistered shebeens. However, the hypotheses would have to be addressed looking at additional towns to have sufficient power to appropriately evaluate this relationship.

BIBLIOGRAPHY

(1) Global Status Report on Alcohol 2004. Geneva: World Health Organization Department of Mental Health and Substance Abuse. 2004. Available at: www.who.int/entity/substance_abuse/publications/global_status_report_2004_overview.pdf. Accessed October 4, 2009.

(2) Davis KC, George WH, Norris J, Schacht RL, Stoner SA, Hendershot CS, et al. Effects of alcohol and blood alcohol concentration limb on sexual risk-taking intentions. J Stud Alcohol Drugs. 2009 Jul;70(4):499-507.

(3) Pithey AL, Morojele NK. Literature Review on Alcohol Use and Sexual Risk Behaviour in South Africa. Pretoria: Alcohol and Drug Abuse Research Unit. 2002 Mar. Available at: http://www.sahealthinfo.org/. Accessed October 4, 2009.

(4) Report on the 2008 National HIV Sentinel Survey. Windhoek: Ministry of Health and Social Services. 2008 Oct.

(5) Cohen DA, Ghosh-Dastidar B, Scribner R, Miu A, Scott M, Robinson P, et al. Alcohol outlets, gonorrhea, and the Los Angeles civil unrest: a longitudinal analysis. Soc Sci Med. 2006 Jun;62(12):3062-3071.

(6) Weitzman ER, Folkman A, Folkman MP, Wechsler H. The relationship of alcohol outlet density to heavy and frequent drinking and drinking-related problems among college students at eight universities. Health Place. 2003 Mar;9(1):1-6.

(7) Kalichman SC, Simbayi LC, Jooste S, Cain D, Cherry C. Sensation seeking, alcohol use, and sexual behaviors among sexually transmitted infection clinic patients in Cape Town, South Africa. Psychol Addict Behav. 2006 Sep;20(3):298-304.

(8) Kalichman SC, Simbayi LC, Vermaak R, Jooste S, Cain D. HIV/AIDS risks among men and women who drink at informal alcohol serving establishments (Shebeens) in Cape Town, South Africa. Prev Sci. 2008 Mar;9(1):55-62.

(9) de la Torre C, Khan S, Eckert E, Luna J, Koppenhaver T. HIV/AIDS in Namibia: Behavioral and Contextual Factors Driving the Epidemic. USAID. 2009 May; SR-09-53.

(10) Morgenstern H. Ecologic studies in epidemiology: concepts, principles, and methods. Annu Rev Public Health. 1995;16:61-81.