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Reproductive History and Pregnancy incidence of Malian and Beninese Female Sex workers before and During Sex Work Practice

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Citation: Gentiane Perrault Sullivan, Fernand Aimé Guédou, Fatoumata Korika Tounkara, Luc Béhanzin, Nana Camara. et all (2021) Reproductive History and Pregnancy incidence of Malian and Beninese female sex workers before and During Sex Work Practice. *J.Women Health Care and Issues,* 4(6); **DOI:**10.31579/2642-9756/075

Abstract:

Aim/Background: To reduce maternal mortality (MM), access to family planning and reproductive health care services are key strategies. Access to and use by marginalized populations pose a substantial challenge. The objective of this study was to describe the reproductive history of female sex workers (FSWs) before and during sex work.

Materials and methods: FSWs aged ≥18 years were recruited in Benin, and Mali, to answer a questionnaire during a face-to-face interview. Descriptive analyses were carried out and comparisons made between countries (Pearson chi-square) and between the periods before (BSW) and during sex work (DSW) practice within women in each country (McNemar chi-square). In addition, multiple imputations were used to estimate and compare the incidence rate of pregnancy BSW and DSW calculated with a generalized linear model for count data with a Poisson distribution and a log link.

Results: Mean age was 26 years in Mali (n=322) and 35 years in Benin (n=330). More women had at least one pregnancy BSW compared to DSW in both Mali (62.1%-vs-33.5%) and Benin (91.2%-vs-32.7%). The pregnancies occurring DSW had lower livebirth rates (57.9%-vs-74.7% Mali, 17.6%-vs-60.6% Benin) and ended more often with a therapeutic abortion, DSW compared to BSW, especially in Benin (65.2%-vs-25.6%). The level of complications associated with therapeutic abortion was high, both DSW (23%) and BSW (20%). The incidence rate of pregnancy was about twice lower DSW compared to BSW [incidence rate ratio (IRR): 0.49; 95% confidence interval (95%CI): 0.37-0.66-Mali and IRR: 0.45; 95% CI: 0.32-0.63-Benin].

Conclusion: In both Benin and Mali, FSWs had more pregnancies during the period preceding sex work practice, about twice more than during sex work when considering the differences in incidence rates. Single mothers need to be supported to avoid sex work as a financial solution. On the other hand, the reproductive needs of FSWs need to be acknowledged to reduce maternal mortality within this marginalized population. It is of paramount importance that interventions remain focused on reproductive health and prevent unwanted pregnancies, answer contraceptive needs and provide safe therapeutic abortions.

Keywords: sex workers; therapeutic abortion; pregnancy; reproductive health; sub-saharan africa

Introduction

One of the main action to promote health in the 2030 agenda for sustainable development, proposed by the World Health Organization, is to achieve health equity [1]. Maternal mortality and access to family planning constitute two inequity-related indicators. The global fertility rate in sub-Saharan Africa is 4.6 births per woman during lifetime [2] which is three times the rate in European Union and Canada [3].The maternal mortality rate in this region is also the highest in the world with 542 deaths per 100 000 live births reported in 2017 [4], thus accounting

for roughly two thirds of maternal deaths worldwide [4, 5]. In Benin, one in 49 women risks dying due complications of pregnancy and/or childbirth and one in 29 in Mali [4]. To reduce maternal mortality, universal access to family planning and reproductive health care services remains a key strategy globally.

Marginalized populations are groups that experience discrimination and exclusion because of unequal power relationship across economic, political and cultural dimensions [6]. Because of this exclusion and discrimination, marginalized populations pose a substantial challenge worldwide when it comes to preventing maternal death through use of and access to family planning and reproductive health services [7, 8].

 Sex workers are known to experience discrimination especially in accessing health services [9, 10]. In West Africa, it is estimated that one in 20 women has ever practiced sex work [11] and most African female sex workers (FSWs) are mothers [12, 13].. Moreover, sex work is associated with many risks that increase pregnancy complications, as well as maternal mortality and morbidity [14]. For example, HIV accounts for 5.5% of the maternal mortality [15] and among FSWs, HIV prevalence is 12 times higher than in the general population [13]. Unsafe abortion can explain up to 13% of the maternal mortality [16] and lifetime abortion varies between 35 and 65% among FSWs in low and middle income countries [17-20].

Despite all these risks and stigma surrounding sex work [21], FSWs have the same rights and desires as women from the general population, regarding pregnancy [22]. Yet, FSWs are underrepresented in fertility-related researches [22] and most of the programmes specifically targeting FSWs often ignore broader sexual and reproductive care needs and family planning [23].

Meeting the reproductive health needs of this marginalized population is required to prevent maternal mortality [24] and to reach the World Health Organization Sustainable Development Goal that states that by 2030, we need to ensure healthy lives and promote well-being for all at all ages. One of the key priorities is to improve maternal health. To do so, we need to have a better knowledge of the reproductive history of FSWs, not only during their sex work practice, but also before. Most of the researches have been fragmentary in describing their reproductive history (unwanted pregnancy or therapeutic abortion) [25], generally covering their entire lifetime (without differentiation between before sex work practice and during involvement in sex work) [18, 26] or only a small time period [27, 28]. Thus, until now, there is no understanding of the full picture of the reproductive history of FSWs. As a result, many questions remain unanswered and because of this lack of knowledge it is difficult to know which intervention to prioritize and at what moment in a women's life the intervention should be available...

The objective of this study was to fulfill these knowledge gaps by describing FSWs' reproductive history before and during sex work in two West African countries (Mali and Benin). To achieve this goal, we first described pregnancy outcomes. Then we characterized the therapeutic abortions. Finally, we calculated and compared the pregnancy incidence rate before and during sex work.

Materials and Methods

The recruitment for the present study was combined with another one investigating cervical cancer and human papillomavirus (HPV) infection among FSWs [29]. This collaboration was made to avoid soliciting the same population for two studies over a short time period. However, the development of the present study was distinct from the one investigating cervical cancer and HPV. To recruit FSWs, trained peer educators and senior staff from participating non-governmental organisations (NGOs) conducted cervical cancer awareness activities in bars, brothels and hotels, etc. Following these activities, women were referred by peer

educators to FSW-friendly clinics *Dispensaire IST* (DIST) in Cotonou, Benin, and *Clinique des Halles* run by ARCAD/SIDA, a national NGO, in Bamako, Mali for cervical cancer screening. After participating in the HPV study, they were offered to participate in the study on reproductive history for which they had to complete a questionnaire administered face-to-face. However, FSWs who declined participation in the HPV study or were excluded from it because they were pregnant were also offered to participate in the present study. 330 women were recruited in Cotonou, Benin, between March and June 2017 and 322 in Bamako, Mali, between November 2017 and February 2018.

Inclusion criteria

FSW was defined as any woman who regularly receives money in exchange for sex. To be included in the study, FSWs also needed to have been involved in the sex trade for at least six months in either Cotonou, Benin, or Bamako, Mali, to be aged 18 years or older and to provide written informed consent. All FSWs included in that study are working for money and to our knowledge were not forced to.

Data collection

A quantitative questionnaire developed by the research team was administered during a face-to-face interview by a qualified interviewer. We collected data on reproductive history, pregnancy intention and contraception. Also, a pelvic examination and a urine pregnancy test were carried out by a physician.

All the data regarding sociodemographic characteristics as well as the HIV and pregnancy test results were extracted from the HPV study dataset.

Missing data

Some participants of the study who were excluded from the HPV study because of a positive pregnancy test (n=18 in Mali and n=13 in Benin) did not complete the sociodemographic section of the questionnaire that was only included in the HPV study questionnaire. The sociodemographic data were backtracked for some women in their medical file, but we could not retrieve the missing data for all women. In addition, women included in both studies had some missing values for different variables. Although, the number of women with entirely missing sociodemographic information was low, we used multiple imputation to compensate for these missing data because most of the exclusions from the HPV study were because of pregnancy at the time of enrolment and we wanted to avoid the introduction of a selection bias since pregnancy is the outcome of interest.

Multiple imputation

We wanted to have a complete data set to calculate the incidence rate of pregnancy before and during sex work practice. We used an imputation model with multiple imputations by chained equations (MICE). We decided to use MICE because all the missing values had a non-monotonous pattern and we had to impute different types of variables [30]. We used the distribution of the observed data to estimate the plausible values for the missing data. We included all the variables needed to assess the incidence rate in the imputation model and further added all the variables that were associated either with the variables that had missing values or with the presence of missing values for a given variable [31], as required to obtain valid MICE models. The number of imputations needed was decided based on the rule of thumb [31]. This rule suggests that the number of imputations should at least be equal to the percentage of incomplete cases. The linear variables were not transformed even if they were skewed. We used predictive mean matching to improve the estimation and avoided transforming the relation between the variables in the imputation model [32, 33].

Incidence of pregnancy before and after sex work

The incidence rate was calculated as the total number of pregnancies over the person-time at risk [34]. To calculate the amount of time at risk for pregnancy during sex work practice we used the duration declared by FSWs at the question: for how long have-you been practicing sex work? To calculate the time at risk before sex work practice, we subtracted the duration of sex work from the period of time between age at recruitment and the age at first sex to obtain the amount of person-time at risk before sex work for each woman. To be able to discriminate between pregnancy occurring before and during sex work practice, FSWs were asked specifically how many pregnancies they had before practicing sex work and how many during sex work practice. Furthermore, to validate those results we asked how many pregnancies each woman had during her lifetime and the total was compared with the aggregate for the two periods. Finally, the total number of pregnancies for each period was compared with the summation of the outcomes. When a discrepancy was observed, a verification was made with the research coordinator in each country.

Statistical analyses

To present the studied population characteristics we used descriptive analyses (frequencies, means values with standard deviations). We also present a comparison between the two countries using Pearson chi-square.

Furthermore, we used descriptive analyses and paired comparisons (McNemar's chi-square for discrete variables and paired Student's t test for continuous variables with normal distribution) in each country, to assess differences in outcomes (pregnancy, therapeutic abortions) according to the period when they occurred (prior to or during sex work practice). For the descriptive analyses, a p-value of 0.05 or less was considered statistically significant.

Thereafter generalized linear model for count data with a Poisson distribution and a log link was used to compare the incidence rate of pregnancy before and during sex work. The log of the duration of the periods before and during sex work was used as offsets in the models. Generalized estimating equations were used to consider the correlation between the periods before and during sex work for a given woman. This analysis was performed with the original as well as the imputed databases. We performed all the analyses using SAS 9.4 (SAS Institute, Cary, NC, USA).

Ethical considerations

Each participant provided a signed informed consent and no nominal information was reported on the questionnaire. The participants received a monetary compensation to cover their transport fees and the possible loss of income due to their participation (5 US dollar in Mali and 2 US dollar in Benin).

The study was approved by the ethics committees of the *CHU de Quebec – Université Laval* (Quebec City, Canada) and the School of Medicine of Bamako, Mali, as well as by the National Health Research Ethics Committee in Benin. Moreover, all methods were performed in accordance with the relevant guidelines and regulations (Declaration of Helsinki).

Results

Missing data

Of the 652 FSWs, ten (3.1%) had missing data in Mali for all the sociodemographic variables. In Benin, since we were able to recover some information, seven (2.1%) women had missing information for all sociodemographic variables. We had no missing data for the pregnancy variables (number, outcome and period of occurrence of the pregnancy). For the variables characterising therapeutic abortion, we had five (1.3%) missing data for therapeutic abortion occurring before sex work and four (2.3%) during sex work. We had respectively 16.1% (105/652) of missing data for the number of years before practicing sex work and 5.2% (34/652) for the number of years during sex work practice. For the data set used to calculate incidence rate, 82.2% of the women had no missing information.

Multiple imputations

We did 20 imputations to impute variables for the incidence rate analysis. We used 15 variables in the imputation model. They included the number of pregnancies before and during sex work, the time variables (number of sexually active years while fertile preceding sex work and the number of years as a sex worker), the variables that both predict the number of sexually active years while fertile preceding sex work practice and the number of years as a sex worker and those predicting missing data for each of the latter variables (country, country of origin, religion, education, marital status, number of biological children and HIV status).

Descriptive analyses

Table 1 shows the sociodemographic and sex work characteristics of the participating FSWs. Women in Benin were older (mean age 34.8 vs 25.8 years - p-value <0.001). In Mali, 74.5% of the population was Muslim whereas over two thirds were Christian in Benin (76.6% - p-value <0.001). More FSWs had a boyfriend in Mali (67.7% vs 50.6% - p-value <0.001). But cohabitation with a sexual partner was low in both countries (3.6% and 3.7% - p-value = 0 .92). More women had at least one child in Benin compared to Mali (76.1% vs 57.4 - p-value <0.001) and almost half of the women in Benin had two children or more. In Mali, 20.2% of the FSWs were HIV positive, compared to 24.9% in Benin (p-value = 0.16). Women in Mali were younger at their first sexual intercourse: 55.0 % were 15 years old or less compared to 17.8% in Benin (p-value <0.001). In addition, they were younger when they started sex work: in Mali 31.1% were less than 18 years old compared to 3.2% in Benin (p-value <0.001). Women in Benin had on average more clients during the last seven days (16 vs 12 - p-value <0.001) and had earned more money than in Mali (260 US dollars vs 86 US dollars - p-value <0.001). Condoms were almost always used with clients in both Mali (94.9%) and Benin (89.8%) during the seven days preceding recruitment (p-value = 0.01). They were however rarely used with boyfriends, only 15% in both countries (p-value = 0.15). Hormonal contraception use was more prevalent in Mali with almost 40% of the FSWs using it (11.8% in Benin - p-value <0.001)). At enrolment, 18 women had a positive pregnancy test in Mali (5.6%) and 13 in Benin (3.9%) (p-value = 0.32).

Comparison of pregnancy and therapeutic abortion's prevalence before and during sex work practice

In Mali, during their lifetime, 79.5% of the FSWs had at least one pregnancy and 50.9% more than one (Table 2). 14.9% of the women had at least one therapeutic abortion which represented 18.8% of the women who ever had a pregnancy (data not shown). In Benin, almost all FSWs (95.2%) had at least one pregnancy, 87.9% more than one pregnancy and more than half of them (57.0%) at least one therapeutic abortion (Table 1).

Sociodemographic variables		Mali (n=322)		Benin (n=330)		
		Frequency (%)	Mean (SD)	Frequency (%)	Mean (SD)	p-value*
Age (years)			25.8 (7.1)		34.8 (10.5)	
	<20	71 (22.1)		7 (2.1)		
	20-24	94 (29.3)		58 (17.6)		
	25-29	75 (23.4)		61 (18.5)		
	30-39	61 (19.0)		92 (27.9)		
	≥40	20 (6.2)		112 (33.9)		
	Missing	1		0		**<0.001**
Country of origin						
	Mali	197 (63.1)		0 (0.0)		
	Benin	36 (11.5)		147 (44.6)		
	Nigeria	28 (9.0)		103 (31.2)		
	Other	51 (16.4)		80 (24.2)		**<0.001**
	Missing	10		0		
Religion						
	Catholic	39 (12.5)		104 (32.2)		
	Other Christian	13 (4.2)		149 (46.1)		
	Muslim	240 (76.9)		20 (6.2)		
	Other	20 (6.4)		50 (15.5)		
	Missing	10		7		**<0.001**
Education						
	Unschooled and Koranic school	129 (41.4)		86 (26.6)		
	Primary	123 (39.4)		131 (40.6)		
	Secondary	37 (11.9)		91 (28.2)		
	Superior	23 (7.4)		15 (4.6)		
	Missing	10		7		**<0.001**
				Marital status		
	Married	16 (5.1)		4 (1.2)		
	Non-marital relationship	9 (2.9)		25 (7.7)		
	Divorced or separated	54 (17.3)		120 (37.0)		
	Widowed	7 (2.2)		55 (17.0)		
	Single	226 (72.4)		120 (37.0)		
	Missing	10		6		**<0.001**
Has a boyfriend						
	Yes	218 (70.1)		167 (54.8)		
	No	93 (29.9)		138 (45.3)		
	Missing	11		**<0.001**		25
Cohabitation with a sexual partner						
	Yes	12 (3.9)		12 (3.7)		
	No	300 (96.2)		312 (96.3)		
	Missing	10		6		0.92
Number of dependents			3.6 (3.4)		3.6 (2.5)	
	None	59 (18.9)		31 (9.9)		
	≤ 2	84 (26.9)		80 (25.6)		

	3	44 (14.1)		56 (17.9)	
	4-5	51 (16.4)		87 (27.8)	
	≥ 6	74 (23.7)		59 (18.9)	**0.001**
	Missing	10		17	
Number of biological children			1.1 (1.4)		1.7 (1.5)	
	0	137 (42.6)		79 (23.9)	
	1	91 (28.7)		89 (27.0)	
	2	53 (16.5)		68 (20.6)	
	3	18 (5.6)		50 (15.2)	
	≥ 4	23 (7.1)		44 (13.3)	**<0.001**
HIV status					
	Negative	241 (79.8)		248 (75.2)	
	Positive	61 (20.2)		82 (24.9)	
	Missing	20		0 (0.0)	0.16
Pregnancy test					
	Negative	303 (94.4)		317 (96.1)	
	Positive	18 (5.6)		13 (3.9)	
	Missing	1			0.32
Sex work characteristics					
Age at first sex (years)			15.2 (3.1)		17.6 (2.6)	
	≤15	160 (55.0)		46 (17.8)	
	16-17	68 (23.4)		71 (27.4)	
	18-19	49 (16.8)		90 (34.8)	
	≥ 20	14 (4.8)		52 (20.1)	
	Missing	31		71	**<0.001**
Age at sex work debut (years)			21.2 (6.5)		28.2 (9.3)	
	≤ 17	97 (31.1)		210 (3.2)	
	18-21	81 (26.0)		75 (18.2)	
	22-25	58 (18.6)		63 (20.1)	
	26-29	37 (11.9)		36 (11.5)	
	≥ 30	39 (12.5)		147 (47.0)	
	Missing	10		17	**<0.001**
Duration of involvement in sex work (years)			4.9 (4.6)		6.9 (6.9)	
	≤ 1	62 (19.9)		78 (24.9)	
	2	70 (22.4)		48 (15.3)	
	3-4	85 (27.2)		67 (21.4)	
	5-9	70 (22.4)		67 (21.4)	
	≥ 10	25 (8.0)		53 (16.9)	
	Missing	10		17	**0.001**
Money received for last paid sex (FCFA)®			4455.0 (4987.7)		2854.1 (2434.2)	
	≤ 1500	27 (8.7)		121 (38.5)	
	1501 - 2000	66 (21.2)		76 (24.2)	
	2001 - 5000	185 (59.5)		97 (30.9)	
	> 5000	33 (10.6)		20 (6.4)	
	Missing	11		16	**<0.001**
Money earned from sex work (per week) ®			47993.6 (42038.8)		144524.0 (90465.8)	

≤ 25000	99 (31.9)		6 (1.9)		
25001 - 50000	125 (40.3)		29 (9.3)		
50001 - 100000	67 (21.6)		106 (33.9)		
100001 -150000	14 (4.5)		75 (24.0)		
> 150000	5 (1.6)		97 (31.0)		
Missing	12		17		**<0.001**
Number of clients (last 7 days)		11.9 (9.8)		16.0 (14.4)	
≤ 5	101 (32.6)		72 (23.7)		
6 – 10	84 (27.1)		55 (18.1)		
11 – 15	35 (11.3)		55 (18.1)		
16 – 19	14 (4.5)		39 (12.8)		
≥ 20	76 (24.5)		83 (27.3)		
Missing	12		26		**<0.001**
Contraception					
Condom use (the last 7 days)					
With clients					
Never/ Not always	16 (5.0)		31 (10.2)		
Always	296 (94.9)		274 (89.8)		
Missing	10		25		**0.01**
With boyfriends**					
Never/ Not always	102 (84.3)		82 (85.4)		
Always	19 (15.7)		14 (14.6)		
Missing	11		25		0.15
Using hormonal contraception					
Six last months					
Yes	123 (38.2)		39 (11.8)		
No	199(61.8)		291(88.2)		<0.001

Table 1: *Sociodemographic and sex work characteristics of female sex workers in Mali and Benin (n=652)*

®FCFA (1 US dollars± = 500 FCFA)

* According to chi-square comparing all the categories of each variable
** The percentages and p-value apply only to FSWs who had sexual relations with a boyfriend during the last 7 days. 209 FSWs in Mali and 190 in Benin had no boyfriend or no sexual relation with a boyfriend during this period.

By comparing the period during sex work practice and the period preceding, we saw a different picture (Table 2). More women had at least one pregnancy before sex work than they did during sex work in both countries (p-value <0.001). The proportion of women having at least one pregnancy before sex work was higher in Benin at 91.2%, compared to 62.1% in Mali while it was similar in both countries during sex work (33.5% vs 32.7%). Women in Benin had an average of 3.81 pregnancies before sex work practice and 0.71 (p-value <0.001) when practicing sex work. In Mali, it was 1.46 before and 0.49 during sex work practice (p-value <0.001).

Fewer women had resorted to therapeutic abortion in Mali than in Benin (14.9% vs 57.0%). In Benin, of the women who had at least one pregnancy, over half of the women had had a therapeutic abortion (59.9 %) during their lifetime and almost two out of three women who had a

therapeutic abortion had more than one (64.4%) regardless of the period (data not shown).

Depiction of pregnancy outcomes before and during sex work practice

In Mali, FSWs had a total of 470 pregnancies before sex work practice and 131 while practicing sex work (Table 3). Most of the pregnancies led to livebirths. Before sex work, it was three out of four (74.7%) and slightly more than one out of two during sex work (57.9%). Approximately the same proportion of pregnancies (13%) resulted in a therapeutic abortion both before and during sex work. Regarding pregnancies during the sex work period, most of them were from boyfriends (82.4%), and followed by husbands with 13.2%. Most of the pregnancies from husbands (90.5%) led to livebirths, with 9.5% of miscarriages. Finally, 14 Malian FSWs (8.8%) knew they were pregnant at the time of recruitment and 4 learned they were with the pregnancy test result.

		Mali (n=322)				Benin (n=330)			
		During lifetime	Before sex work practice	During sex work practice	p-value*	During lifetime	Before sex work practice	During sex work practice	p=value*
Pregnancies									
Mean number		1.95 ±1.9	1.46 ±1.9	0.49 ±0.8	**<0.001**	4.45 ±3.2	3.81 ±3.0	0.71 ±1.6	**<0.001**
At least one	Yes	256 (79.5)	200 (62.1)	108 (33.5)		314 (95.2)	301 (91.2)	108 (32.7)	
	No	66 (20.5)	122 (37.9)	214 (66.5)	**<0.001**	16 (4.8)	29 (8.8)	222 (67.3)	**<0.001**
More than one	Yes	164 (50.9)	113 (35.1)	42 (13.0)		283 (85.8)	255 (77.3)	56 (17.0)	
	No	158 (49.1)	209 (64.9.)	280 (87.0)	**<0.001**	47 (14.2)	75 (22.7)	274 (83.3)	**<0.001**
Therapeutic abortions									
Mean number		0.32 ±0.8	0.31 ±0.8	0.21 ±0.6	0.23	1.50 ± 2.2	1.06 ±1.8	1.46 ±2.1	**0.01**
At least one	Yes	48 (14.9)	38 (11.8)	12 (3.7)		188 (57.0)	151 (45.8)	71 (21.5)	
	No	274 (85.1)	284 (88.2)	310 (96.3)	**< 0.001**	142 (43.0)	179 (54.2)	259 (78.5)	**<0.001**
More than one	Yes	22 (6.8)	14 (4.4)	7 (2.2)		121 (36.7)	77 (23.3)	37 (11.2)	
	No	300 (93.2)	308 (95.7)	315 (97.8)	0.19	210 (63.6)	253 (76.7)	293 (88.8)	**<0.001**
Number of pregnancies									
	1	92 (35.9)	87 (41.6)	66 (61.1)		31 (9.9)	46 (15.3)	52 (48.1)	
	2	73 (28.5)	47 (22.5)	35 (32.4)		39 (12.4)	42 (14.0)	32 (27.8)	
	3	42 (16.4)	30 (14.4)	5 (4.6)		56 (17.8)	58 (19.3)	11 (10.2)	
	4	20 (7.8)	15 (7.2)	2 (1.9)		42 (13.1)	42 (14.0)	3 (2.8)	
	5	10 (3.9)	6 (2.9)	0 (0.0)		54 (17.2)	47 (15.6)	5 (4.6)	
	6	12 (4.7)	9 (4.3)	0 (0.0)		29 (9.2)	24 (8.0)	2 (1.9)	
	7	4 (1.6)	3 (1.4)	0 (0.0)		26 (8.3)	17 (5.6)	1 (0.9)	
	8	1 (0.0)	2 (1.0)	0 (0.0)		15 (4.8)	8 (2.7)	0 (0.0)	
	9	1 (0.0)	0 (0.0)	0 (0.0)		5 (1.6)	4 (1.3)	0 (0.0)	
	≥10	1 (0.0)	1 (0.5)	0 (0.0)		17 (5.4)	13 (4.3)	2 (1.9)	

Table 2: *Comparison of pregnancy and therapeutic abortion's prevalence between sex work practice and the period preceding (n=652)*

* Using McNemar chi-square tests for the paired comparison of proportions before and during sex work practice and Student's t-tests for paired observations for the comparison of means before and during sex work practice.

	Mali (n=322 women and 629 pregnancies)						Benin (n = 330 women and 1492 pregnancies)					
	Before sex work n (%)	During sex work n (%)	Pregnancy's origin during sex work n (%)				Before sex work n (%)	During sex work n (%)	Pregnancy's origin during sex work n (%)			
			Boyfriend	Clients	Husband	Other			Boyfriend	Client	Husband	Other
Pregnancies total	470 (74.7)	159 (25.3)	131 (82.4)	6 (3.8)	21 (13.2)	1 (0.6)	1257 (89.1)	235 (10.9)	153 (65.4)	43 (18.6)	36 (14.7)	3 (1.3)
Outcomes												
Miscarriage	44 (9.4)	30 (18.9)	27 (32.9)	1 (16.7)	2 (9.5)	0 (0.0)	135 (10.9)	29 (12.4)	23 (15.1)	1 (2.4)	5 (14.3)	0 (0.0)
Therapeutic abortion	62 (13.2)	20 (12.6)	18 (13.7)	2 (33.3)	0 (0.0)	0 (0.0)	319 (25.6)	152 (65.2)	100 (65.8)	39 (90.7)	10 (28.6)	3 (100.0)
Stillbirth	13 (2.8)	3 (1.9)	3 (2.3)	0 (0.0)	0 (0.0)	0 (0.0)	37 (3.0)	3 (1.3)	2 (1.3)	0 (0.0)	1 ((2.9)	0 (0.0)
Livebirth	351 (74.7)	92 (57.9)	71 (54.2)	2 (33.3)	19 (90.5)	0 (0.0)	756 (60.6)	41 (17.6)	20 (13.2)	2 (4.7)	19 (54.3)	0 (0.0)
Known pregnancies*	0 (0.0)	14 (8.8)	12 (9.2)	1 (16.7)	0 (0.0)	1 (100.0)	0 (0.0)	8 (3.4)	7 (4.6)	1 (2.3)	0 (0.0)	0 (0.0)
Twin pregnancy	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	10 (0.8)	2 (0.9)	1 (0.7)	0 (0.0)	1 (2.9)	0 (0.0)

Table 3: *Pregnancy outcomes of female sex workers in Mali and Benin*

In Benin, FSWs had a total of 1257 pregnancies before sex work and 235 while practicing sex work. There was an important decrease in the livebirth rate from the period before sex work (60.6%) to that of sex work (17.6%). Expectedly, the therapeutic abortion rate markedly increased from 25.6% to 65.2% between these two periods (Table 3) and 52.1% of women had had more than one therapeutic abortion during sex work practice. Most of the pregnancies during sex work were from boyfriends at 65.4%. It is with pregnancies from husbands that therapeutic abortions were less frequent (28.6%) but those represented only 15% of all pregnancies. Finally, eight (3.4%) of the Beninese women knew they were pregnant at the time of their recruitment in the study and five learned they were with the result of the pregnancy test.

Description of the therapeutic abortions

In Benin, most of the therapeutic abortions were performed in private health centers (79.3% before and 83.1% during sex work) (Table 4). In Mali, they were equally distributed between home (28.6% before and 40.0% during sex work), public (33.3% before and 30.0% after sex work) and private health centers (33.3% before and 30.0% during sex work). In Benin, the sites where the therapeutic abortions took place were the same before and during sex work while in Mali, we observed an increase in therapeutic abortions carried out at home during sex work practice, rising from 28.6% to 40.0%. The methods used to perform therapeutic abortions changed in Mali between the two periods. More therapeutic abortions were done using pills during sex work (30.0% vs 20.6%). In Benin, pills represented less than 10% of the methods used and over half of the therapeutic abortions were completed by curettage regardless of the period. Traditional products represented approximatively 10% of the methods used in the two countries.

	Before sex work practice (n=381)				During sex work practice (n=172)			
		Mali n (%)	Benin n (%)	P-value°		Mali n (%)	Benin n (%)	P-value°
Therapeutic abortions total		62*(16.7)	319 (83.3)			20 (11.9)	152 (88.1)	
Therapeutic abortion sites								
Public health center	43 (11.3)	21 (33.3)	22 (7.0)	**< 0.001**	14 (8.1)	6 (30.0)	8 (5.4)	**< 0.001**
Private health center	270 (70.9)	21 (33.3)	249 (79.3)	**< 0.001**	129 (75.0)	6 (30.0)	123 (83.1)	**< 0.001**
Traditional clinic	8 (2.1)	3 (4.8)	5 (1.6)	0.11	0 (0.0)	0 (0.0)	0 (0.0)	-
At home	56 (14.7)	18 (28.6)	38 (12.2)	**< 0.001**	25 (14.5)	8 (40.0)	17 (11.5)	**< 0.001**
Missing values	5		5**		4		4***	
Methods used								
Abortion pills	32 (8.8)	13 (20.6)	19 (6.1)	**< 0.001**	19 (11.3)	6 (30.0)	13 (8.8)	**0.01**
Suction	30 (8.2)	16 (25.4)	14 (4.5)	**< 0.001**	8 (4.8)	3 (15.0)	5 (3.4)	**0.02**
Curettage	198 (52.5)	16 (25.4)	182 (58.0)	**< 0.001**	86 (51.2)	6 (30.0)	80 (54.1)	**0.04**

Abortion pills and suction	12 (3.2)	4 (6.3)	8 (2.5)	0.87	10 (6.0)	3 (15.0)	7 (4.7)	0.07
Abortion pills and curettage	47 (12.7)	1 (1.6)	46 (14.6)	**0.01**	34 (20.2)	0 (0.0)	34 (23.0)	**0.02**
Suction and curettage	3 (0.8)	0 (0.0)	3 (1.0)	0.44	0 (0.0)	0 (0.0)	0 (0.0)	-
Abortion pills, suction, and curettage	2 (0.5)	2 (3.2)	0 (0.0)	**0.002**	0 (0.0)	0 (0.0)	0 (0.0)	-
Traditional products	36 (9.5)	8 (12.7)	28 (8.9)	**0.01**	10 (6.0)	2 (10.0)	8 (5.4)	0.42
Vaginal stems	17 (4.5)	3 (4.8)	14 (4.5)	0.92	1 (0.6)	0 (0.0)	1 (0.7)	0.71

*One woman declared two places where her therapeutic abortion took place because she had a therapeutic abortion at home and needed to go to a private clinic after for complications. It counts for only one therapeutic abortion in the total. She also declared two methods used.

** One women had five therapeutic abortions and did not answer the questions regarding therapeutic abortion sites.

*** Two women had two therapeutic abortions each and did not answer the question regarding therapeutic abortion sites.

° Pearson chi-square tests were used for the comparison of proportions between the two countries for each period (before and during sex work).

Table 4: *Therapeutic abortion sites and methods used before and during sex work practice in Mali and Benin*

The therapeutic abortions done at home were mostly performed by non-medical personnel or the FSWs themselves. There were complications with the therapeutic abortions in 50.0% of the cases before sex work and 68.0% during sex work (Table S1). No complications followed an intervention done in a public health center during sex work practice. One out of four women experienced hemorrhage (19.4%) or abdominal pain (4.7%) in private health centers during that period, despite these interventions being performed by doctors or nurses (Table S2).

Incidence rate of pregnancy

These analyses have been carried out on both the original and imputed databases. As the results were very similar, but slightly more precise with the imputed database, we only present the results using the latter, except for the numerators and denominators of the incidence rates that are based on the raw data (Table 5). In Mali, 470 pregnancies occurred over 1861 person-years before sex work for an incidence rate (IR) of 0.23 per person-year [95% Confidence Interval (95%CI): 0.20-0.26]. During sex work practice, FSWs had 159 pregnancies over 1281 person-years IR: 0.11, 95%CI: 0.09-0.14]. We observed an average of twice less pregnancies during sex work [Incidence rate ratio (IRR): 0.49, 95%CI: 0.37-0.66] than before.

In Benin and before sex work, FSWs had 1257 pregnancies and contributed for 3143.4 at risk years, giving an IR of pregnancy of 0.37 per person-year (95%CI: 0.31-0.45) (Table 5). During sex work practice, FSWs had twice less pregnancies (IRR 0.45, 95%CI: 0.32-0.63) which is similar to what was observed in Mali even though on average FSWs in Benin had more pregnancies during the two periods.

The results stratified by age at sex work debut show that in Benin, women who started sex work practice when aged 30 years or older had three times less pregnancies during sex work practice compared to the period preceding (IRR 0.27, 95%CI: 015-0.49). Similarly, in Mali, FSWs aged 30 years or older at sex work debut had the lowest pregnancy incidence during sex work (IR 0.08, 95%CI: 0.04-0.16 for Mali and 0.08, 95%CI: 0.04-0.14 for Benin).

	Pregnancies before sex work practice			Pregnancies during sex work practice				
	n/person-years*	IR**	95%CI	*n/person-years*	*IR**	*95%CI*	IRR***	95%CI
	Mali			*Mali*				
	470/1861.0	0.23	0.20 - 0.26	159/1281.0	0.11	0.09 - 0.14	0.49	0.37 - 0.66
Age at sex work debut								
≤ 17	51/196.4	0.24	0.17 - 0.34	52/469.6	0.11	0.09 - 0.15	0.48	0.30 - 0.79
18 - 21	73/279.4	0.25	0.19 - 0.33	46/315.6	0.15	0.11 - 0.20	0.61	0.40 - 0.92
22 - 25	106/354.8	0.26	0.21 - 0.33	30/251.7	0.12	0.08 - 0.18	0.46	0.26 - 0.80
26 - 29	90/364.1	0.23	0.17 - 0.32	12/102.4	0.12	0.06 - 0.25	0.51	0.21 - 1.23
≥ 30	140/666.3	0.19	0.15 - 0.23	11/141.7	0.08	0.04- 0.16	0.43	0.20 - 0.89
	Benin			**Benin**				
	1257/3143.4	0.37	0.31 - 0.45	235/1575.7	0.17	0.13 - 0.21	0.45	0.32 - 0.63
≤ 17	5/10.4	0.37	0.16 - 0.85	11/62.3	0.19	0.11 - 0.35	0.51	0.22 - 1.23
18 - 21	93/156.2	0.49	0.36 - 0.67	46/199.1	0.25	0.16 - 0.34	0.51	0.30 - 0.86
22 - 25	166/330.9	0.44	0.38 - 0.53	53/276.1	0.20	0.14 - 0.30	0.46	0.29 - 0.73
26 - 29	116/310.9	0.31	0.26 - 0.37	40/236.8	0.17	0.09 - 0.34	0.55	0.27 - 1.11
≥ 30	823/2335.7	0.28	0.26 - 0.31	59/801.4	0.08	0.04 - 0.14	0.27	0.15 - 0.49

* Numerators and denominators are based on the raw database

** Incidence rate of pregnancy per person-year, overall and stratified by age at sex work debut, using the imputed database.

*** Incidence rate ratio comparing the period preceding sex work and the period during sex work practice using generalized linear models for count data with a Poisson distribution and a log link applied on the imputed databases

Table 5: *Incidence rate of pregnancy per country, stratified by age at sex work debut*

Discussion

The aim of this research was to describe the reproductive history of FSWs, a marginalized population, in both Mali and Benin. To acquire a global portrait of their realities, we described their reproductive history not only during sex work practice but also before. The main observation is that FSWs had more pregnancies leading to livebirths during the period preceding sex work practice. In Benin as in Mali, the incidence rate of pregnancy declined by half after the initiation of sex work. It is worthy to note that although fewer pregnancies occurred during sex work practice, the ones occurring during that period had lower livebirth rates and higher therapeutic abortion frequency, with associated complications such as hemorrhage and abdominal pain, as described by the FSWs we interviewed.

The number of pregnancies before sex work practice is undoubtedly high. The fact that a large number of pregnancies have occurred before sex work practice can lead women to precariousness and economical strain especially since the vast majority of these pregnancies led to livebirths. For example, in Benin, the country with the higher number of pregnancies before sex work practice, half of the women were widowed or separated. The lack of opportunities to earn money often draws women to sex work [13, 35]. In Mali, the women were 10 years younger than in Benin but were responsible, on average, for the same number of dependents (3.6). In Mali, family poverty is a determining factor for engaging in sex work. Young girls can be driven towards sex trade to help support their family [36]. In our population, one out of three Malian FSWs started selling sex before being 17 years old.

When comparing the two countries, FSWs in Mali had twice less pregnancies during the period preceding sex work than in Benin. FSWs recruited in Mali were younger. Another factor that could explain this discrepancy is that FSWs in Benin were active sexually for a longer period before getting involved in sex work than women from Mali. Indeed, FSWs had their first sexual relation on average over two years younger in Mali (15.2 years) compared to Benin (17.6 years), but the mean age at sex work initiation was 7 years younger in Mali (21.2 years) compared to

Benin (28.2 years). Consequently, women in Benin spent 10.6 of their sexually active years before selling sex rather than the six years found for Malian women. For several women, the need to take care of their children is a sufficient incentive to engage in sex work practice [37-39]. In Mali, prior to initiating sex work, almost 60% had at least one child and in Benin, it was three out of four FSWs.

The cumulative incidence of pregnancy during sex work is similar in the two countries with no regards to the outcome. Our findings indicate that a third of the FSWs had at least one pregnancy while practicing sex work. This overall cumulative incidence is high compared to what has been observed during sex work in other studies which is around 20% [27, 28, 40-43]. Social and popular judgements induce significant stigma to pregnant women during sex work practice [22]. The fact that our study inquired globally about reproductive history for their lifetime may have helped to reduce fear and shame surrounding those issues. The high frequency of pregnancies during sex work, compared to other studies, is worrisome especially considering that nursing a baby during sex work practice is undeniably an added burden for women who already are mothers [44].

 Fewer pregnancies occurred during sex work. but a smaller proportion of those led to livebirths. In Mali, three out of four pregnancies led to livebirths before sex work practice compared to half during sex work. In Benin, this difference was even greater, less than one out of five pregnancies have led to livebirths during sex work, as opposed to three out of five before. These data seem to support the idea that more pregnancies are unwanted during sex work practice. Nevertheless, it must be kept in mind that is not because a pregnancy's outcome is a livebirth that the pregnancy is intended. Low-income countries have both the world's highest unintended pregnancy rate and the world's lowest proportion of unintended pregnancies ending in therapeutic abortion [45]. Worldwide, it is estimated that half of the unwanted pregnancies lead to therapeutic abortion but that the other half leads to livebirths [46]. In both countries, when the husband is the father, the livebirth rate is at its highest. Yet, those pregnancies represent less than 15% in each country. Most

pregnancies during sex work came from boyfriends (82% in Mali and 65% in Benin). We also observed that condom use is low with their boyfriends compared to with their clients. Not using condoms with their boyfriends helps women to make a distinction between their professional and personal lives [47], but also seems to lead to unplanned pregnancies. Moreover, in Mali, the prevalence of miscarriage doubles between the two periods (9.4% before vs 18.9% during). In this regard, miscarriages were more frequent during sex work when the pregnancy came from a boyfriend (32.9%). This variation can be explained by the fact that it is easier to divulge a miscarriage than a therapeutic abortion [48]. In Mali**,** 12.6% of the pregnancies led to a therapeutic abortion during sex work (approximately the same as before sex work). In Benin, 65.2% of all pregnancies led to a therapeutic abortion during sex work and over 50% of the women who had a therapeutic abortion during that period had more than one. The legal framework related to pregnancy termination differs in the two countries which could explain those differences. It is semi-liberalized in Benin and restrictive in Mali [49]. In Mali, therapeutic abortion is permitted only in case of incest, fetal malformation, or risk for the mother's life. In Benin, women can access therapeutic abortion to protect their health. However, it is not because the legal framework is more liberalized that the access to safe abortion is easier [49].

Unsafe therapeutic abortion is responsible for a large proportion of maternal mortality and morbidity [50]. An unsafe abortion is a procedure for pregnancy termination carried out by an individual who does not have the necessary training or in an environment not conforming to minimal medical standards. Unsafe abortion can be classified in two subcategories: 1) The less safe category when the abortion is carried out by a trained provider using non-recommended methods or using a safe method (eg. Misperidol) without providing adequate information to the patient; 2) the least safe category when the abortion is conducted by untrained people using a dangerous, invasive method [51]. The methods used to perform therapeutic abortions differed between Mali and Benin and were mostly in the less safe category. In Mali, one out of three therapeutic abortions were performed at home before and two out of five during sex work. Abortive pills were commonplace in Mali while their use in Benin was below 10%. Abortive pills such as mefipristone and misoprostol, are one of the safest method to perform therapeutic abortion [52]. It also gives the opportunity to conduct the pregnancy termination at home unbeknownst to anyone and can easily looks like a miscarriage if found [48]. Nevertheless, in Mali, 30% of all voluntary chemical intoxications were associated with unsafe therapeutic abortion [53]. A high level of complications was reported in our study despite the fact that we certainly underestimated the aforementioned level of specific complications. Most of the complications typically occurred when the therapeutic abortion was performed at home or in a private health center as other studies have found [54]. In Benin, most of the therapeutic abortions were performed in private health centers during the two periods. In Benin, private health centers are known to provide therapeutic abortion services. They are mostly centralized around Cotonou [49]. In Benin, the cost of a therapeutic abortion was estimated at between 24.50-89.00 US dollars [55]. For a country whose gross national income per capita is 104 US dollars per month [56], the price for a therapeutic abortion is unquestionably high. This may shed light on the apparent contradiction where more therapeutic abortions take place during sex work when the majority of the pregnancies occur before that period. Indeed, it is likely that sex work provides women with enough financial means to access this medical procedure.

Single mothers are at high risk of initiating sex work [57] especially those having had unplanned pregnancies [37]. Single mothers represent a large fraction of our sample (Mali = 55.5% (165/297), Benin = 75.4% (227/301)) and more than 95% of the participants were not married at the time of the study. FSWs constitute a marginalized population and most of the time, poverty leads them to sex work to have enough resources to care

for their children [58]. Nevertheless, the observed incidence rate of pregnancy during sex work is still high, despite the fact that having a baby is an additional burden [44] while practicing sex work and often leads to therapeutic abortion. It is true that the realities are different between the two countries which calls for a different approach when we consider targeted reproductive services. Nevertheless, despite these differences, the risk factors and health consequences associated with sex work are similar in both countries. FSWs from both Mali and Benin have a high HIV prevalence (20.2% and 24.9%, respectively), an appreciable level of pregnancies at the time of recruitment in the study (5.6% and 3.9%), and low condom use with their boyfriend (15.7% and 14.6%). Reaching each country's FSW population through sexual and reproductive health services with specific activities to reduce unwanted pregnancies and therapeutic abortions can help reduce maternal mortality and morbidity.

Strengths and limitations

Our research displays some limitations. First because of social desirability biases, we could have underestimated the frequency and the incidence rate of the studied outcomes, considering that pregnancy and therapeutic abortion are sensitive topics. There is thus a high probability that some women did not disclose some pregnancies or therapeutic abortions. The fact that the questionnaire was completed during a face-to-face interview could also have exacerbated that underreporting [59]. Secondly, women with adverse pregnancy outcomes are underrepresented, especially given that the risk of dying of unsafe therapeutic abortion is the highest in Africa [51] and that we could not enroll in our study women who died following a therapeutic abortion. Consequently, we may have underestimated severe adverse outcomes and therapeutic abortion complications. We can also have an overrepresentation of complications because women can have reported minor issues as complications even though they are not. Moreover, we might have overestimated the pregnancy incidence rate because of our inability to remove the time where the FSWs were not-at-risk of becoming pregnant (non-at-risk time). For example, the time while women were already pregnant or the weeks/months following a therapeutic abortion or delivery or even under contraception during which they could not conceive. However, the IRR comparing the periods before and during sex work should be less biased, since we could not remove the length of time not-at-risk for the two periods. Moreover, women might have a tendency to underestimate the time spent practicing sex work because of shame surrounding this practice [60]. This could also have led to an overestimation of the incidence rate for this period. Finally, we were able to recruit only FSWs who used FSW-friendly clinics and self-defined as FSWs. Non-professional FSWs are more isolated and have a lower frequency of condom use [61] and we cannot extrapolate our findings to that specific population.

On the positive side and to our knowledge, our study is the first to make a clear distinction between the incidence rate of pregnancies before and during sex work practice. We used multiple imputations to avoid biases as much as possible regarding time spent before and during sex work practice. FSWs were recruited with the help of peer educators and the questionnaires were administered in total confidentiality at FSW-friendly clinics to avoid judgement and stigma. The questionnaire was specifically developed to assess reproductive history which gave us a lot of details but also the opportunity to recruit women that might be more comfortable talking about this topic. Finally, we were able to present data for two countries with relatively large samples offering us the occasion to describe the specificity of the Malian and Beninese sex workers in terms of reproductive history.

Conclusions

Most of the pregnancies occurred before sex work practice in Mali as in Benin. Nevertheless, resorting to therapeutic abortion was more frequent during sex work practice especially for Beninese FSWs. These results

highlight the need for two types of prevention. First, single mothers, as well as divorced and widowed ones, need to be supported to avoid sex work as a financial solution. Secondly, reproductive needs of FSWs must be acknowledged and understood so that specific sexual and reproductive health interventions can be targeted towards their needs. Finally, to properly support FSWs who want to have children, more research is needed to understand the mechanisms leading to the intention of becoming pregnant in this population.

Acknowledgements

Conflict of Interest

The authors declare that they have no conflict of interest.

Abbreviations:

BSW: Before sex work

CI: Confidence interval

DSW: During sex work

FCFA : Franc des communautés financières africaines

FSW: Female sex workers

HIV: Human immunodeficiency viruses

HPV: Human papillomavirus

MM: Maternal mortality

IR: Incidence rate

IRR: Incidence rate ratio

MICE: Multiple imputations by chained equations

NGO: Non-Governmental Organisation

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