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# Sero-Prevalence of Syphilis Among Blood Donors in Port Sudan city, Sudan, 2016

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## Abstract

**Background: Several infectious diseases have been found to be associated with transfusion of blood and blood components. Studies conducted in many African countries indicate a high prevalence of blood-borne pathogens such as Syphilis infections among healthy blood donors.**
**Objectives: This study conducted to determine the prevalence of syphilis among blood donors and associated risk factors in Port Sudan city, 2016.**
**Materials and methods: Across sectional laboratory-based study conducted in Port Sudan city. A Blood donor in central blood bank in Port Sudan during the period between August-October-2016. The data was collected through a structured questionnaire. Data was analyzed using SPSS version 15.0.**
**Results: The prevalence of syphilis among blood donors were 13.24%. The risk factors associated with prevalence syphills were significantly the age group 40-49 years, hard workers, primary schools donors and blood donors who has two sex partnerships, $p<0.05$.**
**Conclusion: The overall prevalence of syphilis among blood donors in Portsudan city is 13.2% which is high in comparison to prevalence of noticed studies was done in different areas in the country. The risk factors associated with prevalence syphills were significantly the age group 40-49 years, hard workers, primary schools donors and blood donors who have two sex partnerships. Early and accurate detection of cases and conduction of effective treatment as to stop the progression of disease which can be infective to others. In addition to Health education on blood donations and safe sex behaviors targeting sexually active population, particularly between 20-50years old.**

## Keywords

**Blood donors, Res Sea State, Syphilis.**

## INTRODUCTION

Syphilis is a sexually transmitted disease (STD) caused by Treponema pallidum, which can also be transmitted via accidental direct inoculation, transplacental, during pregnancy, and, rarely, via blood

transfusion (World Health Organization, 2001). Syphilis, an ancient disease, is still a public health problem worldwide. The World Health Organization (WHO) estimated that there are 12 million new cases of syphilis each year, with over 90% occurring in developing nations (World Health Organization, 2001). Moreover, in the past 30 years, through its association with an increased risk of human immunodeficiency virus (HIV) infection, syphilis has acquired new potential for morbidity and mortality (Van Dyck et al., 2004). Syphilis is a chronic infectious disease caused by the spirochetes, Treponema pallidum (T. pallidum). On the basis of its clinical presentation, infectivity and progression, it can be classified into different clinical stages: primary, secondary, early latent, late latent and tertiary syphilis. Primary syphilis is characterized by a painless genital ulcer that develops within 9 to 90 days (average, 21 days) following exposure to infection.

About one- third of untreated primary cases will progress to secondary. Secondary is most clinically apparent and is characterized by a symmetrical macular-popular rash involving the palms and sole and peak bacteremia with a high load of spirochetes in the blood. About 50% of untreated secondary cases will progress to latent infection. In general, the latent phase is asymptomatic and a positive serological test for (STS) is the only indicator of infection. About one- third of untreated cases of latent will progress to tertiary over a period of 10 to 20 years. Tertiary syphilis typically involves the cardiovascular and/or neurological systems. Syphilis is usually transmitted by sexual contact or from mother to infant, although endemic syphilis is transmitted by non-sexual contact in communities living under poor hygienic conditions. T. pallidum can also be transmitted by transfusion of blood or blood components from donors with active 3 or when the blood is unscreened Syphilis is believed to have infected 12 million people in 1999 with greater than 90% of cases in the developing world (Van Dyck et al., 2004). It affects between 700,000 and 1.6 million pregnancies a year resulting in spontaneous abortions, stillbirths, and congenital syphilis. (Chambers et al., 1969). In Sub-Saharan Africa syphilis contributes to approximately 20% of perinatal deaths (Chambers et al., 1969). In the developed world, infections were in decline until the 1980s and 1990s due to widespread use of antibiotics. Since the year 2000, rates of syphilis have been increasing in the US, UK, Australia and Europe primarily among men who have sex with men. (Van Dyck et al., 2004) This is attributed to unsafe sexual practices (Van Dyck et al., 2004).

Increased rates among heterosexuals have occurred in China and Russia since the 1990s. (Van Dyck et al., 2004) syphilis increases the risk of HIV transmission by two to five times and co-infection is common (30–60% in a number of urban centers). (Van Dyck et al., 2004, Woods, 2009) Untreated it has a mortality of 8% to 58% with a greater death rate in males. (Woods, 2009) The symptoms of syphilis have become less severe over the 19th and 20th centuries in part due to widespread availability of effective treatment and partly due to decreasing virulence of the spirochete. (Kent and Romanelli, 2008) With early treatment few complications result. (Mullooly and Higgins, 2010 ). The first case of transfusion-transmitted syphilis was reported in 1915. By 1941, 138 cases had been reported in the literature. Most reported cases were discovered to have occurred when donors were in the primary or secondary stage of disease. T. pallidum may be found in the bloodstream, but levels are variable and bacteremia is often short-lived even following recent contamination.

Moreover, the treponema are relatively fragile and sensitive to cold; hence the risk of transmission through transfusion of blood stored below 20 °C for more than 72 hours is shallow (Singh and Romanowski, 1999). There is a direct relationship between the number of organisms present in the blood and the duration of their vitality (infectivity potential) (Singh and Romanowski, 1999). A look-back study involving 98 units of blood from STS-positive donors, which had been quarantined for a minimum of seven days at 4 °C and transfused into 90 recipients, demonstrated the lack of disease transmission or seroconversion in all tested recipients (Van der Sluis et al., 1985) ; in this same study the presence of passively transfused regains was not detected when the original titer was <1:8, and in those recipients from units with a titer ranging from 1:8 to 1:64, the passively transferred antibodies were no longer detected after ten days. Platelet concentrates are usually stored at room temperature (22 °C) or transfused within a few hours of collection so they carry a higher risk of transmitting. The risk

of transfusion-transmitted is particularly high in developing countries with limited blood supplies where the blood is collected from family donors and transfused within hours. A screening test is considered essential to prevent transfusion-transmitted in such situations. In the past, STS were suggested to provide information on infections caused by other pathogens, such as HIV.

However, a recent study showed that STS has no value as a surrogate marker for blood-borne viral infections among blood donors (Garretta et al., 1977). When the infection is transmitted to a recipient, signs and symptoms appear a few weeks later; these can include macular lesions on the palms, headache, arthralgia, fever, peripheral lymphadenopathy and, rarely, jaundice. In none of the reported cases did the blood donor has a history of venereal disease or the presence of sores at the time of donation. Thus, can be transmitted from donors who clinically and biologically do not show any signs of their disease.

It is important to ask donors about a history of exposure to infection during the preceding two months while performing donor screening or selecting a donor. The last reported case of transfusion-transmitted in the USA occurred in 1966 (Walker, 1965). Universal testing of blood donors played a role in the abolition of transfusion-transmitted. Other possible explanations include: direct donor to recipient transfusion no longer takes place; inactivation of T. pallidum (a cold-sensitive micro-organism) in refrigerated blood components; the decline in the rates of syphilis in the general population which in turn is reflected in the donor population; self-deferral of blood donors who are ill during spirochaetemia; deferral of potential donors who are found to have high-risk behavior for acquiring syphilis infection (e.g., subjects who receive money, drugs or other payment for sex) through the donor eligibility screening process; wide use of antibiotics among transfusion recipients; and difficulty in diagnosing transfusion-transmitted syphilis in recipients (Zou et al., 2009) Although the absence of transfusion-transmitted syphilis in many developed countries has raised questions about the rationale of continuing testing of blood donors (De Schryver and Meheus, 1990) , transmission through blood components still occurs in southern Asia (Chambers et al., 1969). The Standard Operating Procedures of blood transfusion services worldwide do, therefore, include requirements/recommendations for such screening (Woods, 2004).

New draft guidance for screening, testing and managing blood donors and components was recently distributed by the Food and Drug Administration (Kent and Romanelli, 2008). Some diseases besides syphilis are caused by other species or subspecies of Treponema: yaws (T. pertenue), pinta (T. cara teum) and bejel (T. endemic). Yaws and pinta may potentially be transmitted by transfusion but very few data are available. Bejel is unlikely to be transmitted or infect individuals by this route (Van der Sluis et al., 1965). The signs and symptoms of these diseases are usually evident and, therefore, lead to deferral of the potential donors. Various strategies have been proposed by the WHO, International Society of Blood Transfusion and American Association of Blood Banks to prevent transfusion-transmitted syphilis. These include: (i) selection of low-risk donors and screening for the disease using efficient laboratory methods; (ii) application of pathogen reduction technology; and (iii) rational use of blood products. However, blood safety begins with implementation of organized blood centers, a quality system, haemovigilance programs and adherence to Standard Operating Procedures. This study aimed to determine the prevalence of syphilis among blood donors in Port Sudan city, 2016.

## MATERIALS AND METHODS

### *Research design*

Across-sectional laboratory-based study.

### *Study design*

Red Sea State is one of three eastern Sudan states located in the eastern part of Sudan having international boundaries with Egypt in the north Eritrea in the south and Red Sea in the east. The state also has national borders with Kassala state in the south and River Nile state in the west. It occupies 212000 km divided to 10 localities. Total population of the state is estimated as 1.396.110 inhabitants

including the children between 0 to 5 years numbering 150.104 (According to Sudan 5th census and EPI 2009). The State is divided in 10 localities. The most prominent locality in terms of population is Port Sudan locality which divided into 3 administrative units eastern, middle and southern Port Sudan areas with population of 400000. Red Sea state is characterized by its geographical position, which extends from latitude 22 to the latitude 17 north and longitude 34 to 38 degrees east, characterized by the climate change by months of the year and in which the humidity very high at about 17-72% in the winter months, ranging from 40-50% in the summer with high temperature of above.

Climate of the state is of the coastal area which is characterized by high humidity all through the year. Actually, the state face three seasons winter from January up to beginning of maysumer from June to October and it becomes very hot during July and August, and the rainy season during November and December, total population of Red Sea state are 1396101(census 2008).

## *Study population*

This was a facility-based survey a group of blood donors in Port Sudan city. The study population was participants more than 5 years old who signed an informed consent and agreed to be interviewed. Selection of participants was at blood bank- level, as described below.

## *Selection criteria*

**A** Blood donor in central blood bank in Port Sudan during the period between August-October-2016.

## *Sample size*

### Sample size to estimate seroprevalence

The prevalence of syphilis among blood donors in Port Sudan city is unknown. Different scenarios have been calculated to give a range of sample sizes. The table below (table A) shows that the sample sizes for a cross sectional study at a 95% confidence level using different estimates of the prevalence and different levels of precision. A design effect of 2 and a non-response rate of 10% are taken into account to calculate the final sample size.

The assumption that the prevalence for syphilis among blood donors in Port Sudan city is 6% was used. This was maximizing the sample size with a ± 3% error. Formula for calculation of the sample size using Open ID free software (Charan and Biswas, 2013):

Sample size (n) = [DEFF*Np(1-p)]/ [(d2/Z21-α/2*(N-1)+p*(1-p)] = 439

| | |
|---|---|
| Port Sudan city population size = number of households | 523,671 |
| Blood donors /year Male group (18-50 years age) (N) | 12000-14000 |
| Hypothesized % frequency of outcome factor in the population (p): | 6%+/-3 |
| Confidence limits as % of 100(absolute +/- %) (d): | 3% |
| Confidence level % | 95 % |
| level of confidence (Z) | 1.96 |

**Table A:** Different scenarios have been calculated to give a range of sample sizes.

The final sample size with 10 % non-response rate= 439+44= 483

| Estimated prevalence | Sample size | Confidence level | Absolute precision |
|---|---|---|---|
| 5% | 466 | 95% | 5% |
| 6% | 484 | 95% | 5% |
| 10% | 1420 | 95% | 3% |
| 15% | 626 | 95% | 5% |
| 15% | 1601 | 95% | 3% |
| 20% | 694 | 95% | 5% |
| 50% | 9 | 95% | 5% |

**Table B:** the sample sizes for a cross sectional study at a 95% confidence level using different estimates of the prevalence and different levels of precision.

### Sample size to assess risk factors

The sample size has 90% power to detect an adjusted odds ratio (OR) greater than 1.5 with a 95% confidence interval (CI) assuming exposure levels of 30% among non-infected individuals. The study team used a replacement strategy to reduce the non-response rate. We randomly selected members from those attends to give blood donations. Those selected individuals who refused; another member was selected at random.

## *Sampling techniques*

The sampling technique is simple random sampling. Selected from the voluntary blood donors attended to the central blood bank in Port Sudan to give blood donations 476 participants were selected and interviewed after signing the informed consent. Donor flow to the central blood bank is 1166 multiplied by three months per month and the size is 476 which make sample interval of 7.5 so 1 of each 7 blood donors was selected. We listed all the Blood donors in Port Sudan city. We run a cumulative total for the participants. The total number of blood donors in Port Sudan is ≈3498individuals expected to visit the blood bank during the period of the study, divided by 476 (sample size) given the sampling interval (SI) (3498/476=7). Then we selected the number 68 as a random start (RS) using a random integer online generator (http://www.random.org/). We calculated the following series:

RS; RS+SI; RS+2SI; RS+3SI; RS+4SI; RS+5SI; RS+6SI; RS+7SI; RS+8SI; RS+9SI; RS+10SI; RS+11SI; RS+12SI; RS+13SI; RS+14SI; RS+15SI; RS+16SI; RS+17SI; RS+18SI; RS+19SI; RS+20SI; RS+21SI; RS+22SI; RS+23SI; RS+24SI; RS+25SI; RS+26SI……..RS+438SI

## *Data collection*

### The dependent variables

- Positive syphilis infection.
- Negative syphilis infection.

### The independent variables

- Age
- Gender (all the participants were male due culture and beliefs in the which prohibited female blood donations)
- Education level.
- Socioeconomic status.
- A history of blood donations
- sex preference
- occupation

### Data collection tools

The data collection team included the following persons**:**

- Researcher: supervise field activities and sample selection
- Interviewer: a public health officer to fill out the structured questionnaires and record the observations on the risk factors.
- Blood sample collector: a medical cadre to collect the blood sample in the appropriate container, transport it to the laboratory and store it.

### The team used the following data collection tools

1. Individual interviews using structured questionnaires to collect data on the risk factors for syphilis infection (see annex 2), this was included observations by interviewer on some of the questionnaire's items.

2. Blood samples from blood donor members: Collection of 5 mL intravenous blood from each blood donor volunteer using Vacutainer tube processed within 12 hours, and stored at −20°C and investigated for syphilis at Port Sudan blood bank using ICT and confirmed by ELIZA.

## *Data entry*

We used SPSS Entry software for data entry by typing in the data and analyze the data using the multiple analytic features of SPSS version 15.0.

### Data entry test

In order to test the files developed for data entry, the investigator entered 50 records in collaboration with a colleague:

1. Tested the user-friendliness of the data entry form;
2. Identified difficulties and additional instructions (in writing) that have to be made for the comprehension of the data entry person;
3. Assessment of the time necessary to enter 50 records;
4. Assessment of the quality of obtained data.

Data entry done by two persons: one person reads while the other enters the data. The person entering the information should be repeating it aloud before keying it in to further reduce errors. It is not acceptable that a single person is responsible for data entry.

### Data validation

We validated the datasets by naming and labeling variables through the variable window of the software

## *Lab analysis*

- The samples analyzed using ICT& ELIZA
- Laboratory-based Classification

## *Ethical issues and protecting human subjects*

- Ethical clearance was obtained from the ethical committee in the Sudanese Medical Specialization Board. Permission from the Federal Ministry of Health and Red Sea State Ministry of Health was sought to use facilities and access to study population.
- Signed, informed consent will be obtained from all survey participants in their preferred language.
- Participants <18 years of age must obtain a parent's signed consent before giving their own.
- Participation in the survey is voluntary,
- No gifts or financial incentives are offered.
- Survey participants were notified in person or by any means through the SMoH Red Sea State if they tested positive for recent dengue infection.

## RESULTS

Table 1 indicates that the prevalence of syphilis among participants was 13.24% which was confirmed by ICT test and Eliza test.

Table 2 shows that the high positivity of syphilis was significantly prevalent among age group aged between 40-49 years (19.75%), p<.05.

Table 3 explains that most of cases was significantly occurred among married one (14.65%), p<.05.

The high prevalence of syphilis was significantly reported among hard workers (20.59%), table 4.

Table 5 showed that there was association between level of education and prevalence of syphilis, p<0.05. The high occurrence of syphilis was significantly occurred among primary schools (23.81%).

Table 6 indicates that most of syphilis cases were significantly reported among non-surgical operations (13.56%).

Table 7 shows that syphilis was significantly prevalent among a participant who has two sex partnerships (16.67%).

No association was found between prevalence of syphilis and history of being jail or prison, p>0.05 as shown in table 8.

Also, no association was found between prevalence of syphilis and history of using drugs, p>0.05, table 9.

Table 10 shows that there was no association between prevalence of syphilis and history of domestic violence.

Also, no association was found between prevalence of syphilis and history of being transfused before, p>0.05, table 11.

Furthermore, no association was found between prevalence of syphilis and history of being injured or come in contact someone's blood, p=.62.

In addition, the history of homosexual and abnormal sex practice was not associated with prevalence of syphilis, p=.820, table 13. Moreover, no association was found between prevalence and history of donating blood, p=.073, table 14.

| Type of laboratory test | Total | Test result | | % Positive | p- value |
|---|---|---|---|---|---|
| | | positive | Negative | | |
| ICT test | 476 | 63 | 413 | 13.24 | 0.000 |
| ELIZA | 476 | 63 | 413 | 13.24 | |

**Table 1:** Prevalence of syphilis among participants

| Age group | Total | Screening | | %Positive | P.Value |
|---|---|---|---|---|---|
| | | positive | Negative | | |
| 16-19 | 5 | 0 | 5 | 0 | 0.000 |
| 20-29 | 99 | 12 | 87 | 12.12 | |
| 30-39 | 211 | 20 | 191 | 9.48 | |
| 40-49 | 157 | 31 | 126 | 19.75 | |
| 50-59 | 4 | 0 | 4 | 0.0 | |
| TOTAL | 476 | 63 | 413 | 13.2 | |

**Table 2:** Association between prevalence of syphilis and age group

| Marital status | Total | Screening result | | % Positive | P.Value |
|---|---|---|---|---|---|
| | | positive | Negative | | |
| Married | 355 | 52 | 303 | 14.65 | 0.000 |
| Unmarried | 121 | 11 | 110 | 9.09 | |
| TOTAL | 476 | 63 | 413 | 13.24 | |

**Table 3:** Association between prevalence of syphilis and marital status

| Occupation | Total | Screening | | % Positive | P. value |
|---|---|---|---|---|---|
| | | Positive | Negative | | |
| Employee | 344 | 47 | 297 | 13.66 | .000 |
| Hard Worker | 34 | 7 | 27 | 20.59 | |
| Private Worker | 69 | 6 | 63 | 8.70 | |
| No Work | 29 | 3 | 26 | 10.34 | |
| TOTAL | 476 | 63 | 413 | 13.24 | |

**Table 4:** Association between prevalence of syphilis and occupation

| Level of education | Total | Screening | | % Positive | p value |
|---|---|---|---|---|---|
| | | Positive | Negative | | |
| Primary schools | 21 | 5 | 16 | 23.81 | 0.000 |

| | | | | | |
|---|---|---|---|---|---|
| intermediate schools | 17 | 2 | 15 | 11.76 | |
| Postgraduate | 6 | 0 | 6 | 0 | |
| secondary schools | 153 | 22 | 131 | 14.38 | |
| University | 279 | 34 | 145 | 12.19 | |
| TOTAL | 476 | 63 | 413 | 13.24 | |

**Table 5:** Association between prevalence of syphilis and education level

| Surgical operation | Total | Screening result | | % Positive | P.Value |
|---|---|---|---|---|---|
| | | positive | Negative | | |
| No | 435 | 59 | 376 | 13.56 | 0.01 |
| Yes | 41 | 4 | 37 | 9.76 | |
| total | 476 | 63 | 413 | 13.24 | |

**Table 6:** Association between prevalence of syphilis and surgical operation

| Sex partnership | Total | Screening result | | % Positive | P value |
|---|---|---|---|---|---|
| | | Positive | Negative | | |
| one | 355 | 53 | 302 | 14.93 | 0.000 |
| three or More | 34 | 4 | 30 | 11.76 | |
| two | 12 | 2 | 10 | 16.67 | |
| No answer | 75 | 5 | 70 | 6.67 | |

**Table 7:** Association between prevalence of syphilis and sex partnership

| History of being jail or prison | Total | Screening result | | % Positive | P value |
|---|---|---|---|---|---|
| | | Positive | Negative | | |
| Yes | 6 | 0 | 6 | 0 | .112 |
| No | 470 | 63 | 407 | 13.40 | |
| Total | 476 | 63 | 413 | 13.23 | |

**Table 8:** Association between prevalence of syphilis and history of being jail or prison

| History of using Drugs | Total | Screening result | | % Positive | P value |
|---|---|---|---|---|---|
| | | Positive | Negative | | |
| yes | 21 | 4 | 17 | 19.05 | 0.07 |
| No | 455 | 59 | 396 | 12.97 | |
| Total | 476 | 63 | 413 | 13.24 | |

**Table 9:** Association between prevalence of syphilis and history of using drugs

| History of Domestic violence | Total | Screening result | | % Positive | P value |
|---|---|---|---|---|---|
| | | Positive | Negative | | |
| Yes | 1 | 0 | 1 | 0.00 | .132 |
| No | 475 | 63 | 412 | 13.26 | |
| Total | 476 | 63 | 413 | 13.24 | |

**Table 10:** Association between prevalence of syphilis and history of domestic violence

| History of being transfused | Total | Screening result | | % Positive | P value |
|---|---|---|---|---|---|
| | | Positive | Negative | | |
| Yes | 12 | 1 | 11 | 8.33 | 0.09 |
| No | 464 | 62 | 402 | 13.36 | |
| Total | 476 | 63 | 413 | 13.24 | |

**Table 11:** Association between prevalence of syphilis and history of being transfused before

| History of being injured or come in contact with some blood | Total | Screening result | | % Positive | P value |
|---|---|---|---|---|---|
| | | Positive | Negative | | |
| Yes | 8 | 0 | 8 | 0.00 | 0.62 |
| No | 468 | 63 | 405 | 13.46 | |
| Total | 476 | 63 | 413 | 13.24 | |

**Table 12:** Association between prevalence of syphilis and history of being injured or come in contact someone blood

| History of Homosexual and abnormal sex practice | Total | Screening result | | % Positive | P value |
|---|---|---|---|---|---|
| | | Positive | Negative | | |
| Yes | 40 | 3 | 73 | 7.50 | 0.820 |
| No | 434 | 58 | 376 | 13.36 | |
| Not responded | 2 | 2 | 0 | 100.00 | |
| Total | 474 | 61 | 449 | 12.87 | |

**Table 13:** Association between prevalence of syphilis and history of homosexual and abnormal sex practice

| History of blood donation | Total | Screening result | | % Positive | P-value |
|---|---|---|---|---|---|
| | | Positive | Negative | | |
| First time | 86 | 11 | 75 | 12.79 | 0.73 |
| Many times | 390 | 52 | 338 | 13.33 | |
| Total | 476 | 63 | 413 | 13.24 | |

**Table 14:** Association between prevalence of and history of donating blood

## DISCUSSION

This study aimed to determine the prevalence of syphilis among blood donors and associated risk factors in Port Sudan city, 2016. The study showed that the prevalence of syphilis among participants was 13.24%. This was higher than that found in kosti teaching hospital 6.8% and the 7.5% found by Adjei et al (2006) in Ghanaian donors; and is near to the 12.7% found by Matee (Matee et al.,2006) among Tanzanian donors; and the 15.0% found by Alfaki et al. (2016) among Sudanese donors. Also, in our study the prevalence is higher than the 1.2% found by Abdalla et al. (2005) in their study among Kenyan donors, 1.1% found by Fiekumo (Fiekumo et al., 2009) in Osogbo, South-western Nigeria, 0.85% found by Gupta et al. (2004) in Indian donors; the 0.75% found by Bhatti et al. (2007) among Pakistani donors; and the 0.1% found by Ejele (Ejele et al., 2006) in Port Harcourt, South-south, Nigeria. In western Sudan the prevalence was 2.7% in Kassala town in Tajeldin and Abdel Aziem (Tajeldin and Aziem, 2012) study. These variations in these results could be due to the difference in sample size or the methods of test used by blood banks to screen for the high positivity of were significantly prevalent among age group aged between 40-49 years (19.75%). In contrast findings showed a lack of difference between the oldest and youngest age groups is important to note as the focus of STI programming in Zimbabwe is on the vulnerability of young people and others of reproductive age (Myers et al., 2016).

The most of syphilis cases was significantly occurred among married male (14.65%). Contradicted findings showed that the prevalence of syphilis among married MSM was different between cities, the highest (28.8%) in Harbin, followed by Beijing (22.3%), Chengdu (10.2%), and Zhengzhou (7.6%). Proposed explanation may be that married MSM in different cities might have different risks of; for example, there were more gay bathhouses in Harbin and Beijing, where sex between men happened very frequently (Cao et al., 2014).

The high prevalence of syphilis was significantly reported among hard workers (20.59%). There was association between level of education and prevalence of syphilis, $p<0.05$. The high occurrence of syphilis was significantly occurred among primary schools (23.81%). In contrast study showed that a significant rate of was observed in not associated with occupation (Oseni Okolo and Omatola, 2022).

Syphilis was significantly prevalent among a participant who has two sex partnerships (16.67%). The comparable study showed that in relation to sexual behavior, participants without a partner had higher rate of the disease when compared to participants with a stable partner (3.97% vs. 2.51%, $p < 0.026$). The same was found with higher number of partners in the past year (5.01% vs. 1.76%, $p < 0.001$) and/or in those with less current condom use (3.54% vs. 1.89%). Those who had at least one homosexual relationship had a rate five folds higher (10.80% vs. 1.98%, $p < 0.001$) (Kops et al., 2019).

## REFERENCE

Abdalla, F. O.W. Mwanda, F. Rana, (2005). Comparing walk-in and call-responsive donors in a national and a private hospital in Nairobi. East African Medical Journal.,82(10):532-536.

Adjei, A. A., Armah, H. B., Gbagbo, F., Ampofo, W. K., Quaye, I. K., Hesse, I. F., & Mensah, G. (2006). Prevalence of human immunodeficiency virus, hepatitis B virus, hepatitis C virus and Syphilis among prison inmates and officers at Nsawam and Accra, Ghana. Journal of medical microbiology, 55(5), 593-597.

Alfaki, AM. (2016). Prevalence of Hepatitis B Virus Core Antibodies (IgM) among Health Care Workers in Wad Medani, Gezira State, Sudan (Doctoral dissertation, University of Gezira).

Bhatti FA, Ullah Z, Salawat N, Ayub M, Ghani E (2007). Anti-Hepatitis B core antigen testing, viral markers and Occult hepatitis B virus infection in Pakistani blood donors: implications for transfusion practice. Transfusion 47(1):74-79.

Cao, Zhen ; Xu, Juan MD,; Zhang, Hongbo ; Song, Dandan ; She, Min MS; Wang, Jun ; Wang, Jing MD; Fan, Yinguang ; Sun, Yehuan; Zhang, Chengye .(2014). Risk Factors for syphilis Among Married Men Who Have Sex With Men in China, Sexually Transmitted Diseases: Volume 41 - Issue 2 - p 98-102.

Chambers, R. W., Foley, H. T., & Schmidt, P. J. (1969). Transmission of syphilis by fresh blood components. Transfusion, 9(1), 32-34.

Chambers, RW. Foley, HT. Schmidt, PJ. (1969). Transmission of syphilis by fresh blood components. Transfusion.; 9:32–4.

Charan, J., & Biswas, T. (2013). How to calculate sample size for different study designs in medical research? Indian journal of psychological medicine, 35(2), 121-126.

De Schryver, A., & Meheus, A. Z. (1990). and blood transfusion: a global perspective. Transfusion, 30(9), 844-847.

Ejele O.A., O. Erhabor, C.A. Nwauche, (2005). The risk of transfusion-transmissible viral infections in the Niger-Delta area of Nigeria. Sahel Medical Journal.,8(1):16-19.

Fiekumo, I.B., A.M. Musa, Z.A. Jeremiah, (2009). Sero-epidemilogy of transfusion-transmissible infectious diseases among blood donors in Osogbo, South-west, Nigeria. Blood Transfusion.,1:1-10.

Garretta, M., Paris-Hamelin, A., Muller, A., & Vaisman, A. (1977). Syphilis and blood transfusion. Revue francaise de transfusion et immuno-hematologie, 20(2), 287-308.

Gupta N., V. Kumar, A. Kaur, (2004). Seroprevalence of HIV, HBV, HCV, and syphilis in voluntary blood donors. Indian J Med Sci., 58(6): 255-256.

Kent, ME. Romanelli, F. (2008). "Reexamining: an update on epidemiology, clinical manifestations, and management". Ann Pharmacother 42 (2): 226–36.

Kops, NL, Bessel,M, Hohenberger, GF. Benzaken, A, Wendland, E. (2019). Self-reported and associated factors among Brazilian young adults: findings from a nationwide survey. Brazilian Journal of Infectious Diseases. 24;23:274-7.

Matee, MI. Magesa, PM, Lyamuya, EF. (2006). Seroprevalence of human immunodeficiency virus, hepatitis B and C viruses and infections among blood donors at the Muhimbili National Hospital in Dar Es Salaam, Tanzania. BMC public health. 2006 Dec;6(1):1-6.

Mullooly, C. Higgins, SP. (2010). "Secondary: the classical triad of skin rash, mucosal ulceration and lymphadenopathy.". International journal of STD & AIDS 21 (8): 537–45.

Myers, R. S., Feldacker, C., Cesár, F., Paredes, Z., Augusto, G., Muluana, C., ... & Golden, M. R. (2016). Acceptability and effectiveness of assisted human immunodeficiency virus partner services in Mozambique. Sexually transmitted diseases, 43(11), 690-695.

Oseni Okolo, ML. Omatola, CA. (2022). Hepatitis B and prevalence and risk factors of transmission among febrile patients in a primary health facility in Kogi State, Nigeria. Journal of Immunoassay and Immunochemistry. 2;43(1):1938607.

Singh, A. E., & Romanowski, B. (1999).: review with emphasis on clinical, epidemiologic, and some biologic features. Clinical microbiology reviews, 12(2), 187-209.

Tajeldin and Abdel Aziem. (2012). Sero-prevalence of transfusion-transmissible infectious diseases among blood donors in Kassala, eastern Sudan. J Med Med Sci. Apr;3(4):260.

Van der Sluis, J. J., Ten Kate, F. J. W., Vuzevski, V. D., Kothe, F. C., Aelbers, G. M. N., & Van Eijk, R. V. W. (1985). Transfusion, Survival of Treponema pallidum in Stored Donorblood 1: II. Dose Dependence of Experimentally Determined Survival Times. Vox sanguinis, 49(6), 390-399.

Van Dyck, E., Musonda, R., Zekeng, L., Kahindo, M., Anagonou, S., Morison, L., ... & Hayes, R. J. (2004). Study Group on Heterogeneity of HIV Epidemics in Zeltser R, Kurban AK. Clinics in Dermatology, 22, 461-468.

Walker, R. H. (1965). The Disposition of STS* Reactive Blood in a Transfusion Service. Transfusion, 5(5), 452-456.

Wendel, S. (1994). Current concepts on transmission of bacteria and parasites by blood components. Vox Sang ;67(Suppl 3):161–74.

Woods, CR. (2009). "Congenital -persisting pestilence". Pediatr. Infect. Dis. J. 28 (6): 536–7.

World Health Organization. (2001). Global prevalence and incidence of selected curable sexually transmitted infections: overview and estimates. Available at: http://www.who.int/hiv/pub/sti/en/who_hiv.

Zou, S., Notari, E. P., Fang, C. T., Stramer, S. L., & Dodd, R. Y. (2009). Current value of serologic test for as a surrogate marker for blood-borne viral infections among blood donors in the United States. Transfusion, 49(4), 655-661.

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