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Prevalence and Factors Associated with HIV Serodiscordance among Infected Couples in the City of Parakou (Benin)

Sègnon Eurydice Elvire Djossou[1*], Charles Sossa[2], Georgia Barikissou Damien[1], Rhonel Ahanhanzo-Glèlè[3], Ignace Tokpanoudé[1], Gottfried Agballa[1], Ariano Vigniavo Nouatin[1], Ireti Nethania Elie Ataïgba[4,5], Eric Dettin[6], Badirou Aguemon[1]

[1]Public Health Unit of the Faculty of Health Sciences (FHS), University of Abomey-Calavi (UAC), Cotonou, Benin
[2]Comlan Alfred Quenum Regional Institute of Public Health, University of Abomey-Calavi (UAC), Ouidah, Bénin
[3]Regional Center for Prospective Information and Advice on HIV and STD of Borgou/Alibori, Parakou, Bénin
[4]Institute of Nursing and Obstetrics Training, University of Parakou School of Medicine, Parakou, Bénin
[5]Department of Psychiatry, Departmental University Hospital of Borgou and Alibori, Parakou, Bénin
[6]Internal Medicine Department, Armed Forces Training Hospital—University Hospital, Parakou, Bénin
Email: *djossouelvire@hotmail.com

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Abstract

Introduction: Achieving the goal of "zero new human immunodeficiency virus (HIV) infections by 2030" requires the elimination of HIV transmission within serodiscordant couples. In Benin, the phenomenon of HIV serodiscordance remains poorly documented. **Objective:** the aim of this study was to determine the prevalence of HIV serodiscordance and its associated factors among infected couples in the city of Parakou. **Study Framework and Method:** This was a descriptive cross-sectional study with an analytical focusing on qualitative and quantitative plans. It was carried out on thirty approved sites in the city of Parakou between July and December 2022. We used a non-exhaustive convenience sample of people living with HIV (PLHIV) whose partner's status was known. Data collection took place in two phases: an interview phase during which sociodemographic, economic, behavioral and marital/social data were collected. The second phase focused on clinical and therapeutic data which were collected from the patients' personal records. **Results:** A total of 417 study subjects were recruited. The average age (SD) of the subjects was 38.17 (±10.25) years [37.19 - 39.16]. Females accounted for the largest proportion (79.62%). Most respondents (74.11%) were married. Monogamous unions were the most frequent, involving 67.87% of participants, most of whom (44.60%) had been infected for between 1 and 5 years. Couples in union for less than 10 years were the most numerous (218 people

or 52.28%). The respondent was head of household among only 140 respondents (33.57%) of which 84 men (60.00%) and 56 women (40.00%). Female heads of household were mainly divorcees and widows. Around 75% of PLHIV had monthly incomes of less than 50,000F CFA (81.16 USD). Prevalence of HIV serodiscordance was 71.70%. It was 70.91% [65.54% - 76.28%] at care sites and 73.24% [65.95% - 80.52%] at sites involved in preventing mother-to-child transmission (PMTCT sites). Potential predictors of HIV serodiscordance were: household head status; serostatus of last child; duration of relationship; multiple and occasional sexual partners; sharing serostatus with spouse; duration of couple relationship; spouse's extramarital relationships and strained relations with children. **Conclusion:** Response strategies against the HIV pandemic need to be reshaped to better supervise the follow-up of HIV serodiscordant couples in the city of Parakou specifically and in Benin in general.

Keywords

Serodiscordance, HIV, Prevalence, Associated Factors, Benin

1. Introduction

Human Immunodeficiency Virus (HIV) infection remains a major public health problem, responsible for over 36.3 million deaths worldwide to date [1]. Reducing sexual transmission of the virus, particularly among serodiscordant couples, is one of the most important challenges currently facing the fight against the pandemic. Worldwide, more than 50% of new HIV infections occur in serodiscordant couples, either because of a previous infection in one of the partners, or because of infidelity [2]. In many sub-Saharan African countries, a high proportion of people living with HIV are in long-term serodiscordant relationships; there are around 3% to 20% of discordant couples in the general population [3]. This phenomenon is increasingly recognized worldwide as a key factor in sustaining the HIV epidemic [4]. In Benin, the main strategies fighting against the epidemic are focused on vertical transmission and HIV serodiscordance within couples remains poorly documented. The production of data about this matter will help improve the response to achieve the goal of zero new infections by 2030.

Objective: The aim of this study was to shed light on HIV serodiscordance among infected couples in an urban area. More specifically, the aim was to measure the extent of the phenomenon by calculating prevalence and identifying potential predictors of serodiscordance in couples affected.

2. Setting, Patients and Study Methods

2.1. Study Setting

The present study took place in the town of Parakou in north-eastern Benin. It was carried out on 23 prevention of mother-to-child transmission (PMTCT)

sites and 7 care sites in the town, involved in the screening, care and/or follow-up of people living with HIV (PLHIV). Parakou is a cosmopolitan town located 415 km from the capital, Cotonou. The total population was estimated at 255,478 with a sex ratio of 0.99. Of this young population, 41.16% were children under the age of 15, while 51.97% were aged 18 and over. In 76% of cases, men were the head of household [5]. HIV seroprevalence was 0.4% in 2021 [6].

2.2. Patients and Study Method

This was a descriptive, analytic, cross-sectional study conducted over a 6-month period from July to December 2022. Participants were selected according to the following criteria: women or men aged 18 and over; living with HIV for at least 6 months; whose spouse's status was known to health care services; in or having been in a stable union; received at one of the data collection sites during the study period and having given informed consent to the study. Patients physically or mentally unable to answer the questions and cases of withdrawal of consent were excluded from this study. We used non-probability sampling for convenience. The Schwartz minimum sample size was 345 subjects. Quantitative and qualitative data on participants' lives were collected using a questionnaire, focusing on socio-demographic aspects, antecedents, behaviours, marital and psycho-social aspects presented by the participants. Clinical and therapeutic data were collected from patients' personal records. The dependent variable, represented by serodiscordance within HIV+ couples, was defined as a couple in which one partner was HIV-infected and the other was not.

The data collected were analyzed using R 4.3.0 software. Quantitative variables were expressed as means with standard deviations, and qualitative variables as proportions. The Chi-square test was used to compare categorical variables with numbers > 5, and the Fisher test for variables with numbers ≤ 5. The Student's T-test was used to compare means. The association between the two variables was established for a value of $p < 0.05$. A threshold of 20% was used to select variables for inclusion in a logistic regression model to identify potential predictors of HIV serodiscordance among infected couples in the city of Parakou.

3. Results

During the study period, 417 study subjects meeting the inclusion criteria were surveyed.

3.1. General Characteristics of Participants

The average age of respondents was 38.17 ± 10.25 years. Females were the most represented with a proportion of 79.62%, in other words, a sex ratio of 0.26. Most of the respondents (309 subjects, in other words. 74.11%) were married, and 83.69% of them were in an active relationship (married, cohabiting, couple). The average duration of the relationship was 130.75 ± 101.67 months. The minimum duration was 7 months and the maximum was 520 months. Monogamous

unions were the most common, accounting for 67.87% of couples. The respondent was head of household among only 140 couples (33.57%). Nearly a third of the respondents in our study had a primary or secondary education (136 respondents, or 32.61% of the sample). The average income of the respondents was 38,349 F CFA ± 43,443 with extremes of 0 and 340,000F. The urban environment was the most represented (88.73% of cases, in other words. 370 respondents).

All subjects included in our study were infected with HIV1 (100% of cases). Liver serology was made on 357 respondents, in other words, 85.61% of cases. Of these, 37 (10.36%) were co-infected with HIV and viral hepatitis, including 9.52% with hepatitis B. Nearly one patient in eight (51, 12.23%) had a history of STI. During the study period, the last children of those surveyed were aged between 1 and 5 years in the majority of cases, 171 (44.65%). Their serological status, for those known, was negative in 95.29% of cases.

The vast majority of respondents (99.28%) were aware of at least one route of transmission and at least one means of HIV prevention. Among these routes of transmission, sexual and blood transmission were the most familiar to 410 (98.32%) and 312 (74.82%) respondents respectively. Vertical transmission was only known to 165 respondents, representing 39.57% of the total. As for known means of prevention, 387 (92.81%) knew about condoms, followed by abstinence (262 or 62.83%) and faithfulness (197 or 47.24%). Most of the PLHIV surveyed kept themselves informed about HIV, and 81.05% were actively researching the subject. The most common sources of information were health workers (84.61% of cases), television (40.53% of cases) and social networks (23.67% of cases).

3.2. Prevalence of HIV Serodiscordance

The 417 subjects surveyed in our study included 299 who were involved in an HIV serodiscordant relationship, while 118 were in a couple with a serodiscordant positive partner. The prevalence of HIV serodiscordance among couples affected in the city of Parakou in 2022 was therefore 71.70% (IC95% [67.07 - 75.92]). It was 70.91% [65.54 - 76.28%] at PEC sites and 73.24% [65.95% - 80.52%] at PTME sites.

3.3. Factors Associated with HIV Serodiscordance among Couples in Univariate Analysis

According to the results of our study, there is a statistically significant difference between HIV serodiscordance and:

- Socio-demographic variables: marital status and household head status (**Table 1**).
- Antecedents: duration of the couple's relationship, serostatus of the last child and desire for (other) children (**Table 2**).
- None of the clinical or therapeutic variables studied in our study (**Table 3**).
- Behavioral variables: occasional sexual partnership, sharing of serostatus with spouse and spouse's extra-marital relationships (**Table 4**).

- Social and marital variables: state of stress or anxiety and relationship outcome (Table 5).

Table 1. Association between socio-demographic variables and HIV serodiscordance among infected couples—Parakou, 2022.

	Seroconcordance n (%)	Serodiscordance n (%)	OR (IC95%)	p
Age (years)				0.118
[20 - 30[	19 (4.56)	70 (16.79)	1	
[30 - 40[	46 (11.03)	114 (27.34)	0.67 (0.36 - 1.24)	0.204
[40 - 50[	30 (7.19)	80 (19.19)	0.72 (0.37 - 1.40)	0.336
[50 - 76]	23 (5.51)	35 (8.39)	0.41 (0.20 - 0.86)	**0.018**
Gender				0.599
Male	26 (6.24)	59 (14.15)	1	
Female	92 (22.06)	240 (57.55)	1.15 (0.68 - 1.93)	
Marital status				**0.007**
Married	79 (18.94)	230 (55.16)	1	
Cohabiting	8 (1.92)	25 (5.99)	1.07 (0.46 - 2.48)	0.868
In couple	1 (0.24)	6 (1.44)	2.06 (0.24 - 17.38)	0.506
Divorced	13 (3.12)	26 (6.23)	0.69 (0.34 - 1.40)	0.302
Widowed	17 (4.08)	12 (2.88)	0.24 (0.11 - 0.53)	**<0.001**
Education level				0.366
None	32 (7.67)	79 (18.95)	1	
Primary	44 (10.55)	92 (22.06)	0.85 (0.49 - 1.46)	0.551
Secondary	36 (8.63)	100 (23.98)	1.12 (0.64 - 1.97)	0.680
Higher	6 (1.44)	28 (6.72)	1.89 (0.71 - 5.00)	0.199
Monthly revenue (CFA)				0.476
[0 - 50,000[	86 (20.62)	229 (54.92)	1	
[50,000 - 100,000[	19 (4.56)	48 (11.51)	0.95 (0.53 - 1.71)	0.860
[100,000 - 340,000[	13 (3.12)	22 (5.27)	0.64 (0.31 - 1.32)	0.223
Residence				0.559
Urban	103 (24.70)	267 (64.03)	1	
Rural	15 (3.60)	32 (7.67)	0.82 (0.43 - 1.58)	
Household type				0.107
Monogamous	87 (20.86)	196 (47.00)	283 (67.87%)	
Polygamous	31 (7.44)	103 (24.70)	134 (32.13%)	
Head of household				**0.001**
No	66 (15.83)	211 (50.60)	1	
Yes	52 (12.47)	88 (21.10)	0.53 (0.34 - 0.82)	

Table 2. Relationship between respondent history and HIV serodiscordance in infected couples—Parakou, 2022.

	Seroconcordance n (%)	Serodiscordance n (%)	OR (IC95%)	P
Viral hepatitis				0.503
No	86 (20.62)	234 (56.11)	1	
Yes	12 (2.88)	25 (6.00)	0.77 (0.37 - 1.59)	0.474
Not tested	20 (4.80)	40 (9.59)	0.73 (0.41 - 1.33)	0.307
History of STI[a]				0.637
No	105 (25.18)	261 (62.59)	1	
Yes	13 (3.12)	38 (9.11)	1.18 (0.60 - 2.30)	
Duration of infection (years)				0.925
<1	15 (3.60)	38 (9.11)	1	
[1 - 5[	50 (11.99)	136 (32.61)	1.07 (0.54 - 2.12)	0.838
[5 - 10[	31 (7.43)	70 (16.79)	0.89 (0.43 - 1.85)	0.758
≥10	22 (5.28)	55 (13.19)	0.99 (0.45 - 2.14)	0.973
Duration of relationship (months)				
[7 - 520]		(130.75 years ± 101.67)		**0.004**
Last child status (n = 361)				**0.005**
Negative	93 (25.76)	251 (69.53)	1	
Positive	10 (2.77)	7 (1.94)	0.26 (0.10 - 0.70)	
Desire for (other) children				0.242
No	45 (10.79)	96 (23.02)	1	
Yes	73 (17.51)	203 (48.68)	1.30 (0.84 - 2.03)	

a: sexually transmitted infections.

Table 3. Association between respondents' clinical and therapeutic variables and HIV serodiscordance among infected couples—Parakou, 2022.

	Seroconcordance n (%)	Serodiscordance n (%)	OR (IC95%)	p
Clinical condition				0.549
Good	109 (26.14)	281 (67.39)	1	
Poor	9 (2.16)	18 (4.31)	0.78 (0.34 - 1.78)	
Clinical stage (WHO)				0.714
Stage 1	92 (22.06)	239 (57.31)	1	
Stage 2	14 (3.36)	37 (8.87)	1.02 (0.54 - 1.97)	0.959
Stage 3 and 4	12 (2.88)	23 (5.52)	0.74 (0.35 - 1.54)	0.419
Circumstance of discovery of infection				0.158
PMTCT[a]	56 (13.43)	152 (36.45)	1	

Continued

Hospital contact	38 (9.11)	78 (18.70)	0.75 (0.45 - 1.22)	0.247
Voluntary testing	20 (4.80)	66 (15.83)	01.23 (0.69 - 2.22)	0.481
Family screening	4 (0.96)	3 (0.72)	0.28 (0.06 - 1.27)	0.099
Viral load at last check-up				0.069
Detectable	28 (6.72)	48 (11.51)	1	
undetectable	90 (21.58)	251 (60.19)	1.63 (0.96 - 2.75)	
ART compliance				0.337
Good	97 (23.26)	257 (61.63)	1	
Poor	21 (5.04)	42 (10.07)	1.32 (0.75 - 2.35)	

a: preventing mother-to-child transmission.

Table 4. Association between behavioral variables and HIV serodiscordance in infected couples—Parakou, 2022.

	Seroconcordance n (%)	Serodiscordance n (%)	OR (IC95%)	p
Frequent condom use				**0.037**
No	93 (22.30)	205 (49.16)	1	
Yes	25 (6.00)	94 (22.54)	1.71 (1.03 - 2.83)	
Condom use at last intercourse				0.076
No	98 (23.50)	224 (53.72)	1	
Yes	20 (4.80)	75 (17.98)	1.64 (0.95 - 2.84)	
Multiple sexual partnerships				0.104
No	101 (24.22)	235 (56.35)	1	
Yes	17 (4.08)	64 (15.35)	1.62 (0.90 - 2.90)	
Occasional sexual partnerships				**<0.001**
No	89 (21.35)	137 (32.85)	1	
Yes	29 (6.95)	162 (38.85)	3.63 (2.25 - 5.85)	
Stable relationships since diagnosis				0.078
0 - 1	103 (24.70)	239 (57.31)	1	
2 - 6	15 (3.60)	60 (14.39)	1.72 (0.94 - 3.18)	
Sharing serostatus with spouse				**<0.001**
No	33 (7.91)	156 (37.41)	1	
Yes	85 (20.38)	143 (34.30)	0.36 (0.22 - 0.57)	

3.4. Potential Predictors of HIV Serodiscordance among Infected Couples in the City of Parakou in 2022

The multivariate analysis model of this study shows that the potential predictors of serodiscordance were: the status of head of household, the serological status of

Table 5. Association between variables relating to social and marital life and HIV serodiscordance among infected couples—Parakou, 2022.

	Seroconcordance n (%)	Serodiscordance n (%)	OR (IC95%)	p
Tensions within the couple				0.428
No	92 (22.06)	222 (54.24)	1	
Yes	26 (6.24)	77 (18.46)	1.23 (0.74 - 2.04)	
Spouse's attitude towards the disease				**<0.001**
Hostile or indifferent	14 (6.14)	21 (9.21)	1	
Good	71 (31.14)	122 (53.51)	1.15 (0.55 - 2.39)	0.718
Uninformed	33 (7.91)	156 (37.41)	3.15 (1.45 - 6.83)	**0.004**
Partner involvement in disease monitoring				**<0.001**
No	16 (3.84)	30 (7.19)	1	
Yes	69 (16.55)	113 (27.10)	0.87 (0.44 - 1.72)	0.695
Not informed	33 (7.91)	156 (37.41)	2.52 (1.23 - 5.15)	**0.011**
Stress or anxiety				**0.030**
No	87 (20.86)	187 (44.84)	1	
Yes	31 (7.44)	112 (26.86)	1.68 (1.05 - 2.69)	
Tense relationships with children				0.057
No	114 (27.34)	272 (65.23)	1	
Yes	4 (0.96)	27 (6.47)	2.83 (0.97 - 8.27)	
Become relationship				**0.001**
Continuity	88 (21.10)	261 (62.59)	1	
Separation/divorce	13 (3.12)	26 (6.23)	0.67 (0.33 - 1.37)	0.276
Death of spouse	17 (4.08)	12 (2.88)	0.24 (0.11 - 0.52)	**<0.001**

the last child, the existence of multiple sexual partners, the existence of occasional sexual partners, the sharing of serological status with the spouse, the duration of the couple's relationship, the spouse's extra-marital relationships and strained relations with children (Table 6).

4. Discussion

4.1. Prevalence of HIV Serodiscordance

In our study, the prevalence of HIV serodiscordance was 71.70%. It was 73.24% at sites involved solely in monitoring pregnant women. This result corresponds to the model described by Chemaitelly H. [7] in 2012. According to the author, in countries with a low prevalence of HIV infection, around 75% of partnerships affected by HIV are discordant. Benin, with an HIV prevalence of around 1.2%, ranks among these low-prevalence countries. The prevalence described in our study is similar to that reported by Reed *et al.* [8], in the African cohort study,

Table 6. Potential predictors of HIV serodiscordance among infected couples in the city of Parakou in 2022.

	ORa (IC 95%)	p
Head of household		
No	1	
Yes	0.25 (0.13 - 0.47)	**<0.001**
Serological status of last child		
Negative	1	
Positive	0.14 (0.04 - 0.44)	**0.001**
Multiple sexual partners		
No	1	
Yes	2.91 (1.39 - 6.09)	**0.005**
Occasional sexual partners		
No	1	
Yes	7.17 (3.78 - 13.60)	**<0.001**
Sharing status with spouse		
No	1	
Yes	0.31 (0.17 - 0.55)	**<0.001**
Duration of relationship (in months)		
[7 - 272]	0.996 (0.993 - 0.999)	**0.003**
Spouse's extra-marital relationships		
No	1	
Yes	0.51 (0.26 - 0.99)	**0.048**
Tense relationships with children		
No	1	
Yes	4.51 (1.35 - 15.09)	**0.015**

which was 78.52%. Similarly, in Benin City, Nigeria, the reported prevalence varied between 77% and 78.8% [9] [10].

In contrast, Ujah I. [11] in Lagos and Akani [12] at the University Hospital of Port Harcourt, reported lower prevalences, respectively 66.8% and 52%. In Nweni, south-east Nigeria, Ezeama [13] and Nwachukwu [14] found respective prevalences of 54.7% and 38.9% between 2014 and 2021.

This difference can be explained by variations in regional HIV prevalence rates in these countries, which may or may not limit the risk for a subject in the general population to couple up with an HIV-negative partner. While HIV seroprevalence in Lagos was estimated at 1.2% in 2021 [15], it was several times higher in other cities: 7.3% in Port-Harcourt [16]; 9.6% in Nwéni [13].

4.2. Factors Associated with HIV Serodiscordance

The multivariate analysis model of this study shows that the potential predictors

of serodiscordance were the status of the head of household, the duration of the couple's relationship, the serostatus of the last child, the existence of multiple sexual partners, the existence of occasional sexual partners, the sharing of serostatus with the spouse, the spouse's extra-marital relationships and strained relations with children. In Congo, the explanatory factors for serodiscordance were: the number of partners, region of residence, number of children, length of union, age, level of education, ethnicity, protected sex, religion, standard of living and knowledge of HIV/AIDS transmission mechanisms, love and knowledge of infected partner's serostatus [17]. In Mozambique, the factors found by Juga *et al.* [18] in 2020 included: HIV prevalence, number of unions for women, presence of STIs in men, condom use by women, wealth index, condom use by men and number of unions for men. In Nigeria, Akani [12] found the following associated factors: history of at least two ends of pregnancy (OR: 3.05; 95% CI: 2.91 - 3.89) and five or more sexual relationships in the course of a lifetime (OR: 2.3; 95% CI: 1.27 - 3.21).

4.2.1. Head of Household Status

In fact, the status of head of household is a protective factor for serodiscordance, multiplying the risk of being in a positive serodiscordant relationship by 4. This can be explained by the fact that the HIV-infected head of household can impose the type of sexuality he or she wishes on the couple, and decide whether or not to adopt transmission prevention strategies. In this context, the HIV-negative subject, who is in a "dominated" position, cannot negotiate the adoption of preventive measures to maintain his or her serological status, which increases the risk of transmission of the virus within the stable couple. This was reported by Sawadogo *et al.* [19], in a study of unequal power relations within serodiscordant couples in Lomé, Togo, in 2022. For the authors, the domination of male partners is acutely felt in the field of sexuality and prevention, notably through the coercion that can frame a male partner's refusal to wear a condom by using his power of domination over his partner(s).

4.2.2. Duration of Relationship

The average duration of the couple's relationship was 130.75 ± 101.67 months, or around 10.11 ± 8.1 years. The group of couples with a longevity of between 10 and 20 years was the largest (30.21%), and 73.86% of couples had been together for at least 5 years. This is the same observation made by Diemer [20], for whom the majority of couples had a longevity of over 5 years.

When the duration of the couple's relationship increases by one month, the risk of serodiscordance decreases by around 1%. In other words, the longer the relationship lasts, the greater the risk of a positive seroconcordance. This may be explained by the fact that the longer the relationship lasts, the fewer preventive measures are observed, either by the initially positive partner, or by the initially negative partner, who may thus be contaminated inside or outside the couple as a result of lax preventive attention.

4.2.3. Last Child's Serostatus

The serostatus of the last child is a protective factor for HIV serodiscordance in couples affected by the infection. The probability of being in a serodiscordant relationship when the last child's status is positive is reduced by 86%. The positive status of the last child exposes the mother 7 times more to a positive serodiscordant relationship than the negative serostatus of the last child.

This result could be explained by the low proportion of respondents who share their serostatus with their spouse. This undermines preventive efforts, notably ART for mother and infant, which cannot explain the prolonged use of long-term post-partum medication. In the town of Parakou, community organization is still the rule, and couples can count on unfailing social support to accompany the mother-child couple in the first few months of the child's life. Under these conditions, if they do not share their serostatus with these community members, and to avoid arousing suspicion, mothers may be led to take risks that are detrimental to PMTCT (poor compliance with ART, prolonged breast-feeding, failure to keep follow-up appointments, etc.).

4.2.4. Sharing Serostatus with Spouse/Partner

In our study, 54.68% of participants (n = 228) had shared their serostatus with their spouse. This corresponded to 67.06% of men (n = 57) and 51.51% of women (n = 171). While the intention to share one's serostatus is high, as shown by Alassani *et al.* [21] in Parakou in 2020 with a proportion of 92.41%, actual sharing in the event of a positive result remains highly variable. Our result is similar to that described by Coutherut and Desclaux [22] in Senegal, which was 56.7%. It is low compared with that described by Yaya [23] in Sokodé, Togo (60.9%); by Diemer [20] in Bangui (70.3%); by Kra [24] in Bouaké, Côte-d'Ivoire (79.2%) and by Kouanda *et al.* [25] in Burkina-Faso (81.4%).

4.2.5. Occasional or Multiple Sexual Partners

Having occasional or multiple sexual partners is a risk factor for HIV serodiscordance. This multiplies the risk of being in a discordant relationship by 7.17 and 2.91 respectively for subjects with occasional or multiple partners compared with those without.

The impact of multiple sexual partnerships on HIV transmission has been recognized for many years. In a low-prevalence country like Benin, the risk of contracting the infection is high, and so is the risk of ending up in a serodiscordant union.

5. Conclusion

HIV serodiscordance is a significant phenomenon among infected couples in the city of Parakou in 2022. Nearly three out of four couples are affected. This makes it an important factor to take into account in strategies to fight the pandemic. The associated factors are multiple and linked to background, conjugal or social life and behavior. Current prevention strategies, which focus on pregnant women

and young people, now need to pay particular attention to serodiscordant couples. The production of general data on the subject of HIV serodiscordance will provide a better overview of the phenomenon and enable us to reorient our strategies, if necessary, in order to achieve the ambitious goal of defeating HIV/AIDS by 2030.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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