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PREVALENCE OF VENEREAL DISEASE IN THE BLOOD DONOR AND ITS ASSOCIATION WITH EDUCATION LEVEL: AN EXPERIENCE FROM A TERTIARY CARE HOSPITAL

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ABSTRACT

Objective: To determine the prevalence of venereal diseases, HIV and syphilis, in blood donors and to determine association of positive cases of venereal diseases with education level of donors.

Material and Methods: this is cross-sectional descriptive study, extended for eighteen months, in which 1962 healthy donors were enrolled. Screening for HIV was done by Microparticle enzyme immunoassay and Chemiluminescent immunoassay techniques. Syphilis screening was done by Treponema Pallidum particle agglutination and Chemiluminescent Imunoassay methods. Patient's data were analyzed using SPSS. Descriptive statistics were computed. Association of disease with education was observed by using chi square test. The stratification was done. P-value ≤0.05 was considered as significant.

Results: Among 1962 donors 1960 (99%) were males and 2 (0.1%) were females with mean age of 29.8 +- 7. In our study 35 (1.8%) donors were found positive for syphilis and 2 (0.1%) were positive HIV I and II. There was significant association of syphilis with education (p=0.041), majorly having secondary education.

Conclusion: The prevalence of syphilis was noted to be very high as compared to HIV in blood donors. There was strong association with secondary education level.

INTRODUCTION

Safe blood is a cornerstone of modern health care, yet transfusion- transmissible venereal diseases—principally HIV, hepatitis B (HBV), hepatitis C (HCV) and syphilis—continue to threaten supply, especially where donor selection and public health infrastructure are weak. According to the latest WHO fact- sheet, the median prevalence of these infections in low- income- country blood donations is 0.70 % for HIV, 2.81 % for HBV, 1.00 % for HCV and 0.90 % for syphilis, versus ≤0.02 % in high- income settings (1). Such disparities underscore the need for context- specific surveillance at tertiary facilities that provide reference care in low- and middle- income regions.

Hospital- based studies reveal heterogeneous but worryingly high burdens. In Bauchi, Nigeria, 17 % of 400 donors carried at least one pathogen; HBV (8.3 %) and syphilis (4.3 %) dominated, followed by HIV (2.8 %) and HCV (1.8 %) (2). By contrast, a Delhi blood bank screening 42 158 donations reported a composite transfusion- transmissible- infection (TTI) rate of 2.07 %, with syphilis at 0.38 % and HIV at 0.22 % (3). Elsewhere in sub- Saharan Africa, the Arua Regional Blood Bank in Uganda documented a 13.8 % overall TTI prevalence between 2018 and 2019, including treponemal antibodies in 2.8 % of donors (4). These figures illustrate how tertiary- care centres often face a dual challenge of meeting high transfusion demand while screening out significant infection rates.

Beyond simple prevalence estimates, recent literature increasingly highlights educational attainment as a key social determinant of donor safety. A decade- long Brazilian surveillance of 1 424 850 first- time donors found syphilis seroprevalence of 2.19 %, with low educational level independently raising risk (adjusted OR 1.67, 95 % CI 1.45–1.91) (5). Earlier U.S. analyses likewise demonstrated that donors without post- secondary education had higher odds of Treponema pallidum antibodies after controlling for age, ethnicity and donation history (6). A 2025 Thai meta- analysis synthesizing 23 studies (n = 1.14 million) confirmed lower education as a consistent risk factor for syphilis among donors, alongside first- time donation and male sex (7). Collectively, these findings suggest that educational status may mediate behavioural risk, health- seeking patterns and comprehension of predonation screening questions—variables directly relevant to hospital- level donor recruitment strategies.

Despite abundant cross- sectional data, few studies from South Asia have simultaneously quantified venereal- disease prevalence in tertiary- level donors and explored its correlation with formal education. Such evidence is crucial for tailoring pre- donation counselling, designing targeted public- health messaging and refining donor- deferral algorithms that minimize wastage without unduly constricting supply.

To determine the prevalence of HIV, and syphilis among blood donors at tertiary care centre and to evaluate the association between Seropositivity and donors' highest completed level of education.

Methodology

After the ethical approval from the institutional review board this, prospective cross-sectional study was conducted at Department of Haematology and Blood Bank, National Hospital, Karachi, from 29th May 2022 to 28th November 2023. Through non-probability consecutive sampling 1962 patients aged 18-55 years' old, Body weight >50kg, Haemoglobin levels >12.5gm/dl were included in the present study. Donors having history of jaundice, Intravenous drug abusers, Persons having Non-marital sexual contacts, Tattooed persons, Persons with recent blood transfusion or recent surgery, repeat donors during the

study period were excluded from the study. After the informed consent, all qualifying the inclusive criteria had behavioural screening and physical check-up. Data collection tool was in the form of Performa which was filled in the columns name, gender, age, education levels, type of donors, residence, and contact number. Two screening tests were performed one for anti-HIV I/II and other for syphilis. Both screening test were performed on Chemiluminescent Immunoassay (CIA) method on Architect i2000 (Abbot Diagnostic, USA). Written consent was sought from qualifying donors. Patient's data were compiled and analyzed through statistical package for Social Sciences (SPSS) Version 25. Frequency and percentage were computed for qualitative variables like gender, occupation, residence, ethnicity, education, hypertension, diabetes mellitus, smoking status, and veneral diseases (HIV and Syphilis). Mean ± SD were calculated for quantitative variable i.e. age, body weight, temperature, blood pressure, pulse, heamoglobin, HCT, MCV, TLC and PLT. Association of disease with education level was observed by using Chi square test. The stratification was done on age, weight, gender, occupation, residence, ethnicity, education, hypertension, diabetes mellitus and smoking status, to see the effect of these modifiers on outcome using Chi-square test. P-value ≤0.05 was considered as significant.

Results

Among 1 962 prospective blood donors, men overwhelmingly predominated (1 960; 99.9 %), with only two women (0.1 %). The cohort was young and lean- to-moderately built: mean age was 29.96 ± 7.47 years (range 18–55) and mean body- weight 77.20 ± 14.21 kg (range 51–160).

Most volunteers were in private employment (1 288; 65.6 %), followed by businessmen (308; 15.7 %), laborer's (169; 8.6 %), students (160; 8.2 %), government employees (11; 0.6 %) and miscellaneous occupations (26; 1.3 %). The donor pool was drawn chiefly from urban settings (1 691; 86.2 %); rural residents contributed 271 donations (13.8 %). Ethnically, 71.2 % identified as Urdu speaking (a Pakistani language) (1 397), with smaller proportions of Sindhi (Province Sindh)(15.4 %), Punjabi (Province Punjab) (10.5 %), Balochi (Province Balochistan) (1.7 %), Pukhtoon (Province Khyber Pakhtunkhwa) (1.0 %) and other minorities (0.2 %). Educational attainment clustered around secondary schooling (778; 39.7 %) and intermediate college (537; 27.4 %); one quarter had completed university degrees (456; 23.2 %), whereas 191 donors (9.7 %) had primary or no formal education.

Baseline haematology was within expected limits for healthy adult donors. Mean haemoglobin was 15.10 ± 1.06 g dl^{-1} and haematocrit 40.83 ± 3.12 %. Mean corpuscular volume averaged 78.17 ± 7.15 fL, total leukocyte count $7.92 \pm 1.71 \times 10^3$ cells μl^{-1} and platelets $251.27 \pm 53.70 \times 10^3$ μl^{-1}. Just over one in eight participants reported smoking (244; 12.4 %).

Screening identified 35 cases of syphilis (1.8 %) and two anti- HIV- I/II- reactive donations (0.1 %). Syphilis seropositivity showed no association with sex (1.8 % in males vs 0 % in females; p = 1.000), age group (≤35 y = 1.7 % vs >35 y = 2.0 %; p = 0.699), residence (urban 1.8 % vs rural 1.5 %; p = 1.000), ethnicity (p = 0.277) or smoking (p = 0.613). A borderline trend was seen for higher body- weight (≤100 kg 1.6 % vs >100 kg 3.9 %; p = 0.073). However, occupation and education emerged as significant determinants. Labourers (4.7 %), government employees (9.1 %) and donors classified as "others" (7.7 %) had markedly higher syphilis rates than students (0.6 %) or businessmen (1 %) (overall p = 0.004). Likewise, the prevalence was greatest among

those without formal schooling (6.1 %) and fell sharply to zero in primary- educated donors; intermediate and graduate groups showed intermediate risks (1.7 % and 2.0 % respectively), yielding a significant overall trend ($p = 0.041$).

HIV reactivity was too infrequent for robust inference: both positive samples occurred in male, urban, private- sector donors aged ≤35 years; none of the examined demographic, anthropometric, lifestyle or educational variables reached statistical significance (all $p \geq 0.126$). Thus, in this tertiary- hospital donor population, syphilis remains the principal venereal threat, concentrated among lower- educated and manual labour groups, whereas HIV prevalence is exceedingly low and shows no clear sociodemographic pattern.

Table 1: Demographic profile and anthropometry of blood donors (n = 1 962)

Variable	Category / Statistic	n / Value	%
Gender	Male	1 960	99.9
	Female	2	0.1
Age (years)	Mean ± SD	29.96 ± 7.47	—
Weight (kg)	Mean ± SD	77.20 ± 14.21	—
Occupation	Student	160	8.2
	Businessmen	308	15.7
	Private employee	1 288	65.6
	Labourer	169	8.6
	Government employee	11	0.6
	Others	26	1.3
Residence	Urban	1 691	86.2
	Rural	271	13.8
Ethnicity	Urdu- speaking	1 397	71.2
	Sindhi	302	15.4
	Balochi	33	1.7
	Punjabi	206	10.5
	Pukhtoon	20	1.0
	Others	4	0.2
Education	No formal education	99	5.0
	Primary (≤ 5th)	92	4.7
	Secondary (≤ 10th)	778	39.7
	Intermediate (≤ 12th)	537	27.4
	Graduation (≥ 14 yrs)	456	23.2

Table 2: Laboratory parameters, lifestyle factor and venereal- disease screening (n = 1 962)

Variable	Category / Statistic	Value / n
Haemoglobin (g dl^{-1})	Mean ± SD	15.10 ± 1.06
Haematocrit (%)	Mean ± SD	40.83 ± 3.12
Mean corpuscular volume (fL)	Mean ± SD	78.17 ± 7.15
Total leukocyte count (×10^3 cells μl^{-1})	Mean ± SD	7.92 ± 1.71
Platelet count (×10^3 μl^{-1})	Mean ± SD	251.27 ± 53.70
Smoking status	Smoker	244 (12.4%)
	Non- smoker	1 718 (87.6%)
Venereal- disease screening	Syphilis – positive	35 (1.8%)

	Syphilis – negative	1 927 (98.2%)
	Anti- HIV I/II – positive	2 (0.1%)
	Anti- HIV I/II – negative	1 960 (99.9%)

Table 3: Frequency and association of syphilis, according to demographic factors

		Syphilis Frequency (%)			P-Value
		Positive	**Negative**	**Total**	
Gender	Male	35 (1.8)	1925 (98.2)	**1960**	1.000
	Female	0 (0)	2 (100)	**2**	
Age Group	≤35 years	26 (1.7)	1485 (98.3)	**1511**	0.699
	>35 years	9 (2.0)	442 (98)	**451**	
Weight	≤100 kg	30 (1.6)	1804 (98.4)	**1834**	0.073
	>100 kg	5 (3.9)	123 (96.1)	**128**	
Occupation	Student	1 (0.6)	159 (99.4)	**160**	0.004*
	Businessmen	3 (1)	305 (99)	**308**	
	Private Employee	20 (1.6)	1268 (98.4)	**1288**	
	Labor	8 (4.7)	161 (95.3)	**169**	
	Govt. Employee	1 (9.1)	10 (90.9)	**11**	
	Others	2 (7.7)	24 (92.3)	**26**	
Residence	Urban	31 (1.8)	1660 (98.2)	**1691**	1.000
	Rural	4 (1.5)	267 (98.5)	**271**	
Ethnicity	Urdu Speaking	28 (2.0)	1369 (98)	**1397**	0.277
	Sindhi	4 (1.3)	298 (98.7)	**302**	
	Balochi	1 (3)	32 (97)	**33**	
	Punjabi	1 (0.5)	205 (99.5)	**206**	
	Pukhtoon	1 (5)	19 (95)	**20**	
	Others	0 (0)	4 (100)	**4**	

TABLE 4: Frequency and association of syphilis, according to co-morbids

		Syphilis Frequency (%)			P-Value
		Positive	**Negative**	**Total**	
Smoker	Yes	3 (1.2)	241 (98.8)	**244**	0.613
	No	32 (1.9)	1686 (98.1)	**1718**	

TABLE 5: Frequency and association of syphilis, according to education level

	Syphilis Frequency (%)	P-Value

		Positive	Negative	Total	
Education	No formal education	6 (6.1)	93 (93.9)	**99**	0.041*
	Primary	0 (0)	92 (100)	**92**	
	Secondary	11 (1.4)	767 (98.6)	**778**	
	Intermediate	9 (1.7)	528 (98.3)	**537**	
	Graduation	9 (2)	447 (98)	**456**	

TABLE 6: Frequency and association of anti HIV I and II, according to demographic factors

		Anti HIV I and II Frequency (%)			P-Value
		Positive	**Negative**	**Total**	
Gender	Male	2 (0.1)	1958 (99.9)	**1960**	1.000
	Female	0 (0)	2 (100)	**2**	
Age Group	≤35 years	2 (0.1)	1509 (99.9)	**1511**	1.000
	>35 years	0 (0)	451 (100)	**451**	
Weight	≤100 kg	1 (0.1)	1833 (99.9)	**1834**	0.126
	>100 kg	1 (0.8)	127 (99.2)	**128**	
Occupation	Student	0 (0)	160 (100)	**160**	1.000
	Businessmen	0 (0)	308 (100)	**308**	
	Private Employee	2 (0.2)	1286 (99.8)	**1288**	
	Labor	0 (0)	169 (100)	**169**	
	Govt. Employee	0 (0)	11 (100)	**11**	
	Others	0 (0)	26 (100)	**26**	
Residence	Urban	2 (0.1)	1689 (99.9)	**1691**	1.000
	Rural	0 (0)	271 (100)	**271**	
Ethnicity	Urdu Speaking	1 (0.1)	1396 (99.9)	**1397**	0.274
	Sindhi	0 (0)	302 (100)	**302**	
	Balochi	0 (0)	33 (100)	**33**	
	Punjabi	1 (0.5)	205 (99.5)	**206**	
	Pukhtoon	0 (0)	20 (100)	**20**	
	Others	0 (0)	4 (100)	**4**	

TABLE 7: Frequency and association of anti HIV I and II, according to co-morbid

		Anti HIV 1 and II Frequency (%)			P-Value
		Positive	Negative	Total	
Smokers	Yes	0 (0)	244 (100)	**244**	1.000
	No	2 (0.1)	1716 (99.9)	**1718**	

TABLE 8: Frequency and association of anti HIV I and II, according to educational level

		Anti HIV 1 and II Frequency (%)			P-Value
		Positive	Negative	Total	
Education	No formal education	0 (0)	99 (100)	**99**	0.783
	Primary	0 (0)	92 (100)	**92**	
	Secondary	1 (0.1)	777 (99.9)	**778**	
	Intermediate	0 (0)	537 (100)	**537**	
	Graduation	1 (0.2)	455 (99.8)	**456**	

Discussion

Although blood transfusion is pivotal in the care of countless conditions, it inevitably carries the danger of transfusion- transmitted infections (TTIs) and other adverse reactions. Because no screening algorithm can drive the risk to zero (8, 9), transfusion remains perhaps the only medical therapy that clinicians should prescribe only when no safer alternative exists. Strict donor- selection criteria and avoidance of unnecessary transfusions are, therefore, mandatory. In one large data set, all five mandatory TTI markers were present in 2.32 % of donations; Amrutha Kumari B et al. recorded a comparably low overall TTI rate of 2.81 % (10).

Syphilis, a sexually transmitted infection, signals potential exposure to other venereal pathogens; hence, serological screening of every unit is recommended primarily as a surrogate test to detect donors with high- risk behaviour. A previous investigation documented a 0.61 % seroprevalence (11). Rates are generally higher in men—a finding often attributed to communal sleeping arrangements at work sites and inadequate hygiene (11- 13). The HIV/AIDS pandemic has further underscored the importance of vigilant TTI prevention: an estimated 3 % of global HIV infections are attributable to contaminated blood products (14). Over six years, one series reported an HIV sero- reactivity rate of just 0.16 % (15).

Several predominantly Muslim countries have reported vanishingly low HIV figures. Egyptian studies, for instance, have found no seropositive donors (15, 16), mirroring 0 % prevalence in Jordanian (17) and Turkish (18) donors and only one reactive sample among 26 874 donors in Kuwait (19). Karachi- based first- time voluntary donors likewise showed 0 % incidence (15). Such patterns are commonly ascribed to religious and cultural norms that discourage extramarital sex and illicit drug use. Comparable findings arise from Georgia (3 of

4 970 donors), Pakistan (0.004 %) and Canada (6 per 100 000 person- years) (20- 22).

By contrast, seroprevalence is markedly higher in parts of sub- Saharan Africa: 10.6 % in Nigeria (23), 16.7 % in Ethiopia (24) and 2–20 % in Kenya (25); Ghana reports 3.8 % (26). Even within North Africa the burden can vary—one Egyptian cohort showed no syphilis seroreactivity at all (15), consistent with the low background prevalence in that setting.

Multiple factors modulate HIV and syphilis prevalence: family clustering, local endemicity, cross- border migration, dialysis or haemophilia populations, injection- drug use, sexual practices, and the sensitivity of assays or rigour of donor- selection questionnaires (27). In Pakistan, syphilis seropositivity among donors is trending upward. A recent survey documented a 0.68 % prevalence (28), echoing 0.89 % in Islamabad (29), 2.1 % at a Karachi tertiary centre (30), 1.10 % in Faisalabad (31) and as high as 3.1 % in Lahore (32). These discrepancies highlight persistent challenges in ensuring a safe blood supply amid expanding demand, increasing TTIs, incomplete screening and sub- optimal transfusion services (29).

Risk factors for transfusion- transmitted syphilis map closely to sexual behaviour. A 2004 National AIDS Control Programme survey reported syphilis prevalence of 60 % in *hijra* communities and 36 % among male sex workers (31). Unsafe sexual practices—particularly in rural areas with limited health awareness—likely explain elevated syphilis rates around Ghurki Trust Teaching Hospital, which is encircled by more than a thousand villages (32). Because syphilis augments the risk of HIV acquisition two- to five- fold, unchecked infection in such settings could seed future HIV co- epidemics.

Additional hazards include intravenous drug use, tattooing and bisexuality. Meticulous donor questionnaires remain the only practical way to exclude high- risk individuals; Norway's notably low prevalence has been linked to a compulsory pre- donation interview and questionnaire (33). Combining rigorous history- taking with sensitive laboratory screening is essential to curb transfusion- mediated spread.

Crucially, most donors appear clinically healthy at presentation. Because serological markers may lag behind exposure, thorough enquiry into potential risks during the preceding two months—or temporary deferral—is indispensable (34). Yet eliciting accurate information remains difficult where knowledge is limited, highlighting the need for continuous education of both donors and healthcare staff.

Conclusion

Our study results showed 1.8% syphilis and 0.1% HIV among blood donors in our study. The occupation and low level of education were identified as significant risk factors for syphilis however no factor was observed as significant for HIV. Given the prevalence of syphilis and HIV demonstrated that screening for HIV and syphilis should be considered for the blood donor populations and populations at risk. In addition to this, early diagnosis and treatment, health education and promotion of safer sex can help prevent syphilis / HIV in the general population consequently helping to decrease its emergence in the blood donors.

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