

# Human Immunodeficiency Virus Infectious Profile Change in Mali: A Narrative Review

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## Abstract

West Africa is reputed as an epicenter of HIV-2 infection. Studies undertaken in Mali suspected HIV-1 more prevalent. Our study aims to document HIV infectious profiles in Mali and analyze HIV-1 dominance. We documented HIV studies undertaken in Mali from 1985 to 2010. We proceeded to a bibliographic search focused on theses from the Medicine Pharmacy Odontostomatology Faculty (FMPOS) of Bamako, survey reports, and abstracts or papers published in reviews with the reading committee. Documents were physically and virtually (via website) consulted and exploited. We gave preference to studies that discriminated against HIV serotypes. The data were analyzed according to study population/publication, representativeness, infectious profiles reporting, socio-demographic and clinical characteristics. HIV profiles variation in space and time was analyzed by using a linear regression model. Calculations were done using Excel software.

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**Index terms**— epidemiology, HIV infection, serotypes change, Mali, West Africa.

## 1 Introduction

West Africa is reputed to be the epicenter of HIV-2 infection [1]. This HIV profile was also endemic in the same geographic area [2]. In Mali, the first AIDS case was identified in 1985 [3]. In this country, the early studies reported a dominance of HIV-2 on HIV-1 [4,5,6,7]. However, an anterior study conducted in patients admitted in pneumophthysiology setting revealed HIV-1 more prevalent in the sub-study population of non-tuberculosis patients [8]. Unlike the prior studies, more or less recent works conducted in this country reported an opposite trend [9][10][11][12][13][14][15][16] [17] [18][19][20]. However, in the country, a significant higher HIV-2 prevalence was observed in 2010 in older women than in young ones (in 2009), despite a high HIV-1 dominance in the both populations [19]. This HIV-2 trend in older adults contrasting with the low trend in young ones, aroused our curiosity to analyze the dominance of the HIV-1 infectious profile that seems plausible in Mali.

## 2 II.

### 3 Methodology a) Procedure

This narrative review consisted of analyzing the data from previous studies concerning HIV infection in Mali. We have pursued a bibliographic search focused on HIV studies (subject or not to publication in scientific reviews) undertaken in Mali from 1985 to 2010. The FMPOS theses file, as well as papers related to HIV/AIDS topic, were consulted and exploited for data collection and analysis. We prioritized studies having documented the serotypes profiles (HIV-1, HIV-2, and HIV-1/2), by using a discriminatory or confirmatory test. We structured the argumentation around the following criteria: study period, publication date and reference; study population including hospital patients, prostitutes, pregnant women, blood donors, general population; study sample size; study population characteristics such as ages, average age, gender, underlying diseases, clinical symptoms, risk factors; stratification by age (<50-years-old and >50-years-old); testing for HIV serotypes profiles discrimination using immunochromatography, Western Blot or Line Immunoassay principle; typology of the publication such as abstracts or full text from international journals, meetings or conferences presentations, theses and reports.

## 4 b) Statistical Analysis

Results are presented as mean  $\pm$  SD (range) for continuous variables and frequencies (%) for categorical variables. Categorical variables were compared between the groups using a chi-square test.

Results were significant at the 5% level ( $p < 0.05$ ). Linear Regression model was used to analyze the HIV profiles trends. Calculations were done using Excel Software. infection. Studies undertaken in Mali suspected HIV-1 more prevalent. Our study aims to document HIV infectious profiles in Mali and analyze HIV-1 dominance. We documented HIV studies undertaken in Mali from 1985 to 2010. We proceeded to a bibliographic search focused on theses from the Medicine Pharmacy Odontostomatology Faculty (FMPOS) of Bamako, survey reports, and abstracts or papers published in reviews with the reading committee. Documents were physically and virtually (via website) consulted and exploited. We gave preference to studies that discriminated against HIV serotypes. The data were analyzed according to study population/publication, representativeness, infectious profiles reporting, socio-demographic and clinical characteristics. HIV profiles variation in space and time was analyzed by using a linear regression model. Calculations were done using Excel software. Out of 17 studies that reported HIV profiles, nine documented in full serotypes profiles. They mainly concerned health care patients and prostitutes, as they are likely more exposed to HIV infection. The sexual route was mostly described. In prostitutes group, significant regression of HIV-2 was observed between 1987-1989 and 1995 (65/517 vs 7/176) ( $p = 0.001$ ) while HIV-1 increased (36/517 vs. 63/176) ( $p < 0.0001$ ). The chronology of events showed prior existence of both profiles but with an initial dominance of HIV-2. The study surprisingly highlighted HIV-1 profile dominance in Mali, whereas West Africa is reputed as an HIV-2 epicenter. However, it suffered lack of representativeness of preliminary studies. HIV profile change and propagation seem essential due to the sexual route in this country.

## 5 c) Human Subjects

This proposed study uses an anonymous secondary data set, and does not qualify as human subject research. III.

## 6 Results

IV.

## 7 Discussion

A Malian study reported a higher HIV seroprevalence in prostitutes in 1991 (70%) [21]. In Mali, HIV prevalence of 4.1% (41/1000) was measured in 2009 in pregnant women (young women), with a higher dominance of HIV-1 (95%) [19,22]. This seroprevalence measured in 2009 in the Bamako district was comparable to 3.5% (183/5224) reported in 2006 in pregnant women recruited from seven locations (including Bamako) across the country [23]. Likewise, in 2010, HIV seroprevalence 6.1% (14/231) measured in older women did not differ from 4.1% reported in young ones [19,22]. By contrast, the proportion of HIV-2 was significantly higher in older women than in younger ones, 2.16% (5/231) vs. 0.2% (2/1000);  $p < 0.001$ . The HIV epidemiological profile between 1985 and 2010 shows at the beginning of this observation period HIV-2 dominance; a trend that has been reversed later in favor of HIV-1, which is still dominant today. Indeed, several studies have revealed the dominance of HIV-1 between 1988 and 2010 [9][10][11][12][13][14][15][16] [17] [18][19][20], unlike the first studies undertaken in Mali between 1985 and 1989 [4,5,6,7]. This new trend in favor of HIV-1 dominance contrasts a priori with evidence that West Africa is the epicenter of the epidemiology of HIV-2 [1]. Our work is limited by the lack of representativeness from some preliminary studies undertaken and reported in Mali. It suffered equally from the data insufficiency related to HIV infectious profiles in some documents consulted. Guinea-Bissau (a West African country) is described as the epicenter of the HIV-2 epidemic [24]. In the same country, HIV-1, HIV-2 and HIV-1/2 seroprevalence were respectively 1.1%, 8.4% and 0.1% for the period of 1992-1995 and 7.7%, 5.1% and 1.9% in 2005 [25]. Between February 1987 and May 1988, the Central Hospital of Dakar registered HIV-1 frequency comparable to that of HIV-2 46% (50/109) vs 40% (44/109);  $p > 0.05$  [26]. In the same city, prevalence rates for HIV-1 (6%), HIV-2 (3.6%) and HIV-1/2 (0.4%) were reported, in 2000, among sex workers [27]. In Ivory Coast, a predominance of HIV-1 was reported in 1988 [28]. In Mali, a prior study carried out in patients enrolled in a specialized hospital reported in none tuberculosis patients a rate of 5.5% (9/164) for HIV-1 vs. 1.22% (2/164) and 1.83% (3/164) respectively for HIV-2 and HIV-1/2 [8]. However, considering the totality of patients with or without tuberculosis, the frequencies were 4.58% (22/480), 2.71% (13/480), and 3.96% (19/480), respectively for HIV-1, HIV-2, and HIV-1/2. In this country, a high frequency of HIV-1 was reported in 2009 among students [20]. Bouare et al. demonstrated that HIV-2 was significantly more common in older women than in younger ones [19]. Suggesting HIV-2 infection occurred earlier (probably 20 years or more) in these older adults infected. That may explain and confirm two hypotheses: HIV-2 infection oldness and HIV infectious profile change toward HIV-1 in Mali. Moreover, from 1988 to 1992, we observe a quantitative dominance of HIV-1 2.99% (71/2378) vs. 0.97% (23/2378) and 1.39% (33/2378) respectively for HIV-2 and HIV-1/2 [9]. A study conducted between 1990 and 1999 even reported a predominance of HIV-1 with a prevalence of 58.55% (462/789) vs. 5.58% (44/789) and 11.66% (92/789) respectively for HIV-2 and HIV -1/2 [10]. It also described the growing trend of emigration between 1993 and 1998 (4.18% to 8.11%), a sexual transmission rate of 98.10%, the first peak of HIV-1 in 1992, and persistent latency observed for HIV-2. This rate of 98.10% of sexual transmission

102 is supported by Bouare et al. [22], who reported that HIV transmission might be essentially sexual in Mali.  
103 The data for the study A total of 17 studies were exploited. They mainly concerned health care patients and  
104 prostitute women populations (Table 1), as they are likely to be more exposed to HIV infection than the general  
105 population. Samples size in these studies ranged from 23 to 3179 subjects (Table 2). Regarding the stratification  
106 of population by age (<50-years-old versus >50-yearsold), a study revealed that despite HIV-1 prevalence was  
107 high in both strata, HIV-2 was significantly more prevalent in the older populations than in younger (2/1000 vs.  
108 5/231) ( $p = 0.0003$ ). Out of 17 studies reviewed nine only documented in full HIV serotype profiles from the  
109 abstract and/or full text (Table 2). This table also informs on HIV prevalence that ranges between 0.73% and  
110 75.79%. The lowest prevalences were observed in blood donors and pregnant women. The prostitutes and health  
111 care patients were the most affected. When one considers only the prostitutes populations (Table 2), a significant  
112 regression of HIV-2 can be observed between 1987-1989 and 1995 (65/517 vs. 7/176) ( $p = 0.001$ ). Conversely,  
113 HIV-1 increased significantly during the same period (36/517 vs. 63/176) ( $p < 0.0001$ ). As far as health care  
114 patients are only concerned, there was a significant increase in HIV-1 ( $Y_{HIV-1} = 9.20x + 22.80$ ;  $R^2 = 0.6351$ )  
115 while HIV-2 significantly regressed ( $Y_{HIV-2} = -3.81x + 34.47$ ;  $R^2 = 0.2895$ ). Furthermore, when taking into  
116 account the overall population, a similar trend can be observed ( $Y_{HIV-1} = 8.48x + 16.38$ ;  $R^2 = 0.646$ ) vs ( $Y_{HIV-2}$   
117  $= -5.626x + 55.82$ ;  $R^2 = 0.3321$ ). The chronology of events, as well in all the populations studied as in  
118 health care patients taken alone (Table 2 and 3; fig1 and 2), shows that both infectious profiles have pre-existed  
119 in Mali, but with an initial predominance of HIV-2 and change toward HIV-1 that occurred probably between  
120 1990 and 1994.

121 In conclusion, this present work surprisingly highlighted HIV-1 profile predominance in Mali, whereas West  
122 Africa is reputed to be the HIV-2 epicenter. The HIV profile change seems to occur between 1990 and 1994.  
123 The transmission risks and routes such as sexual, trip duration and emigration are a fortiori highlighted. The  
124 propagation of HIV infection seems essentially linked to the sexual route in this country.( D D D D ) C © 2021  
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126 Human Immunodeficiency Virus Infectious Profile Change in Mali: A Narrative Review between 1987 and  
127 1989 [6,7] attributed a significant proportion of HIV infection linked to staying (since 1980) in Central Africa,  
128 West Africa, and Europe. This could partially explain the foreign exposition and contamination of the people  
129 before they come back in Mali. Other studies in Mali focused on prostitution which can explain the spread of HIV  
130 infection [4,5,6,13,14,21]. One of them reported that the highest prevalence was 70% among registered prostitutes  
131 in 1991, and most regions of Mali had experienced higher HIV prevalence among sex workers in 1992 compared to  
132 1988 [21]. Also, a bibliographical study of the period 1983 to 2003 reported in 2004 the dominance of HIV-1 since  
133 1990 and HIV-2 dominance before that time [14]. It also pointed out limitations such as poor access to studies,  
134 especially that of NGOs (Non-Governmental Organizations), and insufficient data regarding some summaries in  
135 general. Through a study conducted in 1995 in Mali regarding prostitutes mainly composed of foreign (including  
136 Nigerian and Ghanaian), Peeters and coworkers reported a significant increase in HIV-1 against a decrease of  
137 HIV-2 [13]. They also reported the similarity of this trend with those observed in the neighboring countries of  
138 Mali. They hypothesized recent contamination among women who started sex work a year (or less than a year)  
139 before they conducted their study since HIV-1 subtype G was detected. As for our study, when we consider only  
140 the population of prostitute women, significant regression of HIV -2 is observed between the periods 1987 to 1989  
141 and 1995 ??12.57 % (65/517) vs. 3.98% (7/176)];  $p = 0.001$ . Conversely, HIV-1 increased significantly during  
142 the same period [6.96% (36/517) vs. 35.79% (63/176)];  $p < 0.0001$ . This is further corroborated and confirmed  
143 by the linear regression analysis related HIV infectious profile change in the both patient population ( $Y_{HIV-1}$   
144  $= 9.20x + 22.80$ ,  $R^2 = 0.6351$ ;  $Y_{HIV-2} = -3.83x + 34.47$ ,  $R^2 = 0.2895$ ) and all the combined populations ( $Y_{HIV-1}$   
145  $= 8.48x + 16.38$ ,  $R^2 = 0.6459$ ;  $Y_{HIV-2} = -5.626x + 55.82$ ,  $R^2 = 0.3321$ ). From the above, we suggest  
146 that the reversal of the epidemiological profile of HIV for HIV-1 probably occurred in Mali between 1990 and  
147 1994, while Antonio Biague et al. described the HIV-1 increase and HIV-2 decline between 1992-1995 and 2005  
148 [25]. In HIV epidemiological study context, documenting of all serotypes profiles (HIV-1, HIV-2, and HIV-1/2)  
149 and genotypes in both abstract statement and full text (usually difficult to access) are needed to track their  
150 evolution in space and time and enable more precise dating of infectious profiles to change.

## 151 8 WHO: World Health Organization

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## 2

## Human Immunodeficiency Virus Infectious Profile Change in Mali: A Narrative Review

Date	Period	Population	Sample size N	Serotypes	HIV (%)*	HIV-1	HIV-2	HIV-1/2	HIV Frequencies (n1; n2; n1/2)	n
1987	1987	1	Prostitutes	30	10,53	78,95	10,53		19 (2 ; 15 ; 2)	3 (1 ;
1987	1987-	1	Prisoners	23	33,33	33,33	33,33		1 ; 1) 9 (3 ; 6 ; 0)	54
1988	1987-	1	Patients	42	33,33	66,67	0		(22 ; 13 ; 19)	40 (13
1988	1987-	2	Patients	480	40,74	24,07	35,19		; 11 ; 16)	14 (9 ; 2 ;
1988	1987-	2	Patients	316	32,5	27,5	40		3) 123 (34 ; 50 ; 39)	
1989		2	Patients	164	64,29	14,29	21,43			
		3	Prosti- tutes	487	27,64	40,65	31,71			
1987-1989		3	Prisoners	496	33,33	55,56	11,11		18 (6 ; 10 ; 2)	
1987-1989		3	Patients	866	31,4	46,28	22,31		121 (38 ; 56 ; 27)	
1987-1989		3	Pregnant women	588	22,22	77,78	0		9 (2 ; 7 ; 0)	
1987-1989		3	Blood donors	687	60	20	20		5 (3 ; 1 ; 1)	
1987-1989		3	Travellers	372	47,37	42,11	10,53		19 (9 ; 8 ; 2)	
1987-1989		3	Women	1578	25,81	48,92	25,27		186 (48 ; 91 ; 47)	
1987-1989		3	Men	1903	40,37	37,61	22,02		109 (44 ; 41 ; 24)	
1987-1989		3	Housewives	780	18,75	64,58	16,67		48 (9 ; 31 ; 8)	

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Figure 1: Table 2 :

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Publication Date	Population	Study Population Characteristics Age (mean±SD)	Risk Factors and other informations
1987	Prostitutes, Prisoners, Patients, Pregnant women (PW)	26	Prostitution, homosexuality, transfusion
1988	Prostitutes	35	Prostitution
1988	Patients	35	Voyage (stay at foreign)
1989/1993	Prostitutes, Patients, Prisoners, Women, Men	30.18	Prostitution (stay at foreign), widowhood, divorce, residence, tattoo, not condom use
1993	Patients		Peasants, Traders, Big travelers
1998	Prostitutes	28.8	Prostitution
2000	Patients (AIDS)		
2001	Patients	35.19±9.45	Sex transmission, emigration; first peak HIV-1 (1992) and HIV-2 latency
2001	Blood donors (BD)		Absence of discriminant test in 93 and 99, HIV-1 predominant (94-98)
2001	Patients, Prostitutes, PW, BD		Prostitution (HIV seroprevalence: 70%)
2004	Bibliographic studies of theses		Groups at risk: prostitutes, ambulatory saleswomen, coaxers, truck drivers; lack studies access, abstracts
2004	Patients	37.5 ±7.93	Stay at foreign
2006	General population		
2006	Patients (children)	7	
2009	Students		More HIV-1 than HIV-2
2012/2013	Pregnant women / Patients	25.2±6.3 / 8.6	Not condom use, divorce, voyage
2013	Patients	35.2±9.4	Patients (Predominantly rural, female and young); Stage III WHO (64.5%)

Figure 2: Table 1 :

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Year 2021

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Volume XXI Issue III Version I	Date	1987-1988	1987-1988	1987-1989	1987-1989	1988-1992	1990-1999	2003	Period	HIV-1 (%)	HIV-2 (%)	HIV-1/2 (%)
		2	2	2	40,74	32,50	24,07	27,50	35,19	40,00		
		3	4	5	64,29	31,40	14,29	46,28	21,43	22,31		
					55,91	77,26	18,11	7,36	25,98	15,38		
									7	87,32	8,45	4,23

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Figure 3: Table 3 :

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