Original Article

Prevalence of Transfusion-Transmissible Infections and Unfitness Predictors among Blood Donors in a Tertiary Hospital in Nigeria

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Abstract

Background: Blood has been utilised for medical and surgical indications but also remains a route for inadvertent transmission of infections. **Aim:** This study assessed the prevalence of transfusion-transmissible infections (TTIs) and unfitness predictors among donors in a tertiary health facility in Nigeria. **Materials and Methods:** This is a retrospective cross-sectional review of a-four years (2015–2019) of hospital records. A structured pro forma was used in collecting data from the hospital records. Analysis was done using SPSS version 21. The statistical significance level was set at a $P < 0.05$. **Results:** Mean age of donors was 30.1 ± 8.2 years and majority, 56.8%, were voluntary donors. The overall prevalence of TTIs was 11.3% and Hepatitis B virus (HBV) (4.4%) was the most prevalent. Family donors have a significantly highest proportion of hepatitis B surface antigen, 17 (9.9%), and human immunodeficiency virus, 5 (3.0%), with $P < 0.001$ and $P < 0.046$, respectively. Age below 26 years of age (adjusted odds ratio [AOR] =1.491; 95% confidence interval [CI] =1.249–1.781, $P < 0.001$), female donors (AOR = 1.358; 95% CI = 1.081–1.705, $P = 0.008$), being a family donor (AOR = 2.471, 95% CI = 1.851–3.297, $P < 0.001$), and voluntary donor (AOR = 1.461; 95% CI = 1.267–1.707, $P < 0.001$) were predictive of unfitness to donate blood. **Conclusion:** TTIs are common among the donors and HBV remains the most prevalent. Family donors have a significantly higher risk of harboring the TTIs, compared with other donor types. **Recommendation:** There is a need for thorough screening of blood donors for TTIs and unfitness by the hospital to prevent inadvertent transfusion reaction in both the donor and the recipient.

Keywords: Donor unfitness, Nigeria, transfusion-transmissible infections

Introduction

Globally, transfusion medicine has contributed immensely to public health. Blood transfusion has since been utilised for various medical as well as surgical indications and the demand for blood and/or its components in the medical field is likely to increase in the future.[1] Although blood or blood product transfusion helps to preserve lives, it is, unfortunate that it is a well-documented route for inadvertent transmission of varying spectrum of microorganisms causing infections of varying severity in recipients.[2]

The rising prevalence of transfusion-transmissible infections (TTIs) such as human immunodeficiency virus (HIV), hepatitis B virus (HBV), hepatitis C virus (HCV), syphilis and malaria among others, has birthed a new phase in the administration of blood transfusion globally with attention on protection and safety of human life.[2,3] In addition, the donation of blood during the window period of infection has further aggravated the challenges associated with TTIs as infected blood might be collected from donors before the manifestation of the serological markers of infection during the incubation period.[4-6]

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Variations have been found in the TTIs median prevalence among blood donors in high-, middle-, and low-income countries, with low- and middle-income countries having a higher burden of these infections. Identified factors contributing to the prevalence of TTIs are low education, being married, multiple sexual activity, male donor, and history of blood transfusion. It is, therefore, necessary to explore the possibility of identifying other factors.[4-9]

Three types of blood donors have thus been identified, namely, voluntary unpaid, family/replacement, and paid donors.[7-9] Unpaid donors are generally believed to be safer donors as compared to family replacement and paid donors. Paid donors are viewed with suspicion because they usually engaged in blood donation for money or material gain. Family replacement donors (FRDs) account for the bulk of the donor population in many countries of Africa.[9] They may be nuclear or extended family members, friends of patients, or colleagues at work or school. While this type of blood donation may be safe, FRDs may hide information to avoid rejection in their concern to ensure the availability of blood for the patient.[2,9]

It has shown using the age profile of blood donors that, proportionally, blood donation is carried out more by young people in low- and middle-income countries than in high-income countries. This information on the demographic of blood donors is important not only in formulating but also monitoring recruitment strategies.[9] Data reported to the WHO by 156 countries reveals a significant increase of 7.8 million in blood donations from voluntary unpaid donors between 2013 and 2018. The regions of the Americas (25%) and Africa (23%) had the highest increase of the voluntary unpaid blood donations.[9]

Despite the importance of blood, providing constant and safe blood has been a public health challenge, especially in sub-Saharan Africa where a high prevalence of TTIs has been documented.[9] The transfusion of infected blood has contributed to the increasing level of infection in the general population with its far-reaching effects on the society at large. The loss of productive labour, increased social and medical care requirements and higher dependency levels placed a heavy burden on the already stretched medical, social, and economic services of the nation.[10]

The Nigeria National Blood Policy which essentially is made up of sets of action plans geared towards the provision of safe, affordable, and available blood donor units.[11-13] Therefore, surveillance of the burden of TTIs in blood donors is very crucial as it affords an opportunity to estimate transfusion risk and improves quality-assured recruitment and screening of donors.[5,6,9]

The prevalence of TTIs among voluntary blood donors in a tertiary health-care facility in Pakistan was lower among voluntary blood donors (3.72%).[6] In a five years hospital-based retrospective study, the estimated overall prevalence of Hepatitis B surface antigen (HBsAg), HCV, HIV, and syphilis was found to be 1.30%, 0.26%, 0.25%, and 0.28%, respectively.[14] In another study among blood donors, the prevalence of HIV, HBV, HCV, Syphilis, and Malaria was found to be 0.04%, 1.84%, 1.7%, 2.1%, and 0.07%, respectively.[15]

The pooled prevalence of HBsAg among blood donors of both the Eastern Mediterranean Regional Office and Middle Eastern countries was 2.03%, with Iran having the lowest prevalence of 0.58%.[16] Similarly, a hospital-based retrospective analysis also found a high (21.2%) TTIs seroprevalence in blood donated at the Edea Regional Hospital's blood bank.[17] Among the Voluntary Blood Donors at the Wolaita Sodo University Teaching Referral Hospital, South Ethiopia, the seroprevalence of TTIs was 29.5%.[11] Bartonjo *et al*. also found an overall prevalence of 14.1% with the prevalence of TTI agents; HIV 3.5%, HBsAg 5.6%, ant-HCV 3.2%, and syphilis 1.2%, respectively.[4]

In Calabar, Nigeria, the overall prevalence of HIV, HBV, HCV, and syphilis was found to be 4.2%, 4.1%, 3.6%, and 3.1%, respectively.[18] In Nnewi, Nigeria, Okocha *et al*. found the prevalence of 2.0%, 2.0%, and 0.1% respectively, for HBsAg, HCV, and syphilis, using rapid test kits.[19] In a Nigerian tertiary hospital, it was documented that the prevalences of HIV, HBsAg, and HCV were 5.6%, 4.6%, and 2.8%, respectively. The percentage positive based on the donor source was 4.6%, 4.6%, and 0.9% for HIV, HBsAg, and HCV, respectively, among the paid donors, 1.9% for HCV among the FRD and 1% for HIV among the voluntary donor.

In Abeokuta, Nigeria, the seroprevalence of HIV, HBsAg, HCV, and *Treponema palidium* antibodies was 6.2%, 10%, 1.5%, and 0%, respectively.[20] Furthermore, another study noted the overall seroprevalence of HIV, HBsAg, HCV, and syphilis to be 1.1%, 18.6%, 3.1%, and 6.0%, respectively, among apparently healthy prospective blood donors.[21] The highest prevalences of HIV, HBsAg, HCV, and syphilis infections were found among those aged 18–47 years old, the most sexually active age group, and commercial blood donors.[21] Herein, Ekiti state, Nigeria, a retrospective study to determine the prevalence rates of TTIs (HIV, HBV, HCV, and syphilis) at a tertiary health facility (among intending blood donors) obtained an overall TTI seroprevalence rate of 2.7%.[22] Given the prevalence of these TTIs, an evaluation of the prevalence of TTIs among donors will provide further insight into the burden of these infections among our prospective donors. Therefore, this study aims to retrospectively review available 5-year records of blood transfusion in the Federal Teaching Hospital, Ido-Ekiti, with a view to establishing the prevalence of TTIs and unfitness predictors.

Materials and Methods

Ekiti state, one of the six states constituting the south-western region of Nigeria, is located between longitudes 4° 45° and 5° 45° East of the Greenwich meridian and latitudes 7° 15° and 8° 15° North of the equator. Ekiti State has three senatorial

districts namely Ekiti South, Ekiti Central, and Ekiti North, and divided into 16 Local Government Areas (LGAs).[23,24] Yoruba are mainly the indigenous people of Ekiti state (speaking the Ekiti dialect) though other ethnic groups also exist in the state. The people of the state are predominantly Christians with some Muslims and few traditional worshippers. There are different Christian denominations in the state, ranging from Catholics to Jehovah's Witnesses, among others.

In Ekiti State, occupations such as the public service, trading, farming, and organised private business owners including transportation are major occupations being engaged in by people. These occupations expose the people to varying degrees of cuts, injuries, including road traffic injuries which might necessitate the use of blood following blood losses of different degrees. Aside from occupational necessities, illnesses of various types also call for transfusion at different times.

Located in Ido-Osi LGA, the Federal Teaching Hospital, Ido-Ekiti, is one of the two tertiary health facilities in Ekiti State. It is located along a busy federal highway which serves as an alternative or major route to Abuja, the Federal Capital city of Nigeria. This, therefore, exposes commuters and residents to the risk of road traffic injuries, which when occur, might necessitate blood transfusion services. The hospital was upgraded to a Teaching Hospital in October 2014 for the training of medical and other students of allied health professionals of Afe Babalola University, Ado-Ekiti. With a designated Department of Haematology and Blood Transfusion services, the hospital provides blood transfusion services to cater to the need of the teeming patients.

Study design

This was a 5-year (2015–2019) cross-sectional retrospective review of hospital records to determine the prevalence of TTIs among donors screened in the Federal Teaching Hospital, Ido-Ekiti.

Study instrument and data collection method

For data collection, a structured pro forma was used to extract the relevant socio-demographic variables and blood transfusion parameters from the available records of the Hospital. These quantitative data collection, which lasted about three months, was done through the use of three trained research assistants. The schematic representation of the data collection protocol is shown in Figure 1.

Data management

Measurement of variables

Variables retrieved were the prevalence of TTIs, age, sex, occupation, donor fitness, and packed cell volume.

Data analysis

Data were analysed using IBM Statistical Package for Social Sciences 21 in a progressive fashion with the conduct of univariate, bivariate, and multivariate analyses of data in line with the study objectives. Pearson's Chi-square was used to establish associations between relevant categorical variables while binary logistic regression was used to identify predictors of unfitness among the donors. The level of statistical significance was set at a predetermined at a $P < 0.05$.

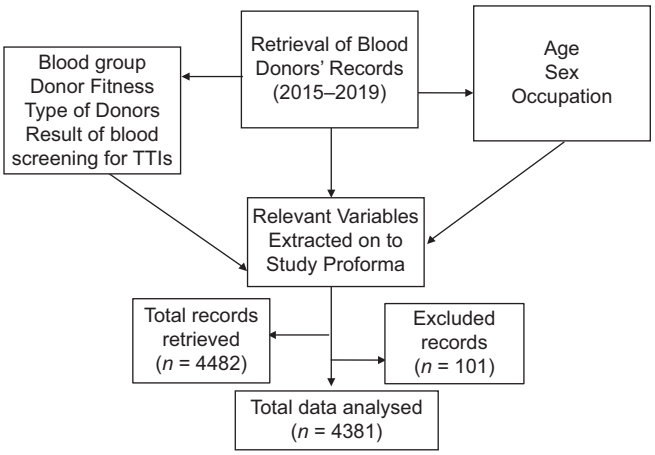

Figure 1: Schematic representation of data protocol for the study

Results

About a quarter of 1123 (25.6%) of the donors are above 35 years of age. More than three quarter, 4006 (91.4%) of the donors are males, and majority, 2490 (56.8%) of the donation were voluntary.

The commonest blood group among the patients and donors is the blood group O positive with more than half of the donors, 2315 (52.8%) and the patients, 2527 (57.7%) having the blood group [Table 1].

The overall combined prevalence of all TTIs among the donors was 11.3% and of this, HBV (4.4%) and HBC (2.7%) are more prevalent among the donors while microfilaria (1.2%) was the least prevalent [Table 2].

The highest proportions of those with positive HCV, 47 (3.8%), venereal disease research laboratory (VDRL), 32 (2.6%), and HIV, 27 (2.2%), results were among prospective donors who are ≤25 years of age. This difference was significant for HCV ($P = 0.008$) and VDRL ($P = 0.001$), but not for HIV ($P = 0.145$) [Table 3].

Female donors, 6 (2.3%) have a higher proportion of HIV seropositive result than the male counterparts, 54 (1.7%) ($P > 0.05$). However, both male and female donors have an equal proportion of positive results for both HCV and VDRL and this was found to be significant with $P = 0.001$ and $P < 0.001$, respectively [Table 4].

The family donors have the highest proportion of those with HBsAg, 17 (9.9%), and HIV, 5 (3.0%), with seropositive result with $P < 0.001$ and $P < 0.046$, respectively. The highest proportion, 487 (30.6%), of those unfit for blood donation was found among those ≤25 years of age [Table 5].

Prospective donors who were under 26 had more likelihood of being unfit to donate (adjusted odds ratio [AOR] =1.49;

Table 1: Demographics, type and blood group of prospective donors (*n*=4381)

Variable	Frequency, *n* (%)
Age group (years)	
≤25	1591 (36.3)
26–35	1667 (38.1)
>35	1123 (25.6)
Age, mean±SD	30.1±8.2
Range (minimum–maximum)	18–60
Gender	
Male	4006 (91.4)
Female	375 (8.6)
Type of donor	
Family	240 (5.5)
Voluntary donor	2490 (56.8)
Commercial donor	1651 (37.7)
Fitness status of donors	
Fit	3190 (72.8)
Unfit	1191 (27.2)
Blood group of patient	
A+	873 (19.9)
A−	84 (1.9)
B+	693 (15.8)
B−	26 (0.6)
AB+	169 (3.9)
AB−	22 (0.5)
O+	2315 (52.8)
O−	199 (4.5)
Blood group of donor	
A+	703 (16.0)
A−	63 (1.4)
B+	693 (15.8)
B−	28 (0.6)
AB+	79 (1.8)
AB−	17 (0.4)
O+	2527 (57.7)
O−	271 (6.2)
PCV of donor (%)	
PCV, mean±SD	42.6±3.9
Range of PCV (minimum–maximum)	7.0–65.0

SD: Standard deviation, PCV: Packed cell volume

Table 2: Prevalence of transfusion transmissible infections

Variable	*n* (%)
Microfilaria test (*n*=3905)	
Positive	48 (1.2)
Negative	3857 (98.8)
HBsAg test (*n*=3510)	
Positive	153 (4.4)
Negative	3357 (95.6)
HCV test (*n*=3494)	
Positive	93 (2.7)
Negative	3401 (97.3)
VDRL test (*n*=3483)	
Positive	54 (1.6)
Negative	3429 (98.4)
HIV test (*n*=3478)	
Positive	60 (1.7)
Negative	3418 (98.3)

**Inconclusive results not included. HBsAg: Hepatitis B surface antigen, HCV: Hepatitis C virus, VDRL: Venereal disease research laboratory

95% confidence interval [CI] =1.25–1.78). Furthermore, female prospective donors were more likely to be unfit to donate than their male counterparts (AOR = 1.36; 95% CI = 1.08–1.71) [Table 6].

Discussion

This is a cross-sectional study involving retrospectively collected data of blood donors at the study site. A total number of 4381 donors' data were retrieved with a mean age of 30.1 ± 8.2 years which falls within the permissible age for blood donation. Those who were above 35 years constituted about a quarter of the donors and this finding was similar to that obtained in another retrospective review of data conducted in Tanzania.[25] This could be due to the fact that, those above 35 years are older and if females, are within the reproductive age, and likely to be unfit or are not presenting for blood donation. Just like similar studies in different parts of the world, the males are more among the donors in this study.[25-28] As expected, females regularly menstruate on a monthly basis and this constitutes a source of blood loss and is more likely to be dreadful of blood donation than the males. In addition, <10% of the donors are family type with majority being voluntary donors just like was observed in a study in Eritrea and Tanzania.[25,28] This study was conducted in a tertiary hospital with periodic drives for voluntary nonremunerated blood donation and this might be responsible for.

The overall combined prevalence of TTIs obtained in this study was 11.3% with HBV being the most prevalent followed by HCV. This finding is an attestation to how widespread these two diseases are. The overall prevalence of TTI was higher than similar studies in Tanzania and Eritrea which obtained 10.1% and 3.7%, however, the Tanzania study also had HBV as the most prevalent.[25,28] Comparatively, a study in Osogbo, Southwest, Nigeria obtained a much higher prevalence of 28.8% for TTIs than that obtained in this study.[21] Although the Osogbo study and this study were conducted in the same region of Nigeria, differences in risk exposure among donors and between the two study sites might be a reason for this.

In this study, the prevalence of the different TTIs among the donors was found to be 4.4% (HBsAg), 2.7% (HCV), 1.6% (Syphilis), and 1.7% (HIV). This is lower than the figures obtained in a study in South Ethiopia with 9.5% prevalence for HBsAg, 8.5% for HCV, 7.9% for Syphilis, and 6.4% for HIV.[11] However, while only the HBsAg prevalence in this study was higher than that obtained in Calabar, Nigeria; the other TTIs including HIV, had a higher prevalence in the Calabar study. It is not surprising as this study was conducted in a State with one of the lowest prevalences of HIV in Nigeria. Besides, the

Table 3: Association between transfusion-transmissible infections and age among donors

Variable	Age group (years)			χ^2	*P*
	≤25, *n* (%)	26–35, *n* (%)	>35, *n* (%)		
Microfilaria result (*n*=3905)					
Positive	14 (1.0)	20 (1.3)	14 (1.4)	1.021	0.600
Negative	1395 (99.0)	1471 (98.7)	991 (98.6)		
HBsAg result (*n*=3510)					
Positive	53 (4.2)	65 (4.8)	35 (3.8)	1.464	0.481
Negative	1196 (95.8)	1277 (95.2)	884 (96.2)		
HCV result (*n*=3494)					
Positive	47 (3.8)	29 (2.2)	17 (1.9)	9.691	0.008
Negative	1192 (96.2)	1310 (97.8)	899 (98.1)		
VDRL result (*n*=3483)					
Positive	32 (2.6)	13 (1.0)	9 (1.0)	13.616	0.001
Negative	1202 (97.4)	1321 (99.0)	906 (99.0)		
HIV result (*n*=3478)					
Positive	27 (2.2)	16 (1.2)	17 (1.9)	3.867	0.145
Negative	1204 (97.8)	1318 (98.8)	896 (98.1)		

HBsAg: Hepatitis B surface antigen, HCV: Hepatitis C virus, VDRL: Venereal disease research laboratory

Table 4: Association between transfusion-transmissible infections and gender among donors

Variable	Gender		χ^2	*P*
	Male, *n* (%)	Female, *n* (%)		
Microfilaria result (*n*=3905)				
Positive	46 (1.3)	2 (0.6)	0.936	0.333
Negative	3550 (98.7)	307 (99.4)		
HBsAg result (*n*=3510)				
Positive	148 (4.6)	5 (1.9)	3.997	0.046
Negative	3102 (95.4)	255 (98.1)		
HCV result (*n*=3484)				
Positive	86 (2.7)	7 (2.7)	0.001	0.975
Negative	3148 (97.3)	253 (97.3)		
VDRL result (*n*=3483)				
Positive	50 (1.6)	4 (1.6)	<0.001	1.000
Negative	3175 (98.4)	254 (98.4)		
HIV result (*n*=3478)				
Positive	54 (1.7)	6 (2.3)	0.593	0.441
Negative	3166 (98.3)	252 (97.7)		

HBsAg: Hepatitis B surface antigen, HCV: Hepatitis C virus, VDRL: Venereal disease research laboratory

Ethiopia study was conducted in a referral hospital with a high volume of blood transfusion and a higher demand for blood will definitely scale up donor screening and detection of TTIs.

Across the age groups, the prevalence of HBsAg was highest among young, unmarried, and possibly sexually active donors aged between 26 and 35 years and those below 25 years in this study. This was similar to the findings in a study in Eritrea where HBV was reported as the most prevalent TTI. Male donors have the highest proportion of TTIs among the donors apart from HIV, whereas female donors have a higher proportion of positive cases. In general, sexual HIV transmission tends to affect females more as they are on the receiving end of male fluid which might be infected. In terms of donor types, HBsAg and HIV positivity are the commonest among the family donors than other categories and this was significant. There is a possibility of concealment of disease status among family relatives. Furthermore, this is possible as a lot of those the patient's relatives present as family members might not be, but rather friends and colleagues of the patient and even commercial donors presented as families for the purpose of blood donation.

This study also identified some predictors of unfitness to donate blood. Younger prospective donors <26 years of age are more likely to be unfit to donate blood than older respondents (AOR = 1.49; 95% CI = 1.25–1.78; $P < 0.001$). This is not unexpected as the blood level might be too low for donation with an increased risk of vasovagal reactions[29] and besides, this study showed that younger donors have a higher prevalence of TTIs. This category of donors, possibly unmarried, might have a risky social and sexual behavior exposing them to TTIs. Similarly, the female donors are more likely to be unfit to donate than their male counterparts (AOR = 1.36; 95% CI = 1.08–1.71; $P = 0.008$). Females are likely to be unfit as a result of childbirth, pregnancy, breastfeeding, and menstruation and are likely to be deferred for blood donation.[25] Being a voluntary donor was also predictive of the unfitness to donate blood. A voluntary donor, who donates at regular intervals, is likely to be faced with unfitness due to the repeated episodes of bleeding, especially if there is inadequate time for replenishment before the next bout.

Conclusion

All categories of blood donors are potential sources of TTIs. The overall combined prevalence of TTIs was 11.3% among the donors and HBV was the most prevalent of all the TTIs

Table 5: Association between transfusion-transmissible infections and type of donor

Variable	Type of donor			χ^2	*P*
	Family, *n* (%)	Voluntary donor, *n* (%)	Commercial donor, *n* (%)		
Microfilaria result (*n*=3905)					
Positive	1 (0.5)	28 (1.3)	19 (1.3)	0.840	0.657
Negative	191 (99.5)	2165 (98.7)	1501 (98.8)		
HBsAg result (*n*=3510)					
Positive	17 (9.9)	108 (5.6)	27 (2.0)	38.43	<0.001
Negative	154 (90.1)	1854 (94.4)	1349 (98.0)		
HCV result (*n*=3484)					
Positive	2 (1.2)	45 (2.3)	46 (3.4)	4.910	0.086
Negative	168 (98.8)	1906 (97.7)	1327 (96.6)		
VDRL result (*n*=3483)					
Positive	3 (1.8)	31 (1.6)	20 (1.5)	0.153	0.926
Negative	167 (98.2)	1911 (98.4)	1351 (98.5)		
HIV result (*n*=3478)					
Positive	5 (3.0)	40 (2.1)	15 (1.1)	6.150	0.046
Negative	161 (97.0)	1900 (97.9)	1357 (98.9)		

HBsAg: Hepatitis B surface antigen, HCV: Hepatitis C virus, VDRL: Venereal disease research laboratory

Table 6: Predictors of unfitness and factors associated with fitness for blood donation

Variable	AOR (95% CI)	*P*	Fitness status		χ^2	*P*
			Unfit, *n* (%)	Fit, *n* (%)		
Age (years)						
≤25	1.49 (1.251.78)	<0.001	487 (30.6)	1104 (69.4)	15.458	<0.001
26–35	1.15 (0.96–1.37)	0.123	430 (25.8)	1237 (74.2)		
>35	1 (reference)		274 (24.4)	849 (75.6)		
Gender						
Male	1 (reference)		1055 (26.3)	2951 (73.7)	17.085	<0.001
Female	1.36 (1.081.71)	0.008	136 (36.3)	239 (63.7)		
Donor type						
Family	2.47 (1.853.30)	<0.001	96 (40.0)	114 (60.0)	46.407	<0.001
Voluntary	1.46 (1.271.71)	<0.001	729 (29.3)	1761 (70.7)		
Commercial	1 (reference)		366 (22.2)	1285 (77.8)		

AOR: Adjusted odds ratio, CI: Confidence interval

followed by HCV and HIV. Blood donation unfitness was highest among those ≤25 years. Younger age (<26 years), being a female and a voluntary donor are significantly predictive of unfitness to donate blood. Therefore, to avert inadvertent TTIs, all categories of donor should be screened for pathological and physiological states so that low-risk donors will be identified.

Strength and limitations of the study

Strength

1. It involved the use of a large database, spanning 5 years, which allows for adequate power for the statistical inferences.

Limitations

1. It was limited to a study site and might not necessarily be generalisable
2. The study used secondary data available from the health facility with the possibility of missing or incomplete records.

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Conflicts of interest

There are no conflicts of interest.

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