**A novel strategy for screening blood donors for syphilis at**

**Komfo Anokye Teaching Hospital, Ghana**

**Structured Abstract**

***Objective*:** To implement and describe a novel syphilis screening strategy for blood donors.

***Background*:** The seroprevalence of syphilis in blood donors is often high in low and middle income countries (LMIC) although the proportion of infectious donations is probably low. Syphilis screening may not happen at all; or the use of non-specific screening tests, which have high false positive rates, results in many donations being discarded unnecessarily. This can have a critical effect on already inadequate blood supplies.

***Materials and Methods*:** Blood donors were screened at the time of donation with an anti-treponemal rapid diagnostic test (RDT) and blood collected irrespective of the result. Units screening negative for syphilis, HIV, and hepatitis B and C were released to stock. RDT screen-positive units were re-tested with Rapid Plasma Reagin (RPR) – units testing negative were released to stock and test-positive units discarded.

***Results*:** Of the 2213 blood donors, 182 (8.2%; 182/2213) screened positive by RDT. Additionally, 38 out of these 182 (20.9%) were RPR positive on post-donation testing. Over two months there was a 79% reduction in blood units discarded due to a positive syphilis screen.

***Conclusion***: In other LMIC, this novel strategy can contribute to improving blood safety without jeopardizing blood supply.

***Background***

Syphilis, caused by the spirochaete *Treponema pallidum*, is prevalent in sub-Saharan Africa (SSA). Of the estimated 12 million new cases a year, a quarter occur in Africa ([WHO 2007](#_ENREF_11)). Syphilis is predominantly spread by sexual contact but may be transmitted by blood transfusion ([Olokoba, Olokoba et al. 2008](#_ENREF_6)). Seroprevalence rates for syphilis in blood donors in SSA range from 1.1% to 14.4%, and in Ghana from 4.7% to 13.5% ([Owusu-Ofori, Parry et al. 2011](#_ENREF_8), [Bisseye, Sanou et al. 2013](#_ENREF_2), [Noubiap, Joko et al. 2013](#_ENREF_5)). Transfusion-transmitted syphilis (TTS) is uncommon and there have been only a few cases documented over the past few decades ([Hook and Peeling 2004](#_ENREF_4), [Brant, Bukasa *et al*. 2007](#_ENREF_3)). The low frequency of TTS reported may be due to a number of factors including: low prevalence in blood donors, effective screening methods, the refrigeration of blood products, and the frequent use of antibiotics in transfusion recipients. However an additional factor in LMIC where the seroprevalence of syphilis in blood donors is higher is poor or absent of haemovigilance systems which may result in under-reporting of TTS. This was highlighted by a recently reported case in Kumasi, Ghana ([Owusu-Ofori, Parry et al. 2011](#_ENREF_8)).

Although WHO recommends screening all blood for transfusion for syphilis ([WHO 2010](#_ENREF_12)), *Treponema pallidum* survives for only a few days at 40 C and therefore is killed during refrigeration of blood products ([Adeolu and Olufemi 2011](#_ENREF_1)). In most high-income countries where the seroprevalence of syphilis in blood donors is much lower and transfusion transmitted syphilis (TTS) is very rare, syphilis screening is routine. In contrast, in low and middle-income countries (LMIC) where the seroprevalence of syphilis in blood donors is higher and refrigerated storage times of donated blood shorter, syphilis screening is often not undertaken ([WHO 2011](#_ENREF_13)).

Reasons for not screening for syphilis in LMIC are constrained resources and a presumption that transmission risk is low. Serological screening methods currently available are unable to determine infectious blood units. In addition they may not differentiate past, present or treated infections. Healthy blood donors thus may be declared falsely positive by the serological screening tests for syphilis ([Ratnam 2005](#_ENREF_10)). Therefore, where seroreactivity rates are high, large numbers of uninfectious blood donations may be discarded unnecessarily. In LMIC, where blood for transfusion is in short supply, this can be critical and endanger lives.

The Transfusion Medicine Unit (TMU) at Komfo Anokye Teaching Hospital (KATH) in Kumasi manages about 18,000 blood donations a year. A high proportion of blood donors are secondary or tertiary students and blood shortages can occur during vacations and examination periods. Blood donors are screened for HIV, HBV and HCV by pre-donation rapid diagnostic test (RDT) and approximately 10% of donors are deferred ([Owusu-Ofori, Temple et al. 2005](#_ENREF_9)). There is currently no post-donation testing. RDT for TTI screening are often preferred in LMIC as they are cheap, quick, require limited expertise and are therefore suitable for screening blood donors pre-donation on mobile blood drives. Pre-donation screening where TTI seroprevalence is high is attractive as the costs of collection are avoided and the chances of mixing up screen positive and screen negative units post collection are reduced.

Until recently there was no screening for syphilis at TMU-KATH. However a recent study at the hospital identified a case of TTS in an 8-year old girl and that 57% of donations were stored for less than 4 days before being transfused ([Owusu-Ofori, Parry et al. 2011](#_ENREF_8)). As a consequence, the hospital transfusion committee recommended the introduction of syphilis screening. A cost analysis by the TMU supported pre-donation screening with a rapid diagnostic test over post-donation screening methods.

***Materials and Methods***

In July 2014, pre-donation screening of blood donors for syphilis was introduced with an anti-treponemal rapid diagnostic test (RDT; Fortress Quick Test, Fortress Diagnostics, UK). This demonstrated a seroreactivity rate of 7.0% and the overall deferral rate for all transfusion-transmitted infections (TTI) increased to 16.5%. This had a critical and unsustainable effect on the blood supply for the hospital. The TMU therefore instituted a novel and pragmatic syphilis screening algorithm to improve blood safety but also to protect the blood supply.

In the new screening algorithm (Fig 1) donors who screen positive for syphilis by RDT, which indicates possible past or current infection, are not deferred. Rather, blood units are collected and then quarantined until an additional screening test- Rapid Plasma Reagin (RPR; IMMUTREP RPR, Omega Diagnostics, UK) - is performed. This non-treponemal syphilis test identifies possible active infection and, therefore, potential for transmission. Units testing positive by RPR are discarded and the donors contacted for referral for further investigation and/or treatment. Conversely, RDT positive units testing negative by RPR are released for transfusion.

***Results***

In August and September 2014, 2455 blood donors presented for blood donation. Of these, 1959 (88.5%) were male, 1080 (48.8%) were voluntary donors, and 1642 (74.2%) were first-time donors. Of the 2455 blood donors, 242 (9.9%) were deferred at pre-donation screening for HIV (2.6%; 64/2455), HBV (6.3%; 156/2455) and HCV (0.9%; 22/2455). After screening for HIV, HBV and HCV, 2213 donors underwent pre-donation screening for syphilis by RDT. Of these, 182 (8.2%; 182/2213) screened positive by RDT and 29 of these screened positive on subsequent RPR testing. Nine RDT positive donations were discarded in error before RPR testing. Thus of 182 syphilis RDT positive blood donations 144 were RPR negative, considered uninfectious and released for transfusion; and 38 were discarded, an overall rate of 1.5% (38/2455). The number of units discarded due to a positive syphilis screen was therefore reduced by 79% (144/182).

Rates of syphilis RDT positivity were higher in family-replacement donors (10.1%; 114/1133) compared to voluntary donors (6.3%; 68/1080) (chi square; p=0.01), and in male donors (8.8%; 172/1959) compared to female donors (3.9%; 10/254) (p=0.008). First-time donors had a greater RDT seroreactivity rate for syphilis (8.9%; 146/1642) than repeat donors (6.3%; 36/571) but the difference in this sample is not statistically significant (p=0.053).

***Discussion***

The novel blood donor syphilis screening strategy described here resulted in a saving of 144 donations over a two month period and has several potential advantages in our setting: the risk of TTS is reduced compared to the status quo of no screening; first-line testing by RDT is cheap and can be incorporated into the existing pre-donation screening panel; the second-line RPR test, which requires laboratory expertise and resources, is only performed on a minority of samples; and the negative impact of syphilis screening on the blood supply is reduced.

The hospital transfusion committee was instrumental in initiating the new strategy, demonstrating the critical role such committees can play in the implementation of evidence-based measures to improve blood safety and availability even when resources are limited ([Opare-Sem, Bedu-Addo et al. 2014](#_ENREF_7)).

It is important to stress we do not know the false negative rate of this screening strategy or its residual risk and this requires further study. Furthermore, robust systems are necessary for the effective quarantining of RDT positive donations pending second-line testing. We anticipate that as the new screening strategy beds in errors resulting in units being discarded before second-line testing will be eliminated. We emphasize that although this novel strategy may be relevant for LMIC with limited resources, it is not necessarily appropriate for high-income countries with different donor characteristics, syphilis prevalence and resource constraints.

***Conclusion***

We believe that in settings similar to ours the novel strategy described here for screening blood donors for syphilis can contribute to improving blood safety without jeopardizing the blood supply.

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**Figure 1** Algorithm for syphilis screening of blood donors, Transfusion Medicine Unit-

Komfo Anokye Teaching Hospital (new pathway shown in red).

(RDT=Rapid Diagnostic Test; RPR=Rapid Plasma Reagin)

**Health check fail**

Donor health questionnaire, physical examination, Hb screen

Defer/refer for health advice

**Screen positive**

Defer/refer for health advice

Screening for HIV, HBV, HCV by RDT

**Screen positive**

Screening for Syphilis by RDT

**Screen positive**

Defer/refer for health advice

Screening for syphilis by RPR

**Screen negative**

**Screen negative**

Release to blood stock for transfusion