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"Taking Risk" in the Era of HIV: A Closer Look at Selling Sex in Thailand

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ABSTRACT

Using game-theoretical modelling, this paper analyses the role of risk perception and signalling on HIV transmission between commercial sex workers (SW) and their clients. The paper also provides results of a survey conducted in late-2014 in Thailand involving 200 SWs (female sex workers, FSW, and male and transgender sex workers, MTSW), as well as 67 clients regarding condom use and HIV testing. It was found that: (1) incomplete information and individual risk perceptions are important factors for engaging in unprotected sex; (2) there is potential for signalling but it is rather weak in practice; and (3) MTSW, as well as men, who have sex with men (MSM) represented the highest-risk groups that are highly vulnerable and exposed to HIV.

Keywords: Commercial Sex, Condom Use, HIV Transmission, Incomplete Information, Risk Perception, Signalling

INTRODUCTION

According to UNAIDS (2014, p. 229), millions of people around the world are vulnerable to HIV infection and AIDS is the leading cause of death among women of reproductive age and young adolescents. The most frequent mode of transmission of HIV is through sexual contact with an infected person. According to the Thai National AIDS Committee (2014, p. 8), new HIV infections in Thailand by unprotected sexual contact is as high as 90%, of which 41% are among male and transgender sex workers (MTSW) and men who have sex with men (MSM), 12% are female sex workers (FSW) and their clients, 33% in discordant couples,

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and 4% among those engaging in casual sex. In general, commercial sex workers (SW) are at higher risks of acquiring and transmitting HIV due to the nature of their work, which includes multiple concurrent partners and inconsistent condom use. In 2012, the HIV prevalence rate among FSW in Thailand working in the venue-based sex market was 2.2%, but this could vary from place to place and reach as high as 20% for non-venue-based FSWs in Bangkok (Thai National AIDS Committee, 2014, pp. 5-6). Furthermore, among male sex workers (MSW), the HIV prevalence rate was 12.2%, which remained significantly higher than in most groups of FSWs (3% nationally) and MSM (7%).

Although the number of sexual partners is positively correlated with the incidence of HIV (and other STDs), research has suggested that condom use is a more effective method of reducing HIV infection than simply reducing the number of sexual partners (Reiss & Leik, 1989, p. 411). As such, this paper focuses on SWs and their clients regarding condom use (protected sex), where HIV-positive (HIV+) and HIV-negative (HIV−) persons may interact. Also adopted are game-theoretical models that take into account the fact that there are often issues of incomplete information regarding HIV status in the commercial sex market. Furthermore HIV status, even when known, is usually not shared among partners, and clients (as well as SWs) could try looking for signals to deduce information about his/her partner's HIV status. The models show how risk perceptions or more specifically perceived probabilities of partner's HIV status can be important in determining outcomes in general and also when signalling is involved.

This paper also presents results of a non-random convenience sample of a survey conducted in late-2014 involving FSW and MTSW, as well as 67 clients (of which 36 are MSM). Specifically, venue-based FSW is distinguished from non-venue-based FSW and MTSW. In Thailand, many venue-based establishments work with the Ministry of Public Health to provide regular STI and HIV testing for SWs (Guest et al., 2007, p. 55), and have made it a policy requiring workers to provide results of HIV testing every 3 months. Hence, the venue-based commercial sex market could supposedly provide signals about the "quality" of SWs. In this paper, it is shown theoretically and empirically that HIV infections continue because uninfected persons engage in unprotected (without a condom) sex with infected persons under conditions of incomplete information and differences in risk perceptions in the commercial sex market.

GAME-THEORETICAL MODELS

Assumptions on Individual Preferences

There are a number of important papers that model the commercial sex market (see for instance, Ahlburg & Jensen, 1998; Edlund & Korn, 2002; Gertler, Shah & Bertozzi, 2005; etc.). Following Schroeder

and Rojas (2002), we assume the following assumptions about individual preferences regarding sex,[1] taking u_i(type of sex, s_i, s_j) to denote the utility for the person *i* depending on the type of sex, either unprotected or risky sex (*RS*), protected sex (*PS*) or no sex (*NS*), and Player *i's* and *j's* (partner's) HIV status to be $s_{i,j} = \{-, +\}$ representing HIV− and HIV+ respectively, then:

1. HIV− person's prefer unprotected or risky sex to protected sex with HIV− partner

$$u_i(RS, -, -) \gtrsim u_i(PS, -, -)$$

2. HIV− person's prefer protected sex to risky sex with HIV+ partner

$$u_i(PS, -, +) \gtrsim u_i(RS, -, +)$$

3. HIV− person's prefer no sex to risky sex with HIV+ partner

$$u_i(NS, -, +) \gtrsim u_i(RS, -, +)$$

4. HIV+ person's preference is described by

$$u_i(RS, +, +/-) \gtrsim u_i(PS, +, +/-) \gtrsim u_i(NS, +, +/-)$$

With the above preference assumptions and under conditions of perfect information, it is easy to show that:[2] (a) if Players *i* and *j* have the same HIV status, i.e. Player *i* is HIV− (HIV+) and knows Player *j* is HIV− (HIV+), then $RS' \gtrsim PS' \gtrsim NS$, (b) if Player *i* is HIV− and knows that Player *j* is HIV+, then $PS, NS' \gtrsim RS$, and (c) if Player *i* is HIV+ and knows that Player *j* is HIV−, then $RS' \gtrsim PS' \gtrsim NS$. In sum, *RS* is the dominant strategy if HIV status is the same for both Players, but *RS* is strictly dominated if Players *i* and *j* have different HIV status. This, although simple enough, still begs the question, "So why do uninfected persons still have risky sex with infected persons?"

Game-theoretical Model I

Provided here is a simple incomplete information game involving two players, Player 1 and 2, who are either HIV+ or HIV−. Player 1 may offer sex (say, SW) after which Player 2 (say, client) makes a "counteroffer" of either *PS* or *RS*. Assume that Player 2 does not know Player 1's HIV status, but may have some subjective probability or belief about Player 1's HIV status (μ). After Player 1 confirms, the couple have sex if in agreement (either *PS* or *RS*), otherwise both end up with NS. Figure 1 considers the case in which Player 2 is HIV−. Ruling out the case in which violence or the threat of violence may be used, which would complicate the analysis,

[1] Note that Rich Lafferty has criticized their game-theoretical model.

[2] We could further have u_i (*PS*,–,+) ~u_j (*NS*, –,+), or u_i (*PS*,–,+) $\gtrsim$ u_j(JS,–,+) for risk-taking *i*, or u_j(*NS*,–,+) $\gtrsim$ u_j(*PS*,–,+) for risk-averse *i*. Note also that assumption 4 includes u_i(*RS*,+,–) $\gtrsim$ u_j(*PS*,+,–), that is, HIV + person prefers unprotected sex with HIV– partner.

and keeping things manageable, the payoffs are depicted as shown in the figures. Note that the amounts are hypothetical with larger positive (negative) numbers referring to higher (lower) payoffs.

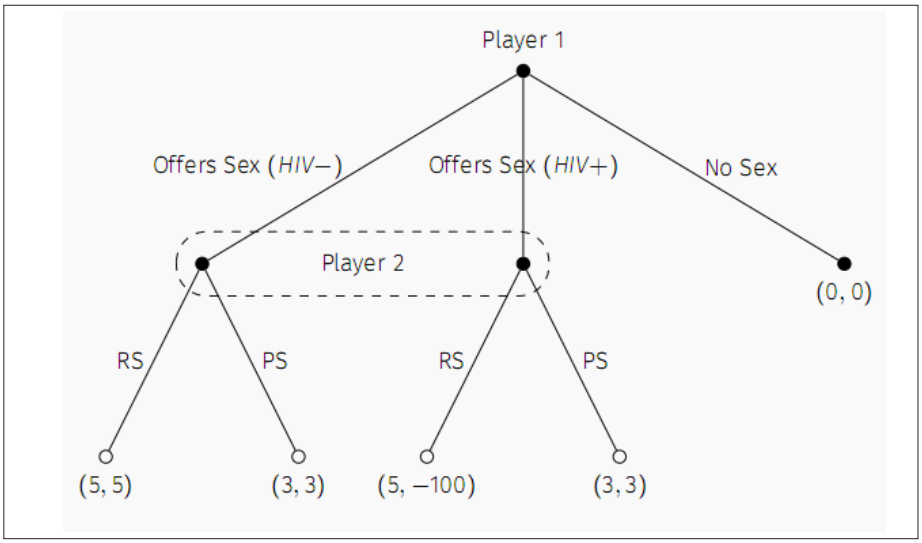

Figure 1. HIV-negative Player 2

Representing Player 2's belief that Player 1 is HIV+ by μ, then for Player 2, we have $EU^{RS}=5\ (1-\mu)-100\mu$ and $EU^{PS}=3(1-\mu)+3\mu$, representing expected utilities for risky sex and protected sex, respectively. Solving gives a "threshold" value of μ of about 2%. That is, given the payoffs and the structure of the game represented in Figure 1, Player 2's expected utility is higher choosing *PS* over *RS* when (s)he believes that infection rates are more than 2% (or $\mu > 2\%$). Note that the threshold μ is lower the larger the negative payoff of becoming infected (which is set to −100). This implies that Player 2, assigning a considerably larger negative payoff from infection, would typically not engage in *RS* unless (s)he believes the HIV prevalence rate to be significantly smaller. Arguably, a risk-averse Player 2 would assign such a large negative payoff of being infected. Conversely, the smaller the perceived negative payoff from infection, the higher the "threshold" value of μ, which would correspond to increased risky behaviour. This could happen, for example, as reported in Lakdawalla et al. (2006) who found that in the U.S. HIV treatment breakthroughs have improved health and survival for the HIV patients, thereby presumably reducing the negative payoff from infection would therefore result in their increased sexual activity, which has

facilitated the spread of HIV.[3] Be as it may, the incomplete information game presented here demonstrates how a HIV− Player 2's choice for *RS* depends on his/her belief about the HIV prevalence rate, μ, which can be influenced by the perceived gravity of the burden from infection.

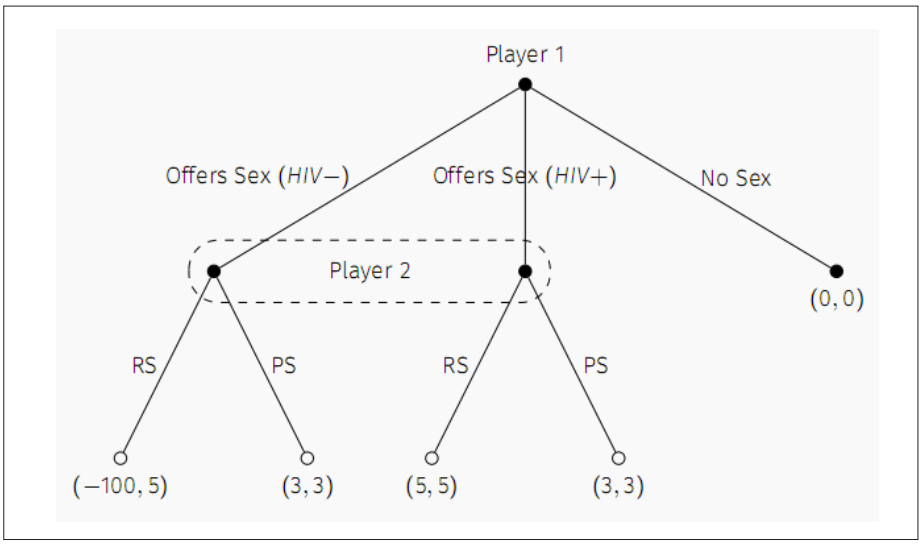

Figure 2. HIV-positive Player 2

The case in which Player 2 is HIV+ is shown in Figure 2. Clearly, here *RS* is the dominant strategy. That is, HIV+ Player 2 prefers *RS* without regard to the HIV status of Player 1 (who might even be HIV−) and is willing to engage in unprotected sex that could result in new infections. Hence, we have here an explanation as to why some infected persons continue to have unprotected sex with uninfected persons (Wenger et al., 1994; Munoz-Perez et al., 1998). This section shows that incomplete information, together with differences in risk perceptions, is an important reason for the spread of HIV.

Game-theoretical Model II

Reality unsurprisingly presents many complications. For example, the HIV status of SWs and their clients is often hidden and obscure. A client may then look for "signals" to try guessing the HIV status of a SW, for example. The classical signalling model in a dynamic game setting is employed here to model the situation of signalling. As before, consider two players, Player 1 who sends a signal or message $M=\{m^-,m^+\}$, denoting "HIV-free" and "HIV-infected" respectively,

[3] On the contrary, Kennedy, et al. (2007) find evidence indicating a significant reduction in risk behaviour associated with antiretroviral therapy (ART) in developing countries.

and Player 2 who receives the signal and decides on the type of action A={*NS, PS, RS*}, denoting "No Sex", "Protected Sex" and "Risky Sex", respectively. Nature selects type t_i from the type space T={*HIV*−, *HIV*+}, representing the HIV status of Player 1. Also, as usual with these games, nature goes first determining the HIV+ rate at θ.

Beginning with the case in which Player 2 (say, a client) is HIV− and does not know Player 1's HIV status; this time however observes a message m^- or m^+ sent by Player 1 (e.g., corresponding to whether the SW works in a venue-based establishment or not). As before, *PS* gives a payoff of 3, *RS* gives 5, and infection −100. Some further behavioural assumptions are considered, which are: (a) Player 2 is risk-averse, hence subtract r (add s) for accepting risky (protected) sex when the signal sent to him/her by Player 1 is m^+, and (b) for a truth-preferring Player 1, sending the true (misleading) message as his/her true type adds (subtracts) to payoff t (c), except when HIV− Player 1 sends m^+ (say with intention to divert from *RS*) and engages in *PS*. Figure 3 summarises this game.

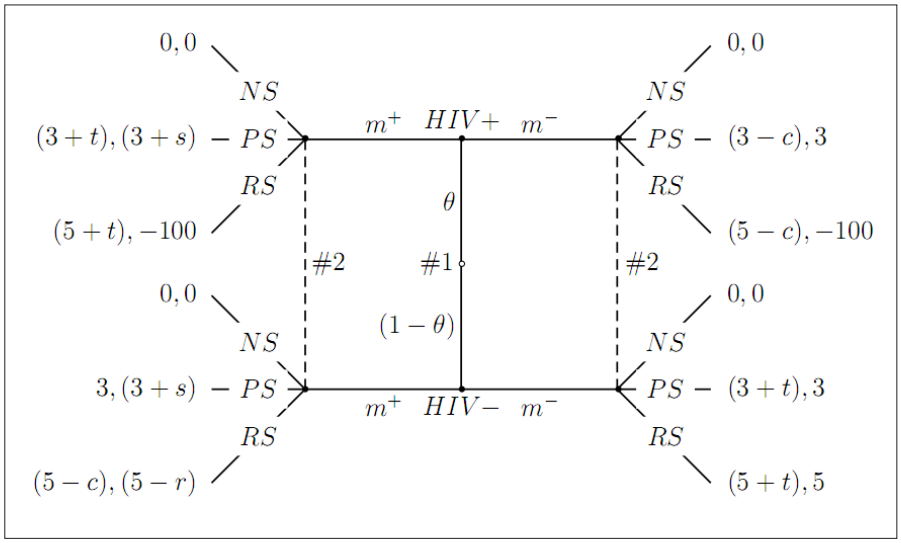

Figure 3. HIV-negative Player 2 receives signal from Player 1

Is there a separating equilibrium? That is, whether each of Player 1 sends message according to one's type, whether $p_1(m^+ \mid +) = 1$ and $p_1(m^+ \mid -) = 0$, is an equilibrium? Here Bayes' rule gives:

$$\mu(+ \mid m^+) = \frac{p_1(m^+ \mid +)p(+)}{p_1(m^+ \mid +)p(+) + p_1(m^+ \mid -)p(-)} = \frac{1 \times \theta}{1 \times \theta + 0 \times (1-\theta)} = 1$$

That is Player 2 believes that HIV+ Player 1 will send m^+ and similarly $\mu(-|m-)=1$. Player 2's sequential rationality implies $p_2(RS \mid m^-)=1$, and $p_2(RS \mid m^+)=1$; That is, Player 2 believes that Player 1 is HIV− if and only if m^- is sent, and consequently ends with *RS*. Hence there is a separating

Perfect Bayesian Equilibrium (PBE) of this type on the further condition that sending a truthful/misleading signal adds/lowers the payoffs (and $c > t$, $c + t \geq 1$), otherwise there is no equilibrium of this type. Equilibrium depends on a truth-telling Player 1.

Next, consider the case when each type of Player 1 sends a message different to one's true type (i.e. $p_1 m^- | +) = 1$ and $(p_1 m^- | - = 0)$. With Bayes' rule, Player 2's sequential rationality implies $p_2(PS | m^-) = 1$ and $p^2(PS | m^+) = 1$, as long as $s > r$ (and $r + s \geq 1$), which corresponds neatly with Kahneman and Tversky's (1979) idea of loss aversion, in which the risk-averse Player 2 assigns a significantly larger negative payoff with risky sex than his/her gain in playing safe sex when the signal from Player 1 is m^+. For example, if $r \leq s$ (e.g., Player 2 is a risk-lover with $RS \gtrsim PS$) when HIV− Player 1 signals m^+, then $p_1(m^- | +) = 0$, contradicting our hypothesis and PBE breaks down. Hence we have a PBE of this type of risk-averse Player 2; otherwise, there is no equilibrium of this type.

Next, we look for possibilities of a pooling equilibrium. First, consider the case when both types of Player 1 send m^-, that is, $p_1(m^- | +) = 1$ and $p_1(m^- | -) = 1$ or "pooling to the right". Bayes' rule implies that $\mu(+ | m^-) = \theta$ and $\mu(- | m^-) = (1 - \theta)$. Hence, after observing m^-, Player's 2 expected payoff with RS is $(1 - \theta) \times 5 - \theta \times 100 = 5 - 105\theta$, while the expected payoff with PS is $\theta \times 3 + (1 - \theta) 3 = 3$. Sequential rationality implies that $p_2(PS | m^-) = 1$ when $\theta > 0.019$ (i.e., HIV prevalence rate of about 2%). Player 2 could engage in *RS* if (s)he believes the HIV prevalence rate to be lower than about 2%. Considering the left-side information set of the game which corresponds to the off-path action, it is easy to see that Player 2's optimal action could differ, if and only if (s)he were not risk-averse.

Lastly, when both types send m^+, that is, $p_1(m^+ | +) = 1, p_1(m^+ | -) = 1$ or pooling to the left, then *PS* is notably the dominant strategy for risk-averse Player 2 (with $s > r > 1$). Considering the right-side information set of the game which corresponds to the off-path action, specifically if $\mu(m_1^- | HIV+) \leq 0.019$, Player 2's optimal action could differ. However, in such a case, Player 1 benefits by deviating to m^-, which is inconsistent with Cho and Kreps' (1987) *intuitive criterion*, thereby ruling out the case where both types send m^+ as an equilibrium.

For completeness, Figure 4 illustrates the case in which Player 2 is HIV+. As before *PS* gives a payoff of 3, while *RS* gives 5, and infection −100. We make some further behavioural assumptions, namely, (a) Player 2, now HIV+, has $RS \gtrsim PS$, and (b) for Player 1, sending the true (wrong) message as his/her true type adds (subtracts) payoff of t (c), except when HIV− Player 1 sends m^+ (say with intention to divert from *RS*) and engages in *PS*. We could of course look for separating and pooling equilibrium (and this is left as an exercise for the reader), but the main conclusion is that HIV+ Player 2, under the conditions and assumptions of our model, ultimately has $RS \gtrsim PS$. An HIV+ Player 2's preferences are not affected by signaling.

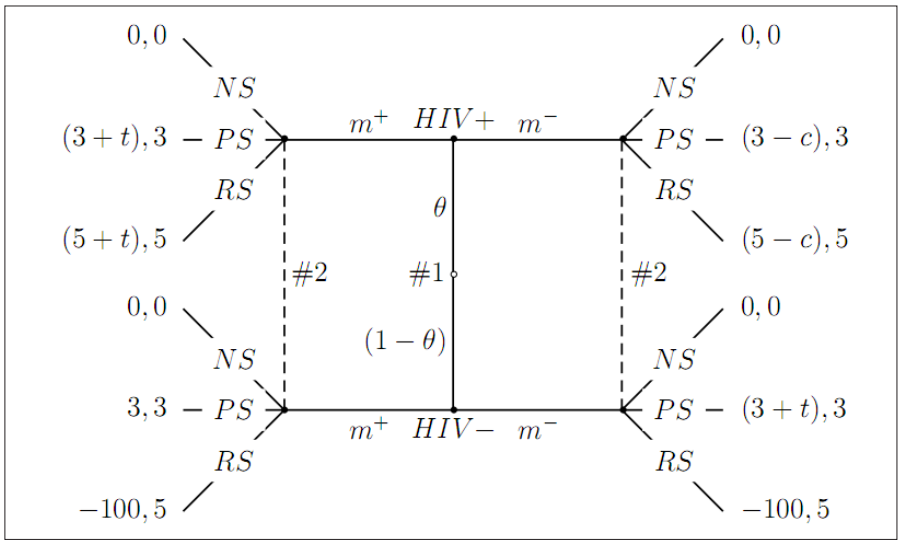

Figure 4. HIV-positive Player 2 receives signal from Player 1

SURVEY DESCRIPTION AND RESULTS

This section provides a summary of the results from a survey conducted in late-2014 from a non-random convenience sample in Bangkok. A total of 200 SWs were surveyed with the help of two established NGOs (100 were FSWs and another 100 were MTSWs). Among the FSWs surveyed, 80 worked in A-GoGo Bars and/or massage parlour (a.k.a. venue-based FSWs), while 20 were freelance (non-venue-based FSWs). Generally, MTSWs worked in the traditional massage parlours, spas and saunas where HIV testing was not a requirement. Also surveyed were 67 clients of which 36 were MSM.

For our sample, the median age of SWs was more or less the same across groups at 27 years (with a standard deviation of 6 years) and about half had been SWs for a period between 1 to 3 years. About 90% of the venue-based FSWs reported "full-time" employment compared to only 30-40% for freelance FSWs and MTSWs. FSWs reported lower average monthly income (53% reported earnings of Baht 10-20,000 per month) from sex work compared to MTSWs (58% reported earnings of Baht 20-50,000). This differs with Nemoto et al. (2012, p. 217) who reported that *kathoey* (male-to-female transgender) sex workers (KSW) have much lower monthly income than FSW in Bangkok.

Table 1
Sex workers' demographic and working profile

	Female Sex Workers	Male and Transgender Sex Workers
Bachelor's degree (%)	8	34
Single (%)	68	92
Having children (%)	39	8
Median number of clients per week	4-5	10

As shown in Table 1, MTSWs have, on average, higher education than FSWs, with 34% attaining a Bachelor's degree or above compared to only 8% for FSWs. MTSWs were also mostly single (92%) compared to venue-based FSWs (63.75%). Regarding the frequency of sex work, MTSWs reported a median of 10 clients per week (with maximum of 25), thereby making them about twice as active when compared to FSWs (median of 4 to 5 clients per week, with a maximum of 10 clients, for venue-based FSW; and median of 5.5, with maximum of 20, for non-venue-based, freelance FSW). This is worrying given the fact that the HIV prevalence rate of MSM is 7% for Thailand and as high as 24.4% in Bangkok (UNAIDS, 2014, p. 67). Moreover, in Bangkok, Chiang Mai and Phuket, it has been estimated that HIV prevalence among transgender people was 10.4% in 2010, making them a particularly at-risk population (UNAIDS, 2014, p. 74).

Table 2
Sex workers' risk profile

	Venue-based FSW (%)	Freelance FSW (%)	MTSW (%)	$\chi 2$
Always use condom	75	85	82	ns
No drugs/alcohol	13	90	38	43.6**
HIV testing within 3 months	37.5	20	32	ns
Never had HIV testing	7.5	35	21	18.7**
% w.t.a no condom use				
Baht 10,000 offered	45	60	48	ns
Baht 2,000 offered	0	0	16	ns

Note. w.t.a, willing-to-accept. ns, not significant. ** $p < 0.01$.

When considering the risk profile of SWs, inconsistent condom use seems typical (see Table 2). Similar to the figures reported by Hsieh (2002) and Tareerat et al. (2010), about 75% of the surveyed FSWs in venue-based establishments reported consistent condom use in our sample, which was somewhat less than that for non-venue-based FSWs and MTSW (85% and 82% respectively). Again, this is similar to a report by the National AIDS Prevention and Alleviation Committee (2010, p. 91), which found that MSM and transgender SWs in Thailand reported condom use with customers at 87.6% and 79.5% respectively. However, the same report also mentioned that MSM condom use during last episode of anal sex was only 21.7%.

SWs were also asked whether they were willing to accept monetary compensation for unprotected sex. Buckingham et al. (2005, p. 643), for example, found that 13% of FSW in brothel-based FSW in Thailand had asked for monetary compensation for vaginal sex without a condom. Nemoto et al. (2013, p. 616) also reported that 86% of Thai FSWs said they would engage in unsafe sex for extra money. In our survey, about half of

FSWs were willing to engage in unprotected sex in exchange for a monetary offer of Baht 10,000. When monetary compensation offered was less than Baht 5,000, all FSWs in our survey rejected unprotected sex for this amount. However, some MTSWs (16%) were still willing to accept unprotected sex for as low as Baht 2,000. This again illustrates the risky nature of MSM, which is worrying given that unprotected sex is particularly more risky for this group, especially when anal intercourse is involved (Baggaley et al., 2010).

A majority of venue-based FSWs reported working under the influence of alcohol and/or drugs. Freelance FSWs, on the other hand, remained mostly free from substance use perhaps because they lacked the physical security provided by venue-based sex establishments. Furthermore, substance use by some MTSWs was common at times to enhance sexual appetite/ performance (Van Griensven, et al., 2010).

Despite the policy in many venue-based sex establishments for SWs to have testing every 3 months, HIV testing was found to be irregular with only 37% venue-based FSWs having tested in the past 3 months, and 7.5% having never tested at all. Also alarming is that 35% of freelance FSWs and 21% of MTSWs reported to never having tested for HIV. In Thailand, as in a large number of countries, dedicated programmes consisting of access to some form of HIV prevention services including HIV testing and condoms mainly reach FSWs, while other Key Affected Populations (KAPS) including MTSWs have been generally ignored. Stigmatisation remains a key barrier to slowing the HIV epidemic and providing proper treatment, and as a result, despite increased efforts to reach these high-risk groups, HIV testing among transgender and other MSM remains somewhat low and many lack a comprehensive knowledge about HIV (National AIDS Prevention and Alleviation Committee, 2010; Nemoto et al., 2012). Detels (2004, p. 3) for example argues that a majority of HIV-infected people in Asia do not know that they are infected, and they continue to infect others. Many do not like to be tested because the mere act of being tested identifies them as being socially "undesirable" and also puts them at risk for being discovered to be infected, which may cause them to be isolated from their communities and even rejected by their families.

Also included in our survey are clients in Bangkok and Phuket. Their average age was 31 years (with standard deviation of 7 years), with more than a quarter having tertiary education. Meanwhile, about 87% were not married. About 40% often visited the commercial sex market (at least once a month) and 60% reported being under the influence of alcohol and/or drugs during their visits. A staggering 30% stated they have had unprotected sex at least once. Although this study could not directly link substance use with unprotected sex, its high level of use is a reason for concern given that alcohol and drugs may affect proper judgment which may lead to increased risky behaviour.

A staggering 30% of the clients surveyed never had HIV testing. 68% reported that they would always use a condom even with a regular partner, and this was somewhat higher at 78% for MSM clients, perhaps demonstrating the increased fear of risk of HIV infection. The findings of our survey are comparable with that reported in Chemnasiri et al. (2010), where among 827 sexually active young MSM surveyed in Bangkok, Chiang Mai and Phuket, 52.3% reported recent inconsistent condom use, but notably, MSWs were most prepared to use condoms with clients.

CONCLUSION

Under conditions of perfect information with risk-averse and rational people, every HIV-negative person should avoid unprotected sex with a HIV-positive partner. However, the reality is much more complex and research evidence over the past 25 years finds that there is no one particular factor for unsafe sex behaviour. Moreover, perfect information in which everyone knows the HIV status of potential partners is unrealistic. Rather, the HIV status (if and) when known is not commonly shared between SWs and their clients. The commercial sex market is characterised by imperfect information, as well as risk-takers and non-truth-tellers. This paper employs standard game-theoretical modelling under incomplete information, while considering the possibility of signalling, to show how outcomes may depend on belief and perceptions about a partner's HIV status, as well as on individual's risk taking attitude which would generally affect judgment for averting risk. More specifically, because clients do not know the health status of a SW, the best (s)he can do is to look for a signal that may reveal the SW's status as uninfected clients try to 'match' with uninfected SWs. Since many Thai venue-based sex establishments require SWs to declare the results of HIV tests every 3 months, this study considers this policy as a potential signal about the "quality" of SWs and analyses various possible equilibria using the signalling game-theoretical model under incomplete information. Equilibrium depends on the validity of the signal, or more specifically in the context of this study, whether the testing policy in the venue-based sex establishments is strictly enforced, as well as the risk attitude of clients (i.e., whether they are risk-averse or risk-lovers). The survey conducted for this study revealed that HIV testing of venue-based SWs was not strictly enforced with only 37.5% having tested in the past 3 months. Moreover, only 75% of SWs used condoms consistently with their clients and about half would accept some monetary compensation for unprotected sex. With only weak signals and incomplete information available in the commercial sex market, a pooling equilibrium in which all types send a message of "no HIV infection" (i.e., SWs in venue-based establishments) would seem the more likely, and in which case, protected sex (*PS*) should be chosen. On the other hand, although protected sex in non-venue-based sex markets would be rational too, differences in risk-taking

attitude could result in unsafe or risky sex, and hence lead to infection. Of particular concern highlighted by our survey is that MTSWs and MSM represent a higher-risk vulnerable group exposed to HIV and AIDS. Be as it may, because of the many uncertainties inherent in the commercial sex market, there is an urgent need to emphasis prevention services, especially endorsing 100% condom use, if the UN mandate of eliminating new HIV infections and ending the AIDS epidemic by 2030 is to be fulfilled.

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REFERENCES

Ahlburg, D. A., & Jensen, E. R. (1998). The economics of the commercial sex industry. In M. Ainsworth, A. M. Over & L. Fransen (Eds.), *Confronting AIDS: Evidence from the developing world* (pp. 147-173). European Commission.

AVERT. *Averting HIV and AIDS.* Retreived from http://www.avert.org/

Baggaley, R. F., White, R. G., & Boily, M. C. (2010). HIV transmission risk through anal intercourse: systematic review, meta-analysis and implications for HIV prevention. *International Journal of Epidemiology, 39*(4), 1048–1063.

Buckingham, R. W., Moraros, J., Bird, Y., Meister, E., & Webb, N. C. (2005). Factors associated with condom use among brothel-based female sex workers in Thailand. *AIDS Care, 17*(5), 640-647.

Cho, I. K., & Kreps, D. M. (1987). Signaling games and stable equilibria. *The Quarterly Journal of Economics, 102*, 179–221.

Detels, R. (2004). HIV/AIDS in Asia: introduction. *AIDS Education and Prevention, 16*(Supplement A), 1–6.

Edlund, L., & Korn, E. (2002). A theory of prostitution. *Journal of Political Economy, 110*(1), 181-214.

Gertler, P., Shah, M., & Bertozzi, S. M. (2005). Risky business: The market for unprotected commercial sex. *Journal of Political Economy, 113*(3), 518-550.

Guest, P. (2007). *2007 survey of sexual and reproductive health of sex workers in Thailand.* Institute for Population and Social Research, Mahidol University.

Hsieh, Y. (2002). Changing faces of commercial sex in Thailand: Implications for the HIV/AIDS epidemic. *Journal of Acquired Immune Deficiency Syndromes, 30*(5), 537-539.

Kahneman, D., & Tversky, A. (1979). Prospect theory: An analysis of decision under risk. *Econometrica, 47*, 263-291.

Kennedy, C., O'Reilly, K., Medley, A. & Sweat, M. (2007). The impact of HIV treatment on risk behaviour in developing countries: A systematic review. *AIDS Care, 19*(6), 707-720.

Lafferty, R. (n. d). Critique of Schroeder and Rojas's "A Game Theoretic Model of IV Transmission". Retrieved from http://www.lafferty.ca/files/writing/stuff/thesis/schroeder.pdf

Lakdawalla, D. H, Goldman, D., & Sood, N. (2006). HIV treatment breakthroughs and risky sexual behavior. *Quarterly Journal of Economics, 12*(3), 1063-1102.

Munoz-Perez, M. A., Rodriguez-Pichardo, A. & Camacho Martinez F. (1998) Sexually transmitted diseases in 1161 HIV-positive patients: a 38-month prospective study in southern Spain. *Journal of the European Academy of Dermatology and Venereology, 11*(3), 221-6.

National AIDS Prevention and Alleviation Committee. (2010). *UNGASS Country Progress Report: Thailand*. Reporting Period January 2008 - December 2009. Bangkok, Thailand.

Nemoto, T., Iwamoto, M., Perngparn, U., Areesantichai, C., Kamitani, E., & Sakata, M. (2012). HIV-related risk behaviors among kathoey (male-to-female transgender) sex workers in Bangkok, Thailand. *AIDS Care, 24*(2), 210-219.

Nemoto, T., Iwamoto, M., Sakata, M., Perngparn, U., & Areesantichai, C. (2013). Social and cultural contexts of HIV risk behaviors among Thai female sex workers in Bangkok, Thailand. *AIDS Care, 25*(5), 613-618.

Reiss, I., & Leik, R. (1989). Evaluating strategies to avoid AIDS: Number of partners vs. use of condoms. *Journal of Sex Research, 26*, 411-433.

Shroeder, K. B., & Rojas, F. G. (2002). A game theoretical analysis of sexually transmitted disease. *Rationality and Society, 14*(3), 353-383.

Tareerat, C., Netwong, T., Visarutratana, S., Varangrat, A., Li, A., Phanuphak, P.,… van Griensven., F. (2010). Inconsistent condom use among young men who have sex with men, male sex workers, and transgenders in Thailand. *AIDS Education and Prevention, 22*(2), 100–109.

Thai National AIDS Committee. (2014). *Thailand AIDS Response Progress Report: Reporting Period 2012-2013*. Bangkok, Thailand.

UNAIDS. (2014). *The Gap Report*. UNAIDS Information Production Unit.

Van Griensven, F., Varangrat, A., Wimonsate, W., Tanpradech, S., Kladsawad, K., Chemnasiri, T.,… Plipat, T. (2010). Trends in HIV Prevalence, Estimated HIV Incidence, and Risk Behavior Among Men Who Have Sex Have Sex With Men in Bangkok, Thailand, 2003-2007. *Journal of Acquired Immune Deficiency Syndromes, 53*(2), 234-239.

Wenger, N. S., Kusseling, F. S., Beck, K., & Shapiro, M. F. (1994). Sexual behavior of individuals infected with the Human Immuninodeficiency Virus: The need for intervention. *Archives of Internal Medicine, 154,* 1849-1854.