Violence against women by their male intimate partners (IPV) has widely recognized health impacts, including physical injury and adverse mental and reproductive health outcomes. (Jewkes et al., 2010; García-Moreno et al, 2006; Kumar et al., 2005; Mayhew et al., 2002). Female IPV victims are at increased risk for STI/HIV infection (Silverman, 2010; Campbell et al., 2008; Sudha et al., 2007; Dunkle et al., 2004; Decker et al., 2003; Maman et al., 2002). A longitudinal study of South African women found increased HIV incidence among IPV victims, suggesting that women may be infected directly by their abusive partners (Jewkes et al., 2010). Evidence is mounting that male IPV perpetrators are more likely than non-perpetrators to have an STI/HIV, potentially increasing their female partners' exposure to infection (Townsend et al., 2010; Decker et al., 2009a; Raj et al., 2008; Silverman et al., 2007). Female IPV victims' risk of STI/HIV exposure is further compounded because they often have limited control over sexual relationships, including condom negotiation (Decker et al., 2009b; Raj et al., 2004).

A growing literature from the US, South Asia, and Africa indicates that male IPV perpetrators are more likely to engage in main partner infidelity (multiple partnerships), sex worker patronage, and inconsistent condom use (Frye et al., 2011; Vu et al., 2011; Dunkle et al., 2006; Raj et al., 2006). This evidence base has resulted almost entirely from cross-sectional data, limiting any discussion of the temporal relationships between IPV perpetration and HIV risk behavior. A longitudinal study of male methadone users in the US found that IPV perpetrators at baseline were more likely than non-perpetrators to have multiple partnerships and to report sex worker patronage in subsequent waves of data collection (Gilbert et al., 2007). The authors suggested that relationship instability associated with IPV may increase the likelihood that men will engage in outside relationships as a form of retaliation or "exit strategy" from the partnership.

Raj et al. (2006) indicate that underlying the relationship between IPV perpetration and risky sexual behavior may be traditional masculine gender role ideologies, or the perceptions of how men and women should behave in relationships and society in general. Decker et al. (2009a) suggest that these socially endorsed masculinity norms may prioritize "sexual entitlement and multiple partnering, and physical and sexual domination of female partners". Individual and social approval of traditional masculinity norms has been associated with IPV perpetration and risky sexual behaviors. In a review of masculinities and partner violence, Moore and Stuart (2005) indicate that US men who approved of more traditional male roles and norms were more likely to perpetrate psychological and physical IPV. Pleck and O'Donnell (2001) reported that endorsement of traditional masculinity norms were associated with violent behaviors among a sample of Latino and African American adolescents.

Although not as well established, US-based studies have linked endorsement of traditional gender norms with risky sexual behavior, including male sexual infidelity, unprotected sex, and more casual partners (Shearer et al., 2005; Thompson and Pleck., 1992). Limited research has established the association of traditional gender role ideologies and both IPV perpetration and risky sexual behavior among the same population. A study of a male clinic-based sample in Boston, demonstrated that endorsement of traditional gender role ideologies were positively associated with unprotected vaginal sex in the past three months and to have perpetrated IPV in the past year (Santana et al., 2006).

Alcohol consumption has been shown to be associated with both risky sexual behavior and IPV perpetration. A review of the topic in Southern Africa demonstrated a consistent correlation between alcohol use and HIV risk behavior (Kalichman et al., 2007). The review suggested that higher quantities of alcohol use predicted greater sexual risks than did frequency

of drinking. The WHO multi-country study on domestic violence showed that in 12 out of 14 countries females reporting drunkenness of their male partners had a greater likelihood of IPV victimization than women who did not (Abramsky et al., 2011). These findings suggest that alcohol consumption is interwoven within a set of risky sexual behaviors, including sex worker patronage and main partner infidelity (Vu et al., 2011).

The vast majority of studies establishing associations between male IPV perpetration and STI/HIV risk have been conducted in the United States, Africa, and South Asia. Few if any have examined this link in the Latin American context. IPV victimization is highly prevalent in Guatemala, with nearly 30% of Guatemalan women reporting lifetime physical or sexual IPV victimization and 10% reporting such abuse in the past 30 days (MSPAS, 2010). A recent study of pregnant Guatemala women linked past-year physical or sexual IPV victimization with an increased prevalence of miscarriage (Johri et al., 2011).

HIV in Guatemala is primarily concentrated among men who have sex with men (MSM) and female sex workers (FSW), although there has been a steady feminization of the epidemic (MSPAS, 2011).[1] Some models suggest that bridge populations, such as male clients of FSW, may link high and low-risk populations and play an important role in spreading HIV in the heterosexual population (Hor et al., 2005). Sábido et al. (2011) showed that HIV prevalence among clients of sex workers in Escuintla, Guatemala was 1.5%, nearly twice the national prevalence estimate. Almost 60% of these clients formed a bridging relationship with a stable female partner. Main partner infidelity may also serve to link high and low risk populations (casual and main partners respectively). Decker et al. (2009a) argue that main partner infidelity posed STI/HIV risk to female partners and was associated with IPV perpetration in India.

[1] The male to female ratio has decreased from 3.5 to 1 in 1980s to 2.29 to 1 in 2009 (MSPAS, 2011). UNAIDS projections, indicate that HIV incidence may be increasing more rapidly among young women aged 15 to 24 than men of the same age group (UNAIDS, 2010; Johri et al 2010).

Evidence concerning the role of IPV as a risk factor for STI/HIV in Guatemala is ambiguous. A single cross-section study of a large hospital sample of pregnant Guatemalan women found that HIV-infected respondents were 1.86 times more likely to have experienced IPV than HIV-negative respondents (Johri et al., 2010). Even less is known about the sexual risk behavior of male IPV perpetrators in the Guatemalan context.

Using data from a a nationally representative sample of married/partnered Guatemalan men, this study assesses the associations between IPV perpetration and both past-year main partner infidelity and lifetime history of sex worker patronage. Based on a review of the literature and the conceptual framework, there are two study hypotheses:

H1: Married/partnered men who report lifetime history of IPV perpetration will have a higher predicted probability of lifetime sex worker patronage than non-perpetrators.

H2: Married/partnered men who report past-year IPV perpetration will have a higher predicted probability of past-year main partner infidelity than non-perpetrators.

CONCEPTUAL FRAMEWORK

A conceptual framework describing the relationship between IPV perpetration and HIV risk behavior was adapted from El-Bassell et al. (2004) and González-Guarda et al.'s (2008) models. The top row considers the socio-demographic determinants of risky sexual behavior. (Figure 1) These distal factors may influence several more proximate determinants of HIV risk behavior. For example, education and wealth may influence HIV knowledge and age at first sex, which are more directly related to HIV risk behavior. (This indirect connection is demonstrated by a dashed line.) Socio-demographic factors may also influence endorsement of traditional

male gender ideologies, and excessive alcohol consumption, both of which have been associated with both IPV and HIV risk behavior.

Endorsement of traditional gender role ideologies are posited as a factor underlying both IPV perpetration and HIV risk behavior. While traditional gender role ideologies were not measured by a valid and reliable scale in this study, such as the Male Role Attitude Scale (Thompson and Pleck, 1992), an additive index of traditional partnership norms was created and included in all multivariate models. IPV perpetration is hypothesized to be associated with HIV risk behavior (Jewkes, et al. 2010; Gilbert et al., 2007; Silverman et al., 2007). Increased sexual risk behaviors by male IPV perpetrators may lead to increased STI/HIV prevalence in this population and their female partners, although these relationships were not tested in this study.

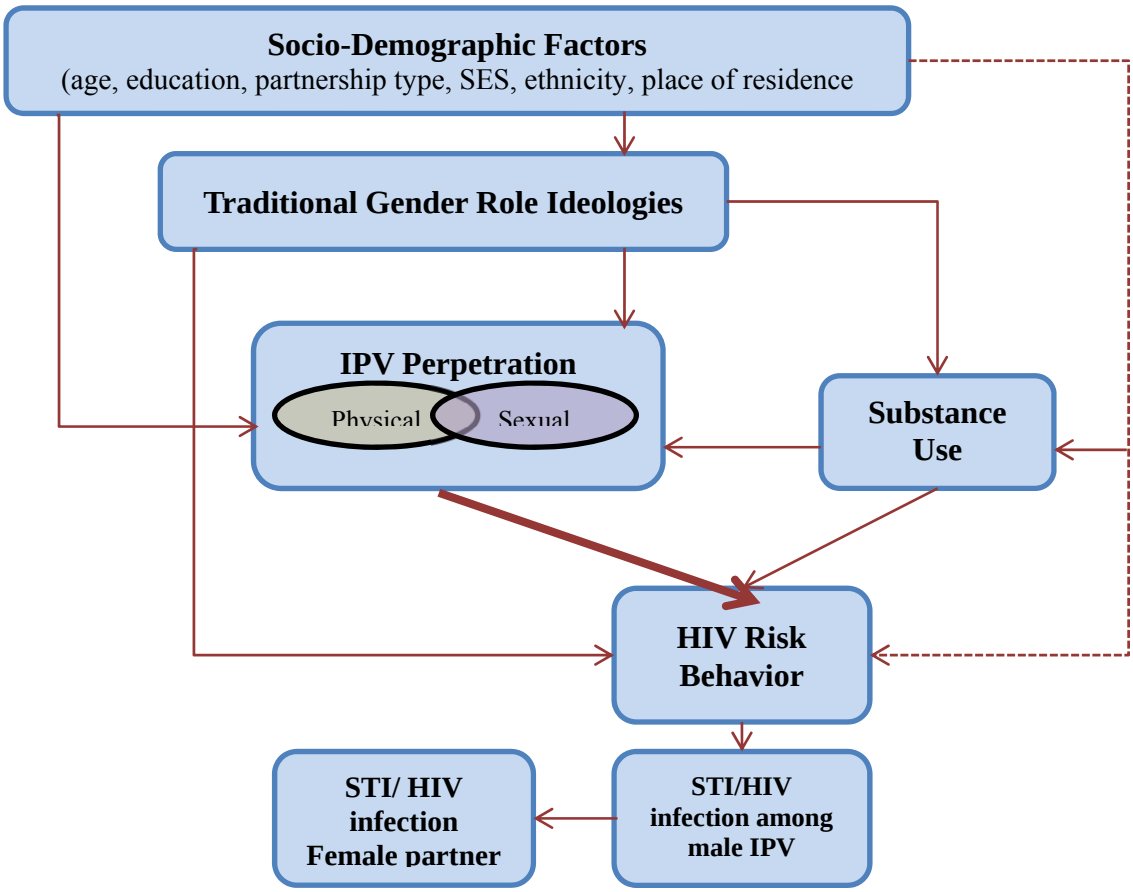


Figure 1: Conceptual Framework - Hypothesized relationships among traditional gender roles, IPV perpetration, and HIV risk.

DATA

This study used the men's data of the 2008/2009 Guatemala *Encuesta Nacional de Salud Materno-Infantil* (ENSMI), which was collected between October 2008 and June 2009 (MSPAS 2011). This national survey was conducted by the Guatemalan *Ministerio de Salud Pública y Asistencial Social (MSPAS)* with technical assistance from the Guatemalan *Instituto Nacional de Estadísticas* (INE) and the U.S. Centers for Disease Control and Prevention (CDC). The survey includes a sample of 7,086 men aged 15 to 59 years and is representative at the departmental level.

The survey used a multi-stage cluster sampling design. A household questionnaire was completed for 10,324 out of the 10,995 selected households. A list of all men aged 15-59 years living in the household was elaborated during the household questionnaire. A male respondent for the individual questionnaire, was randomly selected from this list. Out of 7,893 eligible men, 7,086 were interviewed, for an overall response rate of 84.3%.

This study sample was restricted to men who were currently married or in a common law partnership, reducing the sample to 4,794. The IPV module was only applied in situations where there was sufficient privacy. In 21 cases the privacy criteria were no met, and the sample size reduced to 4,773. Twenty-nine additional cases were dropped due to missing information for two independent variables - age at first sex and/or excessive alcohol use – resulting in a final sample size of 4,744 men.

Measures

All measures were self-reported. The survey questionnaires were administered face-to-face in Spanish or one of four Mayan languages by interviewers who received four weeks of training (MSPAS, 2011). The dependent variables of interest were past-year main partner

infidelity and lifetime history of sex worker patronage. Past-year main partner infidelity is a binary outcome and was defined as a currently married/partnered man who had more than one sex partner in the past 12 months. Lifetime history of sex worker patronage is also a dichotomous outcome. Respondents were considered to have engaged in sex worker patronage if they answered yes to ever having paid money or in kind for sex with a woman.

Independent variables in this study were identified through the conceptual framework and literature review. Single items assessed highest education level attained (none, primary, secondary, post-secondary), ethnicity (indigenous/non-indigenous), and place of residence (rural/urban). Age was included as a continuous variable. A relative index of household wealth was developed based on interviewer-observed assets including dwelling characteristics and ownership of consumer items (MSPAS, 2011

Several factors known to be associated with high-risk sexual behavior were included in the analysis, including HIV knowledge, age of sexual debut, and excessive alcohol use (Vu et al., 2011). Comprehensive HIV knowledge was assessed by a dichotomous variable based on the UNAIDS (2009) definition.[2] Age at first sex was a continuous variable. Having returned home drunk at least once in the past 30 days served as a measure of substance use.

IPV perpetration was measured with two variables – lifetime history of IPV perpetration and past-year IPV perpetration. Both IPV variables are dichotomous and were created to test the study's hypotheses. The ENSMI's domestic violence module contains six questions on perpetration of physical violence and two items on the perpetration of sexual violence, which were adapted from the WHO multi-country study on domestic violence (MSPAS, 2011; García-

[2] UNAIDS defines having comprehensive HIV knowledge if one rejects the country's two most common misconceptions about HIV transmission, identifies condom use and fidelity as ways to prevent HIV, and knows that a person with HIV can look healthy.

Moreno et al., 2005). The respondent was asked if they had ever committed each of the eight acts of violence.[3] If a respondent answered yes to committing any of the eight violent acts, he was considered to have ever perpetrated IPV. All individuals who indicated they had ever perpetrated IPV were asked if they had committed the specific act in the past 12 months. If a respondent performed at least one act of sexual or physical violence in the past year, he was classified as a past-year IPV perpetrator (MSPAS, 2011; Abramsky et al., 2011; Ellsberg et al., 2008; García-Moreno et al., 2006).

The survey's domestic violence module yielded an additional independent variable. Based on the theoretical model, an additive index was created from endorsement of any of six traditional beliefs about gender roles within marriage/partnerships. The continuous variable ranged from 0 to 6 traditional beliefs. It demonstrated a questionable internal reliability, with a Cronbach's alpha of 0.53. The module also included a single item dichotomous variable for having experienced physical violence as a youth or adult (≥15 years), which served as an instrument for endogeneity testing (see Analysis section).

STATISTICAL ANALYSIS

To account for this study's stratified multi-stage sampling design, the analysis was conducted using the *svy* commands in Stata 12.0 (Stata Corp., College Station, TX). These commands adjust for the differential probabilities of selection (sampling weights), the non-independence of individuals sampled from the 733 clusters, and the sampling stratification

[3] The acts of physical and sexual violent acts include: 1) hit/thrown something, 2) pushed, 3) punched (closed fist), 4) kicked, 5) strangled/burned, 6) threatened with a knife or gun, 7)partner had sex with respondent out of fear, 8) respondent forced partner to have sex

(rural/urban). By accounting for the clustering, more accurate standard errors were produced in this analysis.

Frequencies were generated for history of lifetime sex worker patronage, past-year main partner infidelity, IPV perpetration (ever, past-year), and socio-demographics among the sample.[4] Crude associations between the sexual risk behaviors and both socio-demographic factors and IPV perpetration were assessed with Pearson χ^2 analyses. Adjusted Wald tests were used to compare means for continuous variables; significance for all analyses was set at $p<0.05$.

A multivariate probit model was used to test for associations between the dichotomous outcomes (main partner infidelity and lifetime history of sex worker patronage) and IPV perpetration while controlling for potential confounders. Lifetime perpetration of IPV was included in the model for lifetime sex worker patronage, and past-year IPV perpetration was used in the model with past-year main partner infidelity to align temporally the abusive and HIV risk behaviors. Both models included demographic factors (age, education, place of residence, ethnicity, wealth quintile, partnership type) and other potential confounders, including HIV knowledge (Vu et al., 2011), age at first sex (Dunkle et al., 2011), alcohol use (Frye et al., 2011; Raj et al., 2008), and partnership gender roles. (Figure 2) The Stata command *margins* was utilized to calculate the predicted probability of sex worker patronage and main partner infidelity as a function of IPV perpetration.

[4] Missing cases for variables included in the multivariate model (alcohol consumption and age at first sex) were excluded for all analyses.

Figure 2: Econometric Models

$$Infidelity_{year} = \beta_0 + \beta_1 IPV_{year} + \beta_2 age + \beta_3 wealth\ quintile + \beta_4 education + \beta_5 urban + \beta_6 ethnicity + \beta_7 partnership\ type + \beta_8 trad.partnership\ norms + +\beta_{10} agefirstsex + \beta_{11} excessive\ alcohol$$

$$SW\ patronage_{ever} = \beta_0 + \beta_1 IPV_{year} + \beta_2 age + \beta_3 wealth\ quintile + \beta_4 education + \beta_5 urban + \beta_6 ethnicity + \beta_7 partnership\ type + \beta_8 trad.partnership\ norms + \beta_{10} agefirstsex + \beta_{11} excessive\ alcohol$$

Bivariate probit models were developed to test whether IPV perpetration (ever or past-year) was an endogenous explanatory variable (Appendix 1). Adolescent/adult experience of violence served as the instrumental variable and was strongly associated with both lifetime history of IPV perpetration (Wald test: F=42.64, p<0.001) and past-year IPV perpetration (Wald test: F=15.06, p<0.001) in the reduced form models. When the instrument was incorporated into both structural models (Figure 1), Wald tests demonstrated no association with either past-year main partner infidelity or lifetime sex worker patronage (F=0.21, p=0.64 and F=0.22, p=0.65 respectively). Exogeneity of both measures of IPV perpetration was retained for main partner infidelity (ρ=0.19, p=0.84) and lifetime sex worker patronage (ρ=-0.04, p=0.87) (Appendix 1) . The original structural models (Figure 1) were used to determine the predicted probabilities of the outcomes for lifetime and past-year perpetrators of IPV compared to non-perpetrators.

RESULTS

Sample demographics

The mean age of this sample of married/partnered men (N=4,774) was 37.14 years (SD = 14.92) and majority resided in rural areas (58%). (Table 1) Half of the population was indigenous (50%) and almost three-quarters attained no (19%) or primary school level (53%)

education. The sample was spread evenly over the wealth quintiles. The majority of the men were formally married (63%).

IPV perpetration and Sexual risk behaviors

Nearly 17% of currently married/partnered men ever perpetrated intimate partner violence. (Table 2) Three percent of the sample perpetrated IPV in the past 12 months. Over 26% of married/partnered men reported ever paying for sex and 5.5% reported past-year main partner infidelity.

Descriptive statistics

Bivariate analyses (Table 4) revealed that past-year perpetrators of IPV were more likely to report main partner infidelity than non-perpetrators (14.14% vs. 5.21%, $p<0.001$). Nearly 38% of lifetime IPV perpetrators ever paid for sex compared to 24% of non-perpetrators ($p=0.07$). Past-year IPV perpetration was not associated with lifetime history of sex worker patronage, which may be due to the variables were not aligning temporally (past-year vs. lifetime history).

The two sexual risk behaviors were also significantly associated with several demographic variables. (Table 3) Mean age was higher among men reporting sex worker patronage than among those who did not (38.84 years vs. 36.53 years, $p<0.001$). Men reporting past-year main partner infidelity were younger than men who did not report the behavior (35.53 years vs. 37.23 years, $p=0.049$). Sex worker patronage and main partner infidelity were more common among urban compared to rural residents (34.24% vs. 20.53%, $p<0.001$ and 7.32% vs. 4.15%, $p<0.001$ respectively). Similarly ethnicity was significantly associated with both outcomes, where 35% of non-indigenous men reported a lifetime history of sex worker patronage compared to 17% of indigenous men ($p<0.001$). Nearly 8% of non-indigenous men reported main partner infidelity as compared to 3% of indigenous men ($p=0.001$). As both education

level and wealth quintile increased, there was a significantly positive association with lifetime sex worker patronage and infidelity. Partnership type was significantly associated with both outcomes. Fewer formally married men reported sex worker patronage or main partner infidelity (24% and 4% respectively) than men in a common law partnership (31% and 8% respectively).

Among men reporting excessive alcohol use in the last 30 days, more reported sex worker patronage than men who did not consume alcohol excessively ($p=0.001$ and $p=0.001$ respectively). (Table 4) Males with HIV knowledge were more likely to have ever paid for sex than men without (36% vs. 24%, $p<0.001$). There was a marginal association between HIV knowledge and main partner infidelity, where a higher percentage of men without HIV knowledge reported the behavior compared to men with HIV knowledge (7% vs. 5%, $p=0.09$).

Age of first sex was lower for men who reported main partner infidelity compared to those who did not. The mean age of first sex for men who reported sex worker patronage was 15.36 years, significantly lower than those who had never paid for sex. Similarly, mean age of sexual debut was lower for men who reported main partner infidelity (14.72 years, $p<0.001$). There was a negative association between the number of traditional partnership beliefs held by men and sex worker patronage. Men who ever paid for sex held an average of 2.77 beliefs compared to 2.95 beliefs held by men who never paid for sex ($p=0.02$). There was no association in the number of traditional partnership beliefs and main partner infidelity ($p=0.274$).

Multivariate analysis

After controlling for demographic and risk factors, IPV perpetration remained associated with both lifetime history of sex worker patronage and main partner infidelity. (Table 5) Lifetime history of IPV perpetration was positively associated with lifetime history of sex

patronage (β =0.34, p<0.001). Past-year IPV perpetration was positively associated with past-year main partner infidelity (β =0.37, p=0.01).

After controlling for socio-demographics and other risk factors, IPV perpetration increased the predicted probabilities of risky sexual behavior. The predicted probability of lifetime history of sex worker patronage was nearly 10 percentage points higher for married/partnered men with a lifetime history of IPV perpetration (36%) compared to non-perpetrators (26%). (Figure 2) A similar relationship was found for main partner infidelity. The predicted probability of past-year main partner infidelity increased by over 4 percentage points, nearly double for married/partnered men who reported past-year IPV perpetration compared to men who did not report past-year abuse (9.6% and 5.3% respectively).

DISCUSSION

Findings from this study demonstrated that lifetime history of IPV perpetration is high in Guatemala, with nearly 1 in 5 married/partnered men reporting have ever physically or sexually abused a female intimate partner. Relative to their non-abusive counterparts, men who reported ever perpetrating IPV were more likely to have ever engaged in sex worker patronage. Similarly, past-year IPV perpetrators were more likely to have engaged in past-year main partner infidelity than non-perpetrators. The associations between IPV perpetration and risky sexual behavior are consistent with results from studies throughout Africa (Kayibanda et al., 2012; Vu, L et al., 2011; Townsend et al., 2010; Dunkle et al., 2007), South Asia (Decker et al., 2009a; Decker et al., 2009b; Silverman et al., 2007) and the United States (Frye et al., 2010; Gilbert et al., 2007; Raj et al., 2008; Raj et al., 2007). These findings contribute to the literature on IPV perpetration and HIV risk by assessing this relationship in the Latin American context and among a nationally representative sample of men.

As has been described in other contexts facing the clustering of HIV risk behavior and IPV perpetration, individual and socially reinforced norms of traditional masculinity may underlay the relationship (Jewkes et al., 2010; Decker et al., 2009b; Santana et al., 2006; Raj et al., 2006). Bivariate analysis showed a crude negative association between the number of traditional partnership beliefs held and sex worker patronage ($p=0.01$). After controlling for demographic and risk factors, the association was not sustained. This study utilized a scale that had not been validated in Guatemala and had poor internal reliability (alpha=0.53). Further research among diverse samples is needed to understand how masculine gender role ideologies may be associated with men's perpetration of IPV and sexual risk behaviors and the magnitude of this association.

Given that HIV in Guatemala is primarily concentrated among high-risk groups, male clients of sex workers may serve as a bridge group linking high- and low-risk populations. The associations of IPV perpetration with both sex worker patronage and main partner infidelity suggest that it may be considered a risk marker for female partners' STI/HIV infection through the violent male partners' increased exposure to disease (Decker et al., 2009a). This evidence bolsters calls to integrate the prevention and screening of IPV perpetration with STI/HIV prevention efforts. Rigorous impact evaluation of the Stepping Stones Program in South Africa suggests the effectiveness of integrated programs at reducing STI, IPV perpetration, transactional sex, and problem drinking (Jewkes et al., 2008).

Limitations

The current findings should be considered in light of several imitations. Because of the nature of the IPV and sexual behavior questions, it is unknown whether either occurred in the context of the respondents' current primary partnership. Additionally, the study's cross-sectional

design prohibits conclusions about the temporality of the relationships uncovered. Longitudinal work is needed to understand the sequencing of IPV and high risk behaviors on STI/HIV infection and transmission to female partners. Reliance on self-reported information on sensitive and potentially illegal activities, such as perpetration of domestic violence and sex worker patronage, is subject to social desirability and recall biases. These biases mostly likely resulted in underreporting of the delicate issues. For example, the 2008/2009 women's ENSMI showed that over 11% of currently married/partnered women reported past-year physical or sexually IPV victimization. The men report only 3% of currently married/partnered men reported physical or sexual IPV perpetration.

Conclusion

Study findings from Guatemala reinforce the mounting evidence from Africa, South Asia and the United States that male IPV perpetrators are more likely to engage in risky sexual behavior, including sex worker patronage and main partner infidelity. The concurrency of violence and increased STI/HIV may compound the health risks for female victims who also face injury and psychological trauma. These data suggest the importance of further exploring associations between masculinity norms and both IPV perpetration and sexual risk behavior. Additionally this study strengthens the claim for integrating prevention and screening of IPVs into STI/HIV prevention programming.

Tables

Table 1: Percentage of ever-married/partnered men aged 15-59 with select socio-demographic characteristics, Guatemala 2008/2009 (n=4,744)

Socio-demographic characteristic	mean	S.E.	n[1]
Mean age (SD)	37.14		4,744
Residence			
Rural	0.58	0.01	2,743
Urban	0.42	0.01	2,001
Ethnicity			
Indigenous	0.50	0.02	2,359
Ladino (non-indigenous)	0.50	0.02	2,385
Education Level			
None	0.19	0.01	863
Primary	0.53	0.01	2,612
Secondary	0.22	0.22	981
Post-secondary	0.06	0.06	288
Wealth Quintile			
Lowest	0.22	0.01	1,108
Second	0.22	0.01	1,042
Middle	0.20	0.01	935
Fourth	0.20	0.01	960
Highest	0.16	0.01	699
Partnership type			
Married	0.64	0.01	3,067
Union (cohabitating sexual partners	0.36	0.01	1,677

[1]Unweighted sample size;

Table 2: Percentage of married/partnered men 15-59 who report past-IPV perpetration, percentage reporting sexual risk outcomes, Guatemala 2008-2009 (n=4,744)

	Mean	S.E.	n
Lifetime history of IPV perpetration			
Yes	0.17	0.01	750
No	0.83	0.01	3,994
Past-year IPV perpetration			
Yes	0.03	0.01	154
No	0.97	0.01	4,590
Lifetime history of sex worker patronage			
Yes	0.26	0.01	1,233
No	0.74	0.01	3,511
Past year main partner infidelity			
Yes	0.05	0.01	286
No	0.95	0.01	4,458

***p<0.01; **p<0.05; *p<0.10

Table 3: Percentage of men 15-59 reporting sex worker patronage and percentage reporting main partner infidelity (past year), by socio-demographic characteristic, (n=4,744)

Socio-demographic characteristic	Lifetime sex worker patronage %	Past-year main partner infidelity %	n
Mean age (SD)	38.84 (14.05)***	35.53 (14.10)***	4,744
Residence	***	***	
Rural	20.53	4.15	2,743
Urban	34.24	7.32	2,001
Ethnicity	***	***	
Indigenous	17.12	2.98	2,359
Ladino (non-indigenous)	35.29	7.99	2,385
Education Level	***	***	
None	15.33	2.07	863
Primary	27.87	4.99	2,612
Secondary	30.46	7.45	981
Post-secondary	30.65	13.11	288
Wealth Quintile	***	***	
Lowest	12.85	1.65	1,108
Second	21.49	3.02	1,042
Middle	29.35	6.49	935
Fourth	34.33	8.45	960
Highest	37.26	9.19	699
Partnership type	***	***	
Married	23.83	4.08	3,067
Cohabitating sexual partner	30.55	8.02	1,677

***p<0.01; **p<0.05; *p<0.10

Table 4: Percentage of men 15-59 reporting past-year main partner infidelity and percentage reporting lifetime history of sex worker patronage, by IPV perpetration and other risk factors,(n=4,744)

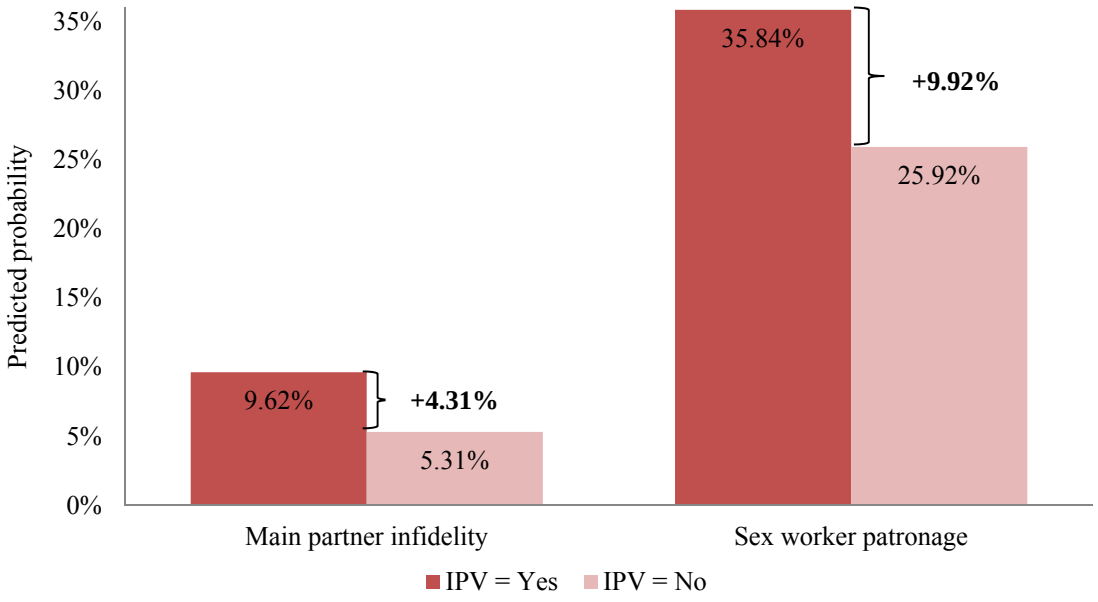
Risk factors	Lifetime sex worker patronage %	Past-year main partner infidelity %	n
Lifetime IPV history	***	*	
Yes	37.97	7.04	750
No	24.02	5.19	3,994
Past year IPV perpetration	ns	***	
Yes	29.90	14.14	154
No	26.21	5.21	4,590
Excessive alcohol use	***	***	
Yes	37.29	10.79	602
No	24.65	4.68	4,142
Comprehensive HIV knowledge	***	*	
Yes	35.59	5.10	988
No	23.83	6.95	3,756
Mean number of traditional partnership beliefs (SD)	2.78 (2.24)**	2.79(3.86)^{ns}	4,744

***p<0.01; **p<0.05; *p<0.10

Table 5: Correlates of lifetime history of sex worker patronage and past-year main partner infidelity among married/partnered men, Guatemala (n=4,744)

	Lifetime history of sex worker patronage			Main partner infidelity (past year)		
	β	SE	p-value	β	SE	p-value
IPV perpetration (ever)						
No	Reference			---		
Yes	0.340	0.067	<0.001	---	---	---
Past year IPV perpetration						
No	---			Reference		
Yes	---	---	---	0.368	0.146	0.012
Age	0.022	0.003	<0.001	-0.001	0.001	0.117
Residence						
Rural	Reference			Reference		
Urban	0.175	0.069	0.011	-0.080	0.107	0.454
Ethnicity						
Indigenous	Reference			Reference		
Non-indigenous (Ladino)	0.243	0.064	<0.001	0.128	0.086	0.135
Education Level						
None	Reference			Reference		
Primary	0.400	0.081	<0.001	0.231	0.144	0.108
Secondary	0.256	0.120	0.035	0.304	0.175	0.083
Post-secondary	0.057	0.165	0.731	0.808	0.217	0.000
Wealth Quintile						
Lowest	Reference			Reference		
Second	0.096	0.086	0.261	0.095	0.157	0.545
Middle	0.198	0.088	0.026	0.467	0.148	0.002
Fourth	0.176	0.105	0.094	0.545	0.165	0.001
Highest	0.214	0.133	0.108	0.524	0.193	0.007
Partnership type						
Married	Reference			Reference		
Cohabitating partner	0.163	0.631	0.010	0.333	0.084	0.000
Excessive alcohol use						
No	Reference					
Yes	0.244	0.077	0.002	0.242	0.092	0.008
Comprehensive HIV knowledge						
No	Reference			Reference		
Yes	0.242	0.067	<0.001	-0.064	0.115	0.581
Traditional partnership beliefs	-0.011	0.024	0.653	0.011	0.035	0.743
Age at first sex	-0.155	0.012	<0.001	-0.121	0.018	0.000

Figure 2: Change in predicted probabilities of extramarital sex and sex worker patronage associated with IPV perpetration



Appendix 1: Endogeneity Testing

Bivariate probit models were developed to test whether IPV perpetration (ever or past-year) was an endogenous explanatory variable (Appendix 1). As described in the conceptual framework, evidence suggests that IPV perpetration and sexual risk-taking practices may arise from underlying ideals of "successful" masculinity (Decker et al 2009; Dunkle et al 2006; Raj et al 2006; Santana et al). Although traditional gender norms in the context of partnerships were assessed in the ENSMI and included in the structural econometric models (Figure 1), a validated measure of masculine gender role ideologies was not included. This unobservable information, potentially related to both IPV perpetration and the risk outcomes, suggested the possible endogenity of IPV perpetration.

Figure 3: Structural and Reduced Form Models

Main partner infidelity

Structural model

$$Infidelity_{year} = \beta_0 + \beta_1 IPV_{year} + \beta_2 age + \beta_3 wealth\ quintile + \beta_4 education + \beta_5 urban + \beta_6 ethnicity + \beta_7 partnership\ type + \beta_8 trad.partnership\ norms + +\beta_{10} agefirstsex + \beta_{11} excessive\ alcohol$$

Reduced form model

$$IPV_{year} = \pi_0 + \pi_1 abused_{older} + \pi_2 age + \pi_3 wealth\ quintile + \pi_4 education + \pi_5 urban + \pi_6 ethnicity + \pi_7 partnership\ type + \pi_8 trad.partnership\ norms + +\pi_{10} agefirstsex + \pi_{11} excessive\ alcohol$$

Sex worker patronage

Structural model

$$SW\ patronage_{ever} = \beta_0 + \beta_1 IPV_{ever} + \beta_2 age + \beta_3 wealth\ quintile + \beta_4 education + \beta_5 urban + \beta_6 ethnicity + \beta_7 partnership\ type + \beta_8 trad.partnership\ norms + \beta_{10} agefirstsex + \beta_{11} excessive\ alcohol$$

Reduced form model

$$IPV_{ever} = \pi_0 + \pi_1 abused_{older} + \pi_2 age + \pi_3 wealth\ quintile + \pi_4 education + \pi_5 urban + \pi_6 ethnicity + \pi_7 partnership\ type + \pi_8 trad.partnership\ norms + +\pi_{10} agefirstsex + \pi_{11} excessive\ alcohol$$

Adolescent/adult experience of abuse served as the instrument, which strongly associated with both lifetime history of IPV perpetration (Wald test: F=42.64, p<0.001) and past-year IPV perpetration (Wald test: F=15.06, p<0.001) in the reduced form models. When the instrument was incorporated into both structural models (Figure3), Wald tests demonstrated no association with either past-year main partner infidelity or lifetime sex worker patronage (F=0.21, p=0.64 and F=0.22, p=0.65 respectively). It was uncorrelated with the residuals with either structural model.

Exogeneity was retained in the bivariate probit model for main partner infidelity (ρ=0.19, p=0.84) and lifetime sex worker patronage (ρ=-0.04, p=0.87) (Appendix 1) . The original structural models (Figure 1) were used to determine the predicted probabilities of the outcome for past-year perpetrators of IPV compared to non-perpetrators.

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