Journal of Food Security, 2016, Vol. 4, No. 5, 104-111
Available online at http://pubs.sciepub.com/jfs/4/5/1

DOI:10.12691/jfs-4-5-1

Food Insufficiency, Violence and HIV Risk Behaviors among Female Sex Workers in India

Sangram Kishor Patel*, Madhusudana Battala, Rajatashuvra Adhikary

HIV and AIDS Program, Population Council, 142, Golf Links, New Delhi, India
*Corresponding author: sangramkishor@gmail.com, skpatel@popcouncil.org

Abstract **Background**: Food insufficiency is one of the important contributing factors among female sex workers (FSWs) to engage in risky sexual behaviors and cause of HIV infection in developing countries. Studies exploring linkages between food insufficiency and HIV risk behaviors among FSWs are limited despite having potential program and policy implications. This study attempts to assess the food insufficiency among FSWs and examine its relationship with HIV risk behaviors and violence in India. **Materials and Methods**: Data were drawn from the Avahan-III baseline evaluation survey- 2015, conducted among FSWs (n=4098) using a three-stage cluster sampling approach in four states of India. Multivariate logistic regression (with adjusted odds ratios (AOR) and their 95% confidence intervals (CI)), bivariate analysis and frequency were used to assess the relationships between food insufficiency, HIV risk behaviors and violence. **Results**: Nearly one-fifth of FSWs (17%) reported of facing food insufficiency in past 6 months. More than 35% of FSWs had entertained more clients to cope with the situation of food insufficiency followed by defaulted on loans (24%), borrowed money from informal sources (20%) and had sex without condoms (7%). The likelihood of consistent condom use with non-regular (67% vs. 77%; AOR: 0.6; 95% CI: 0.4-0.9) and regular partner (22% vs. 51%; AOR: 0.3; 95% CI: 0.2-0.4) were significantly lower among FSWs who reported food insufficiency than among those who did not. The likelihood of consistent condom use with occasional (90% vs. 95%; AOR: 0.5; 95% CI: 0.4-0.7) and regular clients (88% vs. 91%; AOR: 0.8; 95% CI: 0.6-0.9) were significantly lower among FSWs who reported food insufficiency compared to those who did not. FSWs who reported food insufficiency were also significantly more likely to report STI symptoms (28% vs. 13%; AOR: 2.7) and any violence (16% vs. 9%; AOR: 2.1) than their counterparts. **Conclusions**: The findings of the study highlight that FSW's food insufficiency is significantly associated with HIV risk behaviors and violence. This study underscores the need for community-led interventions focusing on food insufficiency and economic strengthening activities to reduce HIV vulnerability among FSWs. However, further evidence-based research and advocacies on food insufficiency is required to ensure that HIV prevention programs are appropriately addressed.

Keywords: *food insufficiency, food insecurity, consistent condom use, violence, HIV risk, India*

Cite This Article: Sangram Kishor Patel, Madhusudana Battala, and Rajatashuvra Adhikary, "Food Insufficiency, Violence and HIV Risk Behaviors among Female Sex Workers in India." *Journal of Food Security*, vol. 4, no. 5 (2016): 104-111. doi: 10.12691/jfs-4-5-1.

1. Introduction

Food insecurity as well as food insufficiency are now the known public policy concern for not only among food-poor countries, but also among food-rich countries. The estimates on global hunger indicate that about 795 million people are estimated to be chronically undernourished in 2012–14, and more than 90% of food-insecure individuals live in Asia (512 millions) and Africa (233 millions) [1]. Determinants of food insufficiency in the general population in both resource-rich and resource-poor countries include markers of low socioeconomic status (lower education, income, assets, and unemployment, age, larger household size, and number of children [2,3,4]. Women are invariably responsible for feeding household members, notably children and the infirm [5]. Lack of food can lead to risky coping strategies in the household, which may increase economic vulnerability or exposure to HIV (particularly among women), including the redirection of wage labor or the exchange of sex for money or food [6,7,8,9,10]. Due to food insufficiency, women may become involved in sex work or intergenerational relationships to gain access to money or food-related resources, where they lose the ability to negotiate safe sex practices [7,11]. A study among South African women described that transactional sex was more likely among those who reported hunger than their counterparts [12]. Similar findings were reported in Nigeria, where 35% of female sex workers (FSWs) said that poverty and lack of means to obtain food caused them to join the sex trade, and to engage in unprotected sex with clients to earn quick money [13]. A population-based survey in Swaziland and Botswana found that women reporting food insufficiency in the past year had 80% increased odds of selling sex for money or resources, 70% increased odds of engaging in unprotected sex and reporting lack of sexual control, and 50% increased odds of intergenerational sex [8].

Food insufficiency and HIV are entangled in a vicious cycle that intensifies the vulnerability to and worsens the severity of, each condition [14]. Worldwide studies in various regions among FSWs have shown that food insufficiency is associated with inconsistent condom use [8,15], sexual exchange [8], multiple sexual partnerships [16,17,18], a lack of control in sexual relationships [8], sexual relations with older or gang-affiliated partners [18]. Due to frequent engagement in risky sex, FSWs have a global HIV prevalence of 12%, which is 13.5 times higher than in the general population [19]. Further, evidence-based research studies across the globe highlighted that food insufficiency is also associated with sexual violence [20], symptoms consistent with sexually transmitted infections (STIs) [15,21] and substance use before sex [18]. In San Francisco, food insufficiency was longitudinally associated with unprotected sexual activity and having multiple sexual partners among 154 homeless persons living with HIV [16]. For researchers, programmers and policymakers interested in food insufficiency, understanding the food insufficiency and risky sexual behavior and violence will be crucial for guiding policies for integrating nutrition support, and HIV and AIDS programming in ensuring that such programs target the priorities and needs of this vulnerable population. Although studies on debt, violence and risky sexual behavior has been conducted in India [22,23,24], studies exploring food insufficiency of FSWs and its relationship with HIV risk vulnerabilities and violence are scarce in India, despite having potential policy implications, and needs immediate attention. This study attempts to fill in this gap by understanding the food insufficiency and coping mechanism among FSWs, and assessing its association with HIV risk behaviors and violence in India.

2. Materials and Methods

2.1. Study Settings and Design

We used data from the Avahan-III baseline evaluation survey - 2015 for this study. This is a cross-sectional survey conducted among FSWs during August to November 2015 in four high HIV prevalence states of India, including Andhra Pradesh/Telangana, Tamil Nadu, Karnataka and Maharashtra. The main focus of Avahan-III is to reduce the vulnerabilities (including HIV risk) among FSWs and men who have sex with men (MSM) by improving the access to financial security, social protection services, and to make the community-based organizations (COs) strong and sustainable. The baseline survey was designed to measure different vulnerabilities and capture the key behavioral indicators (e.g. HIV risk behaviors, social protection, financial security, violence, institutional development etc.).To sustain the impact of HIV prevention efforts in four states in India, Avahan-III program was initiated. Bill and Melinda Gates Foundation (BMGF) is partnering with Swasti and its group organizations from Catalyst Group (Catalyst Management Services and Vrutti) to implement the Avahan-III program. In this regard till the baseline survey time, a total of 87 COs were engaged in Avahan-III program; 75 COs are working towards FSWs population and 12 COs with MSM population.

2.2. Sampling and Sample Size

In Avahan-III baseline survey – 2015, sample size and power considerations were constructed based on our primary outcomes of interest: savings through formal sources, consistent condom use, and proportion experienced any violence. The sample size calculation assumed a 2-sided chi-square test with continuity correction, and a significance level of 0.05. We estimated the intra-class correlation of 0.15, and a non-response rate of 33% (based on the previous surveys). With this we calculated a sample size of 10 COs per state (to present state-level estimates), and minimum 3 outreach worker (ORW) areas per CO, and minimum 30 individual interviews per ORW area. With the assumption of 3 ORW areas within each CO, we estimated the sample size of 900 per state. However the technical committee anticipated that the power for the longitudinal analysis will be higher (as the baseline survey will be followed by mid-line and end -line survey), we inflated the sample size up to 10% and, we estimated the sample size of approximately 1000 FSWs per state. This translates to Pan-Avahan level sample size of 4000 individuals, recruited from 115 ORW areas within 39COs.The sampling frame was prepared based on a comprehensive list of FSWs who were administered with Membership Engagement Communication Tool (MECT) by implementing organization by 31st July 2015 in each CO. A three-stage cluster random sampling method was used to select respondents within a state. In the first stage, 10 COs were randomly selected within each state. In the second stage, three ORW areas (clusters) were randomly selected from each selected CO. In the third stage, the required numbers of FSWs were selected randomly from each selected ORW area (cluster). All clusters were selected under the COs where the numbers of clusters were below three and the size of individual sample is proportionately distributed. In Tamil Nadu state, all nine COs were selected as the total number of COs were under ten. A total of 4098 FSWs were interviewed across 39 COs from four states.

2.3. Methods of Data Collection

All interviews were conducted by trained female investigators with verbal and written skills in the local language of each state. The survey instrument (structured questionnaire for FSWs) was developed in English and translated into local languages. The questionnaire was pre-tested in communities similar to the survey sites, prior to the main survey. All the interviews were held in a private location specifically hired for the survey, or in a location convenient to the study participants. Field staff checked the data immediately after the interviews to ensure accuracy and completeness of the filled-in questionnaires. A user-written computer program in CSPro (version 5.0) was used for double data entry by trained data entry officers.

2.4. Ethics Statement

The overall study design, questionnaires and consent processes were reviewed and approved by the institutional review board for human research of population council in the USA and Sahara, centre for residential care and rehabilitation IRB/ethics board in India. Verbal consent

was obtained from all respondents prior to participation in the interview, and steps were taken to ensure confidentiality. For ethical reasons, among the FSWs population, individuals aged 18 years or above were part of the sampling frame and among them, the information on selected participants was collected accordingly. No names and information were recorded on the questionnaires. Participants were not provided any compensation for their time in the study, but were referred to local CO project sites run by the implementing agency for more information and services. All the respondents were given contact details of the lead researchers at the Population Council to communicate their concerns on research, injuries and to get more information on the study. They were also provided the contact numbers of members of the accountability and transparency sub-committee for SWASTI (implementing agency) governing board to know their rights for being a participant in the research.

2.5. Measures

The measures and socio-demographic variables used in this study were selected as per the objectives of the paper, availability of variables in the data set and the review of literature. The socio-demographic variables considered in the analysis were age (<=30 years, > 30 years); marital status (never married, currently married, and others (widowed/divorced/separated/deserted)); education (illiterate, literate); place of solicitation for sex work (home, brothel/lodge/hotel, public places/street/highways, others), living status (living with family members/husband, living alone and living with others) and livelihood status (sex work only, other work with sex work); coping mechanism for food insufficiency (entertained more clients, defaulted on loans, borrowed money from informal sources, resorted to sex without using condoms, sold assets and others); consistent condom use with occasional clients (no, yes); consistent condom use with regular clients (no, yes); consistent condom use with non-regular partners (no, yes); consistent condom use with regular partners (no, yes); experienced STI symptoms in past six months (no, yes) and experienced any violence (physical and/or sexual) in past six months (no, yes) were also assessed. More details on the definitions of measures are given in the footnote of Table 3.

2.5.1. Food Insufficiency

Operational definitions of food insecurity vary between international organizations [25,26,27]. One of the most comprehensive definitions describes food in security as "the limited or uncertain availability of nutritionally adequate, safe foods or the inability to acquire personally acceptable foods in socially acceptable ways"[25]. Implicit in this general definition is the notion that a food-insecure individual may have one or several of the following characteristics: 1) insufficient quantity of food; 2) limited diversity of food groups; 3) poor safety of food; 4) feelings of hunger or anxiety regarding access to food; and 5) procurement of food in socially unacceptable manners, including begging, relying on charity, scrounging, stealing, exchanging sex for food, and other illicit activities [28]. The United States Department of Agriculture (USDA) defines food insufficiency as a state in which "consistent access to adequate food is limited by a lack of money and other resources at times during the year" [29]. Based on the USDA concept, in this study, food insufficiency status constitutes the dependent variable and was measured using the following two questions: In this survey, FSWs were asked two questions: First, in the past 6 months, did you or any of your household members ever eat less than the requirement because there wasn't enough money to buy food? Second, in the past 6 months, were you or any of your household members ever felt hungry, but didn't eat because you couldn't afford enough food? The answers were recorded in one of the following two categories, 0: no; 1: yes. Based on the above two questions, the composite index for food insufficiency was calculated (1= food insufficient) and (0= no).

2.6. Data Analysis

Descriptive statistics (i.e., means, standard deviations, and proportions) and bivariate analyses were used to describe the strength and association of socio-demographic characteristics, HIV risk behaviors, STI symptoms, violence, and food insufficiency among FSWs. The respective p-values for the bivariate analysis were calculated through chi-square test. Adjusted odds ratios (AOR) and their 95% confidence intervals (CI) were estimated through multivariate logistic regression, adjusting for socio-demographic characteristics, to assess the relationships of the degree of food insufficiency and with the potential HIV risk behavior variables. All analyses were conducted using STATA software (version 11.2).

3. Results

More than three-fifths of FSWs included in the study were greater than 30 years of age (67%) and three-fifths were currently married (62%), literate (58%) and living with family members/husband (60%) (Table 2). A little less than one–fifth of FSWs (17%) reported experiencing food insufficiency in the past 6 months (Table 1). Among FSWs who reported facing food insufficiency, more than three-fifths were greater than 30 years of age (72%), currently married (63%), depends on other works with sex work for livelihood (65%), and living with family members/husband (62%); more than one-third of FSWs who reported experiencing food insufficiency were belonged to home based solicitation (33%) followed by rented room/massage parlour/others (30%), public place/street/highways (24%) and public place/street/highways (14%) solicitation respectively (Table 2). Among FSWs who reported facing food insufficiency, nearly half were illiterate and more than one-third were widowed/divorced/deserted/separated. Among FSWs who reported experiencing food insufficiency, more than half of the FSWs (53%) had two and more numbers of dependent children. More than 35% of FSWs had entertained more clients to cope with the situation of food insufficiency in past 6 months followed by defaulted on loans (24%), borrowed money from informal sources (20%), others (11%) and resorted to had sex without using condoms (7%) (Figure1).

Table 1. Food insufficiency status as reported by female sex workers in four survey states, India, 2015

Indicators	Percentage	N
In the past 6 months, did you or any of your household members ever eat less than the requirement because there wasn't enough money to buy food?		
No	85.4	3501
Yes	14.6	597
In the past 6 months, were you or any of your household members ever felt hungry, but didn't eat because you couldn't afford enough food?		
No	85.7	3511
Yes	14.3	587
Food insufficiency (Composite index)		
No	83.4	3420
Yes	16.6	678
Total	**100.0**	**4098**

Note: household member includes FSW herself, children and any adult member of the family; food insufficiency is a composite index.

Table 2. Socio-demographic characteristics of FSWs who reported food insufficiency in four survey states, India, 2015

		Food insufficiency status		
Socio-demographic characteristics	**% (n) or Mean (SD)**	**No**	**Yes**	**p-value**
Age (Mean, SD)	34.4 (6.6)			
Age				0.000
<= 30 years	33.5 (1374)	34.7 (1187)	27.6 (187)	
> 30 years	66.5 (2724)	65.3 (2233)	72.4 (491)	
Education				0.013
Illiterate	42.5 (1740)	41.6 (1423)	46.8 (317)	
Literate	57.5 (2358)	58.4 (1997)	53.2 (361)	
Marital status				0.000
Currently married	62.1 (2545)	62.0 (2121)	62.5 (424)	
Never married	7.7 (314)	8.7 (298)	2.4 (16)	
Others[#]	30.2 (1239)	29.3 (1001)	35.1 (238)	
Typology (Place of solicitation)				0.000
Home-based	25.1 (1030)	23.7 (810)	32.5 (220)	
Brothel/lodge/hotel-based	29.9 (1227)	33.0 (1130)	14.3 (97)	
Public places/street/highways	21.6 (887)	21.3 (728)	23.5 (159)	
Others[$]	23.3 (954)	22.0 (752)	29.8 (202)	
Living status				0.000
Living with family members/husband	59.9 (2453)	59.5 (2036)	61.5 (417)	
Living alone	21.8 (895)	21.2 (724)	25.2 (171)	
Living with others[@]	18.3 (750)	19.3 (660)	13.3 (90)	
Livelihood status				0.000
Sex work only	47.8 (1959)	50.4 (1723)	34.8 (236)	
Other work with sex work	52.2 (2139)	49.6 (1697)	65.2 (442)	
Dependent children				0.000
No children	28.3 (1161)	29. 6 (1012)	22.0 (149)	
One	27.8 (1141)	28.3 (970)	25.2 (171)	
Two	33.6 (1377)	32.4 (1107)	39.8 (270)	
Three and above	10.2 (419)	9.7 (331)	13.0 (88)	
Total	**100.0 (4098)**	**100.0 (3420)**	**100.0 (678)**	

Note: p-values were calculated through chi-square test. [#]includes divorced/separated/deserted; [$]includes rented room/massage parlour/others; [@]includes living with madam/sex workers/partner.

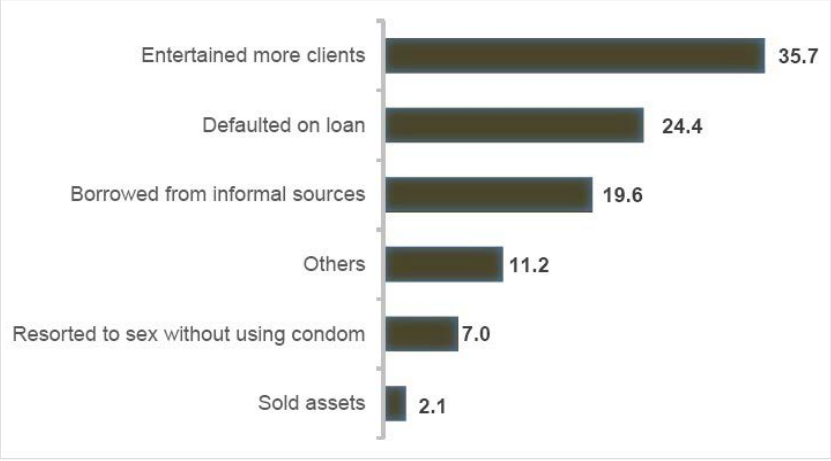

Figure 1. Coping mechanism for food insufficiency as reported by FSWs in past six months in four survey states, India, 2015

Note: Average number of occasional clients per week was 4.1 (SD=5.7) among food insufficient FSWs compared to others (3.1 (SD=3.4)), whereas average number of regular clients per week was 3.4 (SD=4.6) among food insecure FSWs compared to others (3.1 (SD=3.3)).

The AORs in multivariate logistic regression models were adjusted for age, education, marital status, place of sex work solicitation, living arrangements and livelihood status (Table 3). Results show that the likelihood of consistent condom use with non-regular (67% vs. 77%; AOR: 0.6; 95% CI: 0.4-0.9) and regular partner (22% vs. 51%; AOR: 0.3; 95% CI: 0.2-0.4) were significantly lower among FSWs who reported food insufficiency than among those who did not. The likelihood of consistent condom use with occasional (AOR: 0.5; 95% CI: 0.4-0.7) and regular clients (AOR: 0.8; 95% CI: 0.6-0.9) was significantly lower among FSWs who experienced food insufficiency compared to those who did not. FSWs who reported food insufficiency were also significantly more likely to report any STI symptoms (28% vs. 13%; AOR: 2.7) and any violence (16% vs. 9%; AOR: 2.1) than their counterparts.

Table 3. Association between food insufficiency and HIV risk behaviors among FSWs in four survey states, India, 2015

		Food insufficiency	
HIV risk behaviors	**N = 4098**	**No**	**Yes**
Consistent condom use with occasional clients	% (n)	94.8 (2973)	89.8 (566)
	AOR (95% CI)	Reference	0.5 (0.4-0.7)**
Consistent condom use with regular clients	% (n)	91.3 (2949)	88.2 (563)
	AOR (95% CI)	Reference	0.8 (0.6-0.9)**
Consistent condom use with non-regular partner	% (n)	76.6 (1023)	66.9 (95)
	AOR (95% CI)	Reference	0.3 (0.2-0.4)***
Consistent condom use with regular partner	% (n)	50.9 (1249)	22.1 (103)
	AOR (95% CI)	Reference	0.6 (0.4-0.9)***
Experienced STI symptoms in past 6 months	% (n)	12.5 (427)	27.6 (187)
	AOR (95% CI)	Reference	2.7 (2.2-3.3)***
Experienced any violence in past 6 months	% (n)	8.8 (300)	15.5 (105)
	AOR (95% CI)	Reference	2.0 (1.6-2.6)***

Note: CI: Confidence Intervals; AOR: Adjusted Odds Ratios; *** and ** indicate values are significant at 1% and 5% level of significance respectively. AORs were adjusted for age, education, marital status, living arrangements, livelihood status and typology and dependent children. Consistent condom use refers to use of condom every time by the partners/clients while having sexual intercourse with the FSWs; Occasional clients refer to who pay every time but FSWs do not know them at all and remember their faces anyway; Regular clients refer to who pay every time they have sex with FSWs and FSWs know them well or recognize them as they visit them repeatedly; Non-regular partner refer to outside marital union or cohabiting; Regular partner refer to the main male sexual partner (either husband, boyfriend or live- in partner); STI symptoms refer to having symptoms of either of genital sore/ulcer, or yellowish/greenish discharge from vagina with or without foul smell, or lower abdominal pain when not suffering from diarrhea/ dysentery or combination of these symptoms; Any violence refer to either physical violence (hurt, hit, slapped, pushed, kicked, punched, choked, or burnt..etc) or sexual violence (forced to have sex by anyone when you didn't want to) or both.

4. Discussion

The study findings indicate that nearly one-fifth of FSWs reported experiencing food insufficiency in their household in the past six months. The findings of the study show that FSWs' food insufficiency is significantly associated with experience of any violence and consistent condom use with different clients and partners. The food insufficiency is highly prevalent among FSWs who are more than 30 years of age, illiterate, currently married, divorced/deserted/separated, depends on other works with sex work for a livelihood, living with family members/husband, and among FSWs either belonged to the home based solicitation or public places/street based solicitation or rented room/massage parlour/others based solicitation. Our study findings extend previous findings by Oyefere (2007), who found that low socioeconomic status and food insufficiency played a strong role in influencing women to become sex workers, and sex workers described food insufficiency as a primary motivation for both joining and remaining in the trade [13]. In-depth analysis of the study adds further that FSWs with two or more children had 70% higher chances of reporting food insufficiency than others.

To overcome the situation of food insufficiency among the household of the FSWs, the study findings describe that more than one-third of FSWs had entertained more clients to cope with the situation of food insufficiency, while more than one-fifth have either defaulted on loans or borrowed money from informal sources, and a significant percentage had sex with clients without using condoms. The findings of the study show that FSWs who report of facing food insufficiency is significantly less likely to use condom consistently during the sexual act with regular and non-regular clients. Findings from the in-depth analysis also suggest that the average number of occasional clients per week is 4.1 (SD=5.7) among FSWs who reported food insufficiency compared to those who did not (3.1 (SD=3.4)), whereas the average number of regular clients per week is 3.4 (SD=4.6) among FSWs who reported food insufficiency compared to those who did not (3.1 (SD=3.3)). Previous studies also validate our findings in explaining that food insufficiency has significantly influenced the decision to use condoms among FSWs [13,30]. Several previous studies have also shown strong associations of food insufficiency of women with HIV risk behaviors (inconsistent condom use, increase clients, unprotected sex, intergenerational sex, forced sex, and sex exchange) in sub-Saharan Africa [7,12,30]. This study also shows that FSWs who faced food insufficiency are also more likely to report any STI symptoms. Previous studies have also described how food insufficiency contributes to STI and HIV acquisition risk in resource-poor settings among FSWs [15,31,32]. To the existing literature, our study further adds that FSWs who face food insufficiency are also defaulting on loans or borrowing money from informal sources, which is exacerbating their socioeconomic and mental conditions to even worst.

The study also shows that FSWs who faced food insufficiency were more likely to report violence than their counterparts. This finding is consistent with previous research in explaining that food insufficiency as a critical variable influencing women's risk of violence [33]. It is well known that the social and economic marginalization

of FSWs' constrain their ability to engage in HIV risk reduction behaviors and also increase the risk of facing any violence as well [7,33]. Further, these findings are well supported by an African study that FSWs who had experienced violence (particularly sexual violence) are lacking control over their sexual decision making [34,35] and are more likely to engage in unprotected sex, to exchange sex for money or resources, to have multiple partners, and to be at HIV risk [36,37,38].

Findings from the study about food insufficiency and HIV risk add to the expanding research in India and elsewhere in emphasizing the importance of food insufficiency as a variable of central importance in HIV prevention activities. This study further highlights a strong need for programs to address food insufficiency, poverty, and income strengthening and employment in particular. Possible program focus should be in the long term, efforts at the national level to improve women's social, legal, and economic standing – including improved access to education, financial security, social protection schemes and employment – are needed to broaden women's economic options and to reduce the vulnerability of FSWs. In the shorter term, economic interventions such as microfinance and micro-enterprise projects can create an additional income source for FSWs and provide a buffer against financial crises and food insufficiency [39,40].

In India, a micro-enterprise program was found to reduce HIV risk behaviors and provide a feasible and acceptable source of secondary income in a cohort of FSWs [41]. Some other best examples in India are the Sonangachi project in Kolkata, and the Pragati intervention in Bangalore, where community-led interventions not only helped in change community perceptions of HIV/AIDS and sex work, and reduce stigma, culminating in a political-legal change that helped FSWs organize and claim their rights, but also instrumental in economic strengthening of FSWs to reduce their vulnerability. Other examples from the southern states of India show that the HIV prevention programs have emphasized community mobilization for the economic strengthening of sex workers [24,42] to reduce vulnerability among sex workers, including food insufficiency. Similar interventions, microfinance program and other social safety program in Cambodia, Kenya and sub-Saharan African countries have also shown a positive impact in reducing poverty and HIV risk behaviors among key populations, and improved their household food sufficiency, and ability to access health care services [43,44,45]. These types of interventions would likely to be more successful if considering the concept of "transformatory" interventions, where goals are more inclusive and set by beneficiaries as active agents, rather than "instrumental", where goals are set outside [39]. It can be underlined that mobilizing key populations were the first step towards generating change in the community, and economic strengthening activities (e.g. microfinance and vocational training) followed, based on the response from the community [24,46,47,48].

5. Limitations

Although the study findings offer important insights on the relationship between food insufficiency, violence and HIV risk among FSWs in India, they must be interpreted in light of certain study limitations. The food insufficiency, violence and HIV risk indicators are based on self-reports which are susceptible to social desirability and recall biases. The analyses are cross-sectional and causality cannot be assumed as in the case of prospective research studies. The study findings cannot be generalized to the whole FSWs community as the study was conducted among selected FSWs, still can be generalized for FSWs belonged to the similar type of settings. Furthermore, food insufficiency is only one component of the broader concept of food insecurity, which also includes insufficient quality and diversity of foods, poor safety of food, feelings of deprivation or restricted choice about the amount and types of food available, and inability to procure food in a socially acceptable manner [27,28]. More detailed studies among FSWs using more extensive and sensitive food security scales validated in the Indian context with attention to possible regional and cultural differences will be necessary for furthering the policies and programs.

6. Conclusion

In conclusion, the study findings offer important insights into the vulnerability of FSWs in terms of food insufficiency, violence and HIV risk, which require immediate program attention. This study recommends that protecting and promoting access to food should be an instant step taken forward by the government may sustain the food security and decrease the vulnerability to HIV among FSWs. Therefore, targeted food assistance and support for FSWs' subsistence farming and other means of food production should also be considered as strategies to reduce vulnerability among FSWs in India. Steps should also be taken for reducing the burden of upstream risk factors include a national recession, high unemployment, global climate change, and other factors beyond the control of individual sex workers. At the end, the study suggests for strengthening community-led interventions focusing on economic strengthening activities (e.g. microfinance, vocational training and access to financial services) and other social safety programs for addressing the food security as a path to a sustainable reduction of HIV risk. More importantly, HIV prevention programs and policies need to acknowledge that food insecurity is an important structural issue that needs to be addressed through integrated program approach and community mobilization interventions. More in-depth research is required to investigate the causal mechanisms of effective economic strengthening interventions, including their effect on poverty and food insecurity reductions, which have implications for ending the spread of HIV in India and elsewhere.

Conflict of Interest and Financial Disclosure Statements

None declared.

Acknowledgements

This paper was written as part of Avahan-III evaluation grant of the Bill & Melinda Gates Foundation through

Avahan, its India AIDS Initiative. The views expressed herein are those of the authors and do not necessarily reflect the official policy or position of the Bill & Melinda Gates Foundation and Avahan. The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript. We are grateful to other colleagues of Population Council for providing the necessary inputs for writing this paper.

Author Contributions

Conceived and designed: SKP.

Performed the experiments: SKP, MB and RA.

Analyzed the data: SKP.

Contributed reagents/materials/analysis tools: SKP, MB and RA.

Wrote the paper: SKP, MB and RA.

References

[1] FAO, IFAD and WFP. The state of food insecurity in the World 2015. Meeting the 2015 international hunger targets: taking stock of uneven progress. Rome, FAO. 2015.

[2] Laraia B, Siega-Riz A, Gunderson C, Dole N. Psychosocial factors and socioeconomic indicators are associated with household food insecurity among pregnant women. Journal of Nutrition 2006; 136(1):177-182.

[3] Foley W, Ward P, Carter P, Coveney J, Tsourtos G, Taylor A. An ecological analysis of factors associated with food insecurity in South Australia, 2002-7. Public Health Nutrition 2010; 13(2): 215-221.

[4] Mohammadzadeh A, Dorosty A, Eshraghian M. Household food security status and associate factors among high-school students in Esfahan, Iran. Public Health Nutrition 2010; 13(10):1609-1613.

[5] Kadiyala S, Gillespie S. Rethinking food aid to fight AIDS. Washington, DC: International Food Policy Research Institute; 2003.

[6] Fenton L. Preventing HIV/AIDS through poverty reduction: the only sustainable solution. Lancet 2005; 364(9440):1186-1187.

[7] Gillespie, S., Kadiyala, S. HIV/AIDS and food and nutrition security: from evidence to action. Washington, DC: International Food Policy Research Institute; 2005.

[8] Weiser S, Leiter K, Bangsberg D, Butler L, Pery-de Korte F, Phaladze N, Heisler M. Food insufficiency is associated with high-risk sexual behavior among women in Botswana and Swaziland. PLoS Medicine 2007; 4:1589-1597.

[9] Ngo AD, McCurdy SA, Ross MW, Markham C, Ratliff EA, Pham HT. The lives of female sex workers in Vietnam: Findings from a qualitative study. Culture Health and Sexuality 2007; 9(6): 555-570.

[10] Fitzgerald-Husek A, Martiniuk AL, Hinchcliff R, Aochamus CE, Lee RB. I do what I have to do to survive: an investigation into the perceptions, experiences and economic considerations of women engaged in sex work in Northern Namibia. BMC Womens Health 2011; 11: 35.

[11] Gillespie S, Kadiyala S, Greener R. Is poverty or wealth driving HIV transmission? AIDS 2007; 21(Suppl 7):S5-S16.

[12] Dunkle KL, Jewkes RK, Brown HC, et al. Transactional sex among women in Soweto, South Africa: prevalence, risk factors and association with HIV infection. Social Science and Medicine 2004; 59:1581-1592.

[13] Oyefara JL. Food insecurity, HIV/AIDS pandemic and sexual behaviour of female commercial sex workers in Lagos metropolis, Nigeria. Journal of Social Aspects of HIV/AIDS 2007; 4(2): 626-635.

[14] WHO. Nutrient requirements for people living with HIV/AIDS: Report of a technical consultation. Geneva: World Health Organization; 2003.

[15] Tsai AC, Weiser SD. Population-based study of food insecurity and HIV transmission risk behaviors and symptoms of sexually transmitted infections among linked couples in Nepal. AIDS and Behavior 2014; 18 (11):2187-97.

[16] Vogenthaler NS, Kushel MB, Hadley C, Frongillo EA, Jr., Riley ED, Bangsberg DR, et al. Food insecurity and risky sexual behaviors among homeless and marginally housed HIV-infected individuals in San Francisco. AIDS and Behavior 2013; 17 (5):1688-93.

[17] Eaton LA, Cain DN, Pitpitan EV, Carey KB, Carey MP, Mehlomakulu V, et al. Exploring the relationships among food insecurity, alcohol use, and sexual risk taking among men and women living in South African townships. The Journal of Primary Prevention 2014; 35 (4):255-65.

[18] Raiford JL, Herbst JH, Carry M, Browne FA, Doherty I, Wechsberg WM. Low prospects and high risk: structural determinants of health associated with sexual risk among young African American women residing in resource-poor communities in the south. American Journal of Community Psychology 2014; 54(3-4):243-50.

[19] Kerrigan DL, Fonner VA, Stromdahl S, Kennedy CE. Community empowerment among female sex workers is an effective HIV prevention intervention: A systematic review of the peer-reviewed evidence from low- and middle-income countries. AIDS and Behavior 2013; 17(6): 1926-1940.

[20] Tsai AC, Leiter K, Heisler M, Iacopino V, Wolfe W, Shannon K, et al. Prevalence and correlates of forced sex perpetration and victimization in Botswana and Swaziland. American Journal of Public Health 2011; 101 (6):1068-74.

[21] Tsai AC, Hung KJ, Weiser SD. Is food insecurity associated with HIV risk? Cross-sectional evidence from sexually active women in Brazil. PLoS Medicine 2012; 9 (4):e1001203.

[22] Reed E, Gupta J, Biradavolu M, Devireddy V, Blankenship KM. The context of economic insecurity and its relation to violence and risk factors for HIV among female sex workers in Andhra Pradesh, India. Public Health Reports 2010; 125 Suppl. 4: 81-89.

[23] Saggurti N, Jain AK, Sebastian MP, Singh R, Modugu HR, Halli SS, Verma RK. Indicators of mobility, socio-economic vulnerabilities and HIV risk behaviours among mobile female sex workers in India. AIDS and Behavior 2012; 16:952-959.

[24] Patel SK, Prabhakar P, Jain AK, Saggurti N, Adhikary R. Relationship between community collectivization and financial vulnerability of female sex workers in southern India. PLoS ONE 2016; 11(5): e0156060.

[25] UNSN. Nutrition and HIV/AIDS. Statement by the Administrative Committee on Coordination, Sub-committee on Nutrition at its 28th session. United Nations Sub-committee on Nutrition: Nairobi, Kenya; 2001.

[26] Save the Children. Food security, livelihoods and HIV/AIDS: A Guide to the linkages, measurement and programming implications. Westport, CT: Save the Children; 2004.

[27] UNFAO. The state of food insecurity in the World: high prices and food security--threats and opportunities. United Nations Food and Agriculture Organization; 2008.

[28] Keenan DP, Olson C, Hersey JC, et al. Measures of food insecurity/security. Journal of Nutrition Education 2001; 33:S49-S58.

[29] Bickel G,Nord M,Price C, Hamilton W, Cook J. Guide to measuring household food security (PDF). USDA Food and Nutrition Service. Retrieved 23 April 2016; 2000.

[30] Hargreaves JR, Morison LA, Chege J, Rutenburg N, Kahindo M, et al. Socioeconomic status and risk of HIV infection in an urban population in Kenya. Tropical Medicine and International Health 2002; 7: 793-802.

[31] Miller CL, Bangsberg DR, Tuller DM, Senkungu J, Kawuma A, Frongillo EA, et al. Food insecurity and sexual risk in an HIV endemic community in Uganda. AIDS and Behavior 2011; 15(7):1512-9.

[32] Fielding-Miller R, Mnisi Z, Adams D, Baral S, Kennedy C. There is hunger in my community: a qualitative study of food security as a cyclical force in sex work in Swaziland. BMC Public Health 2014; 14:79.

[33] de Waal A, Whiteside A. New variant famine: AIDS and food crisis in southern Africa. Lancet 2003; 362: 1234-1237.

[34] Stillwaggon E. HIV transmission in Latin America: Comparison with Africa and policy implications. South African Journal of Economics 2000; 68: 985-1011.

[35] Ambrus JL Sr., Ambrus JL Jr. Nutrition and infectious diseases in developing countries and problems of acquired immunodeficiency

syndrome. Experimental Biology and Medicine 2004; 229: 464-472.

[36] Kalichman SC, Simbayi LC. Sexual assault history and risks for sexually transmitted infections among women in an African township in Cape Town, South Africa. AIDS Care 2004; 16: 681-689.

[37] Koenig MA, Zablotska I, Lutalo T, Nalugoda F, Wagman J, et al. Coerced first intercourse and reproductive health among adolescent women in Rakai, Uganda. International Family Planning Perspectives 2004; 30: 156-163.

[38] Weiser SD, Leiter K, Heisler M, McFarland W, Percy-de Korte F, et al. A population-based study on alcohol and high-risk sexual behaviors in Botswana. PLoS Medicine 2006; 3: e392.

[39] UNAIDS, UNAIDS guidance note on HIV and sex work. Geneva, Switzerland: UNAIDS, 2012.

[40] Kennedy CE, Fonner VA, O'Reilly KR, Sweat MD. A systematic review of income generation interventions, including microfinance and vocational skills training, for HIV prevention. AIDS Care 2014; 26 (6):659-73.

[41] Sherman SG, Srikrishnan AK, Rivett KA, Liu SH, Solomon S, Celentano DD. Acceptability of a microenterprise intervention among female sex workers in Chennai, India. AIDS and Behavior 2010; 14(3):649-657.

[42] Pillai P, Bhattacharjee P, Ramesh BM, Isac S. Impact of two vulnerability reduction strategies - collectivisation and participation in savings activities - on HIV risk reduction among female sex workers: Karnataka Health Promotion Trust, Bengaluru, Karnataka, India; 2012.

[43] Lee H, Pollock G, Lubek I, Niemi S, O'Brien K, Green M, Bashir S, Braun E, Kros S, Huot V, et al. Creating new career pathways to reduce poverty, illiteracy and health risks, while transforming and empowering Cambodian women's lives. Journal of Health Psychology 2010; 15(7):982-992.

[44] Odek WO, Busza J, Morris CN, Cleland J, Ngugi EN, Ferguson AG. Effects of micro-enterprise services on HIV risk behaviour among female sex workers in Kenya's urban slums. AIDS and Behavior 2009; 13(3):449-461.

[45] Baird SJ, Garfein RS, McIntosh CT, Oezler B. Effect of a cash transfer programme for schooling on prevalence of HIV and herpes simplex type 2 in Malawi: a cluster randomised trial. Lancet 2012; 379(9823):1320-1329.

[46] Basu I, Jana S, Rotheram-Borus MJ, Swendeman D, Lee SJ, Newman P, Weiss R. HIV prevention among sex workers in India. Journal of Acquired Immune Deficiency Syndromes 2004; 36(3): 845-852.

[47] Souverein D, Euser SM, Ramaiah R, Ram P, Gowda N, Gowda CS, et al. Reduction in STIs in an empowerment intervention programme for female sex workers in Bangalore, India: the Pragatiprogramme. Global Health Action 2013; 6: 22943.

[48] Vejella S, Patel SK, Saggurti N, Prabhakar P. Community collectivization and consistent condom use among female sex workers in southern India: evidence from two rounds of behavioral tracking surveys. AIDS and Behavior 2016; 20(4): 776-87.