REVIEW

Blood Transfusion in the Caribbean: A Case Study of Trinidad and Tobago

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ABSTRACT

The Caribbean islands form an archipelago connecting North and South America. They have all been colonised by European countries and share strong historical, social, economic and diplomatic links with North America. However, their blood transfusion services have evolved differently, using predominantly family/replacement rather than voluntary non-remunerated donors as has been the practice in England and the United States of America since 1926 and 1970, respectively. This article uses the case of Trinidad and Tobago to examine the history and current state of blood transfusion services in the Caribbean and to present early results of an initiative for improving blood safety and adequacy in the region.

Keywords: Blood transfusion, replacement, voluntary

La transfusión de sangre en el Caribe: Un estudio de caso de Trinidad y Tobago

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RESUMEN

Las islas del Caribe forman un archipiélago que conecta América del Norte y del Sur. Todas han sido colonizadas por países europeos y comparten fuertes vínculos históricos, sociales, económicos y diplomáticos con América del Norte. Sin embargo, los servicios de transfusión de sangre han evolucionado de manera diferente, usando predominantemente donantes familiares o por reposición, en lugar de donantes voluntarios no remunerados como ha sido la práctica en Inglaterra y los Estados Unidos de América desde 1926 y 1970, respectivamente. Este artículo aborda el caso de Trinidad y Tobago para examinar la historia y el estado actual de los servicios de transfusión de sangre en el Caribe, así como para presentar los primeros resultados de una iniciativa para mejorar la seguridad y la adecuación de las transfusiones de sangre de la región.

Palabras clave: Transfusión de sangre, reposición, voluntario

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Trinidad and Tobago is a twin island republic and the most southerly of the Caribbean islands, lying eight miles off the coast of Venezuela, South America (Fig. 1). It is small (1980 square miles), with an adult literacy rate of 98% and a gross domestic product per capita of US$14 370.22 (1). This is largely due to its oil resources, and makes it the third richest country in the region of the Americas after the United States of America (USA) and Canada.

The population is estimated to be 1 245 773 persons, with composition Indo-Trinidadian 37.3%, Afro-Trinidadian 36.3%, mixed race 24.2%, White, Chinese, Arab or Lebanese 1.8% and Amerindian 0.1%. The main religious groups are Catholics (26%), followed by Hindus (22%), Anglicans (7.8%), Baptists (7.2%), Pentecostals (6.8%), Muslims (5.8%) and Seventh Day Adventists [4%] (2). The capital city is Port of Spain and there is a Westminster-styled parliamentary system of government, with changes in political administration every five years. The main tertiary education institution is The University of the West Indies (UWI), St Augustine, which shares a Faculty of Medical Sciences with other UWI campuses in The Bahamas, Barbados and Jamaica.

The two islands were a single British colony between 1889 and 1962. This period spanned the inception of voluntary blood donation by Percy Lane Oliver and establishment of the world's first voluntary, municipal blood transfusion service in Britain (3). It also spanned World Wars 1 and 2 (WW1 and WW2) when local soldiers served alongside British, Canadian and American forces (4). During WW2, large-scale community blood donation programmes were developed to supply armies and at-risk civilians (5–7).

However, there was no community blood donation programme in Trinidad and Tobago after WW2. Scant individual donations evolved slowly into a fragmented, hospital-based national service, which, to today, relies almost exclusively on family/replacement (F/R) donors (8). Like most of the Caribbean islands, Trinidad and Tobago, designated TRT by the Pan American Health Organization (PAHO), has encountered serious challenges in complying with international standards for blood safety and adequacy.

There are 19 countries in the PAHO classification of the Caribbean region. These include The Bahamas, Barbados, Jamaica and TRT whose blood systems rely on mostly F/R and the Netherlands Antilles (Aruba and Curacao) where the goal of total voluntary non-remunerated donors (VNRD) has been attained. This review describes the evolution and current state of blood transfusion services in TRT, the case being typical of the majority of Caribbean countries. It also presents the early results of a University-led initiative to achieve

Fig. 1: Map of the Caribbean showing Trinidad and Tobago.

total VNRD and blood transfusion reform in TRT and the Caribbean region.

EARLY HISTORY OF BLOOD TRANSFUSION IN TRINIDAD AND TOBAGO

There was one report of desperate transfusion of blood into a dying woman in 1880 (9), but organised blood transfusion first occurred in TRT between 1939 and 1945 during WW2. A very basic service at the Colonial Hospital, Port of Spain, utilized tile cross-matching technology. There was no donor pool or blood storage facility (10).

This war saw TRT occupy a position of strategic importance to Britain and her allies. As a result of a land lease agreement between Britain and the USA, there were over 223 American military bases, three military base hospitals and 100 000 foreign troops on the island in 1942. Trinidad and Tobago had the largest oil refinery in the British empire at Pointe-à-Pierre, the busiest air-strip in the world at Wallerfield and the largest natural harbour in the world (The Gulf of Paria) in which the convoys to the North Atlantic assembled.

This made her a potential target for attacks by air or sea. In fact, GermanU-boats inflicted severe damage on merchant ships taking oil and supplies from TRT to Britain and the allies in the North. Thousands of merchantmen were killed in the waters off TRT and thousands more washed ashore for treatment in Trinidad (4).

The next record of blood transfusion in TRT was in 1951, six years after WW2, when 55 units were transfused for the year in the entire country that then had a population of 300 000. After this, the Trinidad and Tobago Red Cross Society, a branch of the British Red Cross, participated in early voluntary mobile blood collection from the community, which was well supported by large numbers of British, American and Canadian oil workers in the South of the island (11). These were supplemented by blood collected at public hospitals from patients' relatives and social contacts (Fig. 2).

In 1972, a group of local surgeons and businessmen, recognizing the need for more blood, launched the Friends of the Blood Bank Association (FBBA) to increase mobile blood donations and lobby for the establishment of a national blood bank (11). Faced with poor donation rates, they offered voluntary blood donors the right to reclaim their blood for the family member or friend of their choice as an incentive to boost donations.

In 1986, during a period of severe economic hardship for TRT, the National Blood Transfusion Service (NBTS) was established. The casualty department of the old Colonial Hospital, now the Port of Spain General Hospital, was refurbished using funds raised by the FBBA. It was converted to the headquarters of the NBTS, the headquarters of the FBBA, central laboratories (CL) and a blood donation centre. Existing blood donation facilities and blood banks at public hospitals were made satellite centres of the NBTS, and the entire blood system was managed by the Ministry of Health (MOH). The FBBA remained a non-governmental organization, which received an annual government subvention and was assigned responsibility for fundraising and voluntary blood donor recruitment. The guarantee of blood in return for voluntary donors was formalized.

Fig. 2: Blood donation at Port of Spain General Hospital in the 1960s. Courtesy Nurse Barbara Holder.

Under these arrangements, shortages, inappropriate crossmatching, improper storage and wastage of blood were soon reported and the need for totally voluntary blood donation, transfusion guidelines and maximum surgical blood ordering schedules recognised (12). In 1994, as part of health sector reform, Regional Health Authorities (RHAs) were established in TRT. Whereas determination of health policy and direction remained with the MOH, day-to-day management of health facilities was devolved to RHAs. These facilities included hospitals, blood donation centres, adjoining blood banks and staff (Table 1). The NBTS Director and some long-standing CL staff remained employees of the MOH.

TYPES OF BLOOD DONATION IN TRINIDAD AND TOBAGO

The only official blood collection facilities in TRT are the six fixed donation centres and a mobile unit (MU) operated by the FBBA. Patients at public or private health institutions needing blood component transfusion

Table 1: Blood donation centres and Regional Health Authorities in Trinidad and Tobago

Donation centre	Regional Health Authority
Central laboratories (CL)	North West Regional Health Authority (NWRHA)
Eric Williams Medical Sciences Complex (EWMSC)	North Central Regional Health Authority (NCRHA)
Sangre Grande County Hospital (SGCH)	Eastern Regional Health Authority (ERHA)
San Fernando General Hospital (SFGH)	South West Regional Health Authority (SWRHA)
Area Hospital Point Fortin (AHPF)	
Scarborough Regional Hospital (SRH)	Tobago Regional Health Authority (TRHA)

must have the equivalent units donated on their behalf at a fixed centre. Family/replacement donors receive a donor chit in the name of the intended beneficiary, which is used to obtain a unit of component. This chit cannot be transferred to another beneficiary and expires six months after the donation is made.

Alternatively, MU donors are considered voluntary and receive a credit for each donation. Each credit could be used to obtain a donor chit for a patient of the donor's choice and has no expiry period. Voluntary donors could also donate at CL for the same benefits. Similarly-modelled voluntary programmes were subsequently started at other RHA collection centres independently of the FBBA. Generally, about 90% of TRT's annual blood donations are from F/R and 10% from voluntary donors. The blood service is publicly funded. There is no cost recovery system as neither patients nor requesting institutions pay for blood components.

HOSPITAL-RELATED TRANSFUSION ACTIVITIES

Requests for blood components are made by clinicians on hospital wards. Patients and/or relatives are informed of the requirement for F/R by medical or nursing staff. Relatives and social contacts of the patient attend the nearest donation centre and receive a chit as proof of successful donation. Chits are returned to the clinician who attaches them to the blood component request form to obtain components from the blood bench. Compatible units, if available, are supplied on a 'one chit, one unit' basis, irrespective of the blood groups of donor and beneficiary. In cases of emergency, components are supplied and F/R sought later.

EARLY PAHO/WORLD HEALTH ORGANIZATION BLOOD SAFETY RESOLUTIONS AND BLOOD TRANSFUSION LAW IN TRINIDAD AND TOBAGO (1978–2002)

Although the current methods of donating blood in TRT were never written into national policy or law, they survived the passage of serial PAHO/World Health Organization (WHO) blood safety resolutions over the decades. Even before the establishment of TRT's NBTS, it was recommended that national transfusion services be based exclusively on voluntary donors for the safety of donors and recipients (13). Sometime later, the global HIV threat and recognition that the Caribbean had the second highest prevalence of the virus after Sub-Saharan Africa caused PAHO to adopt a new resolution to secure blood safety and adequacy (14). This resolution urged members to develop centrally organised national blood programmes that were based on VNRD as one indicator of human development. Termination of the requirement to replace blood was an essential factor for achieving this. Ministers of Health in return asked PAHO to monitor their progress in this regard.

In response, PAHO created a standardized form to collect information from countries on an annual basis. Instructions to complete the form defined a VNRD as one who gives blood 'voluntarily without pressure of any type from any individual – members of the health care team, or patients' relatives or friends and who does not receive any kind of payment, be it in money or in kind', a F/R donor as one who donates 'in response to specific requests by health care workers or relatives' and a remunerated donor as one who 'receives payment in cash or kind' for giving blood (15). An individual who is guaranteed blood in return for his or her donation is considered a remunerated donor, and this practice is discouraged by PAHO (Dr J Cruz, personal communication).

When strategic and programmatic orientations of PAHO for 1999–2002 were declared, only Aruba and Curacao in the Caribbean reported 100% VNRD. Annual reports showed collection rates in Caribbean countries to be around 14 units of blood per 1000 inhabitants, well below the 50 recommended internationally, with the majority coming from F/R. This resulted in a higher risk of transmitting infections by transfusion as well as a higher percentage of discarded blood units (16). For

example, TRT annual donations in 2002 were 13 per 1000 inhabitants, 81% from F/R and 18% from voluntary donors. The prevalence (%) of infectious markers among donors was 0.39, 0.6, 0.39, 2.57 and 1.18 for HIV, hepatitis B surface antigen (HBsAg), hepatitis C virus (HCV), syphilis and human T-cell lymphotropic virus I and II (HTLV I and II), respectively. This contrasted with the situation in Curacao where blood donations were 45 per 1000 inhabitants and 100% VNRD with zero prevalence for all infectious markers in donors (15).

PAHO'S STRATEGIC REGIONAL PLAN 2006–2010 AND NATIONAL BLOOD POLICY

When little progress was made in increasing total donations or percentage VNRD, PAHO passed a further resolution for blood safety and adequacy (15). This resolution identified critical issues and lessons learned and in trying to achieve the goals of the plan for 1999–2002:

- The difference in HIV reactive donors in countries with at least 98% VNRD was 2 per 100 000 donors, compared with 350 per 100 000 in countries with paid donors and 340 per 100 000 in countries with replacement donors.
- Inadequate VNRD caused failure to establish a permanent blood stock and chronic shortage.
- Hospital-based systems concentrated on replacing the limited number of units made available by the relatives, friends and acquaintances of patients rather than promoting VNRD. As a consequence, the general population preferred to save their blood for a family member or friend and not give altruistically. This in turn provided the basis for hospital-based blood banks' unwillingness to share their blood with other centres.

The main objectives of the new regional plan for 2006–2010 were collection of at least 50% of blood from VNRD, revision of legal and regulatory frameworks for blood donation, quality assurance and appropriate use of blood components.

CHALLENGES IN IMPLEMENTING THE REGIONAL PLAN FOR 2006–2010 IN TRINIDAD AND TOBAGO

Obtaining blood primarily from F/R with a parallel system for remunerated (considered voluntary) blood donation continued to negatively impact management of the blood system in TRT. Blood donation in all sociodemographic groups, mostly F/R, remained poor due to lack of information and poor access to donation (8). Chronic blood shortage continued as annual donations plateaued as is typical of blood systems based on replacement donation (17). Medical services at public and private institutions expanded as the economy improved, training of local specialists increased and the population grew.

To increase the likelihood of obtaining blood in an emergency and to increase the blood supply, F/R recruitment was intensified in excess of anticipated need for surgeries (18) and routine deliveries. In fact, this approach had the unintended effects of attracting unsuitable donors, encouraging professional donors, increasing donor deferrals (19) and ensuring high initial seroreactivity among donors (20).

In addition, because collection centres depended on the availability of personnel from adjoining hospitals, staff shortages were frequent. This caused prolonged waiting times, complaints from donors and negative media publicity which augured against VNRD. Table 2 demonstrates that similar problems were a feature of the blood donation systems in The Bahamas, Barbados and Jamaica but not Curacao.

Table 2: Annual blood bank data for The Bahamas, Barbados, Jamaica, Trinidad and Tobago and Curacao

A. Annual blood bank data for 2006 (20)

Country	Annual donations per 10 000	VNRD (%)	Total TTI* (%)	Deferral (%)
The Bahamas	132.2	16	2.25	6.0
Barbados	107.9	10	1.23	17.0
Curacao	440.0	100	0.00	0.6
Jamaica	84.6	9	4.36	17.9
TRT	150.8	8	3.36	38.1

B. Annual blood bank data for 2009 (20)

Country	Annual donations per 10 000	VNRD (%)	Total TTI* (%)	Deferral (%)
The Bahamas	182.4	19	2.07	**
Barbados	164.7	**	1.19	**
Curacao	435.2	100	0.00	0.52
Jamaica	91.2	15	5.13	**
TRT	171.3	13	3.09	44.5

* Transfusion-transmissible infections
** Not reported

NATIONAL BLOOD TRANSFUSION POLICY IN TRINIDAD AND TOBAGO

Being aware of these shortcomings, the MOH took steps to reorganize the blood system. It established

national policy and technical guidelines for blood transfusion (21). This policy envisaged a National Blood Transfusion Programme administered by a National Blood Authority which had representation from the MOH, all RHAs, the FBBA, PAHO, the community and private health institutions. The goals were to recruit and train dedicated staff, upgrade infrastructure at donation centres, laboratories and blood banks, facilitate transfer of blood components between blood banks, educate the public through World Blood Donor Day events (22) and move to total VNRD. Drafting of specific blood bank legislation was commenced.

While this was ongoing, PAHO recognised that aiming for 50% VNRD was causing ethical, policy and operational challenges and issued a new resolution which recommended 100% VNRD with termination of replacement and paid blood donation by the end of 2010 (23). The resolution also recommended establishment of a social network of volunteers to help educate the community to promote VNRD.

However, an acute fall in donations at all centres and the MU followed termination of replacement and remunerated blood donation in TRT. The consequences of acute or chronic blood shortage were widely reported in the media. Following an outcry by the public, surgeons and voluntary donors, chits and credits were reintroduced after four months, and implementation of the national blood policy was discontinued. There was a marked fall in the annual donation rate for TRT in 2011 (24) and a subsequent return to the plateau of 20 000 units and the attendant shortcomings of F/R (25).

THE UNIVERSITY OF THE WEST INDIES BLOOD DONOR FOUNDATION

Following the publicity surrounding the discontinuation of chits and credits, The University of the West Indies Blood Donor Foundation (UWIBDF) was formed in the Faculty of Medical Sciences (FMS) at the St Augustine campus. Its mission is to promote voluntary altruistic blood donation and appropriate blood use through research, education and example.

Since its inception, blood donation has been introduced in the medical curriculum at FMS in St Augustine. Sensitization activities are undertaken among medical students who have also participated in Knowledge, Attitude and Practices surveys surrounding blood donation in the community (Table 3).

The UWIBDF has organised a successful VNRD programme in collaboration with the North Central Regional Health Authority at the Eric Williams Medical Sciences Complex blood donation centre. Communication is by social media, emails, WhatsApp and text messages. Donations are made by appointment. Specifically trained nurse phlebotomists are used for donor events that are held every three months. No chits or credits are given to donors, and all blood collected is donated to the national blood service for use by any patient in need. Donations have more than tripled in the first year (Fig. 3). Donor deferral rate and initially seroreactive units in this programme have been 9% and 0.06% compared with 44.5% and 3.04%, respectively, for the country in 2009.

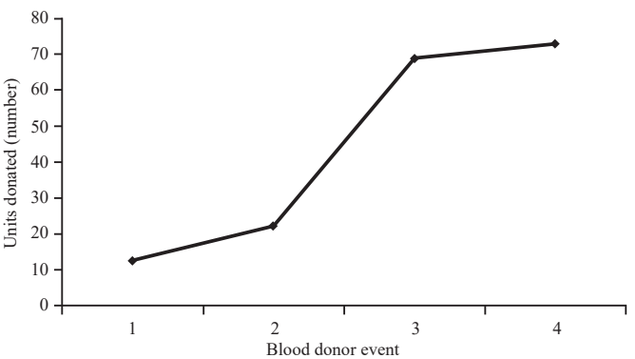

Fig. 3: First four UWIBDF blood donor events, 2015–16.

Table 3: Studies on the knowledge, attitude and practices of blood donation in Trinidad and Tobago

Study	Design	Main findings	Conclusion
Attitudes to blood donation in TRT: a 10-year follow-up study (26)	Non-random, cross-sectional survey. 816 adult respondents	Improvements in knowledge and attitudes but % donors and % F/R unchanged (21% *vs* 18.8%, $p = 0.337$ and 86.9% *vs* 86.0%, $p = 0.851$)	Revision of donation system needed to allow positive attitudes to translate into positive donation behaviour
Attitudes to receiving blood in TRT (27)	Cross-sectional, quota sampling. 500 adult clinic attendees	Significant knowledge gaps about blood transfusion identified. 84% would accept transfusion but 69% concerned about acquiring infection, mostly from hospital-related activities	Public education about entire blood transfusion process needed
Local public knowledge of blood transfusion systems (BDS) in TRT, USA and UK (28)	Quota sampling. 500 participants. Self-administered questionnaire	53.6% and 83.2% poor knowledge of BDS in TRT and UK/USA respectively. 44% believe TRT BDS totally voluntary. 35.6% non-donors likely to donate if TRT system more like UK/USA	Knowledge surrounding different types of blood donation is lacking. Understanding efficient systems in UK/USA may encourage VNRD in TRT

DISCUSSION

Historically, the development of blood transfusion in TRT did not keep pace with the first acceptance of the procedure as life-saving in WW1, the initiation of voluntary blood donation in the interwar period or the establishment of community voluntary blood donor programmes in developed countries during WW2. In contrast to the United Kingdom where the voluntary NBTS was established before its National Health Service with which it has worked closely, TRT's NBTS was established and appended to a public health system using F/R for decades. Over time, the NBTS has been outpaced by the demands of expanding clinical services while its output has been limited by the unpredictability of F/R.

Percy Lane Oliver's principle of voluntarism was adopted by Van Dijk to establish the Dutch Blood Transfusion Service in 1930 (29), then by Dutch nuns to establish the Curacao Red Cross Blood Bank in 1938 (Professor Ashley Duits, personal communication). As in the other previous Dutch colonies of Aruba and Suriname, this voluntary model has persisted to today. Like TRT, the other UWI campus territories of The Bahamas, Barbados and Jamaica were British colonies in which blood transfusion evolved differently. Despite technical support and publication of standards for Caribbean blood banks by international organizations (30), major challenges to blood safety and sufficiency in the Caribbean region continue to exist (31). Differences between colonial powers in organising transfusion services in their colonies have also been described in Sub-Saharan Africa (32).

The F/R-based system requires significantly less organisation and public education than one based on VNRD. It transfers a major responsibility of the healthcare system to patients and relatives (33). Once entrenched, an F/R system seems to be perpetuated by the same condition that created it – unfamiliarity of major stakeholders with the concept of VNRD. The TRT experience of 2011 had previously occurred in Jamaica when an attempt was made to discontinue F/R in that country (34).

Surveys on the knowledge, attitude and practices of blood donation in TRT have revealed several themes in common with similar surveys in other developing countries – misinformation about blood donation, fear, willingness to donate for family and friends and failure to transfer positive attitudes into actual blood donation (35). Information from these and future studies will be used to provide material and inform strategies for a national voluntary blood donation campaign.

The way forward

The current UWIBDF voluntary blood donation programme is generating a new pool of young VNRD at a minimal additional cost to the health system. The UWIBDF intends to collaborate with the MOH, RHAs and PAHO to extend this programme to all six fixed donation centres and to the community. Using the medical student base, chapters of UWIBDF will be started on the other UWI campus territories. Dissemination of research, information and voluntary blood donor activities will occur throughout the Caribbean communities.

However, a change in the requirements of the health system is necessary to facilitate VNRD as the population becomes more informed. The decision to move to VNRD must be backed by strong political will, clearly understood and articulated to all major stakeholders, including the media, and publicly endorsed by respected international organizations such as PAHO, the International Federation of Red Cross and Red Crescent Societies and the American Association of Blood Banks. A pool of VNRD, generated from new donors and existing F/R, will prevent an acute fall in donations while transitioning (36, 37).

CONCLUSION

Blood transfusion services in TRT are a close reflection of those in the majority of Caribbean countries where the common problem is a reliance on F/R. It is this author's opinion that entrenched replacement donation systems are the biggest impediment to achieving blood safety and adequacy in the region because they compromise every step in the quality process. Introducing the concept of VNRD to a group of young medical students has generated donation behaviour and initial results hitherto associated almost exclusively with developed societies. The future challenge is to gain acceptance of this model by the general population, health professionals, governments and politicians to influence change in blood bank legislation and regulation.

What is known about the topic?

- Blood transfusion services in the Caribbean region are primarily based on replacement (F/R) blood donation.
- This poses a serious threat to blood safety and adequacy.

What is new?

- The historical basis of replacement blood donation in the Caribbean is examined.
- A new approach to achieving blood safety and adequacy in TRT is reported.

What are the future key questions for future work on the topic?

- Is the new approach sustainable?
- Does it gain acceptance throughout the Caribbean?
- What is its impact on blood safety and adequacy over the next five years?

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