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Should Kiribati continue to aim for 100% voluntary non-remunerated blood donation as recommended by the WHO?

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Setting: Tungaru Central Hospital Blood Bank Laboratory, Nawerewere, Tarawa, Kiribati.
Objective: To determine characteristics, deferrals and reasons for deferral amongst blood donors from 2011 to 2016.
Design: A cross-sectional study using routinely collected data.
Results: From January 2011 to March 2016, 8531 potential blood donors were registered. For each full year, the proportion of voluntary non-remunerated blood donors (VNRBD) was below 10%, although it increased to 13% in 2015. The overall proportion of blood donors deferred increased each year over the 5-year period, from 44% to 57%, with similar increases in deferrals in VNRBD and family replacement donors (FRD). Among all blood donors, a higher proportion of females than males (59% vs. 43%) and VNRBD than FRD (56% vs. 44%) were deferred ($P < 0.001$). Deferrals were due to 1) failing the medical questionnaire (53%), 2) having anaemia and/or high white cell count (26%), or 3) transfusion-transmissible infections (21%). More VNRBD were deferred due to failing the medical questionnaire, while more FRD were deferred due to anaemia and/or high white-cell count; the number of deferrals was similar for transfusion-transmissible infections.
Conclusion: This 5-year study showed that the proportion of VNRBD is low and deferrals are higher for this group than for FRD. There is a strong case for encouraging both types of donor in the country.

Blood transfusion can save lives and improve health. Transfusions are mainly used for surgery, trauma, pregnancy-related complications, haematological malignancies and childhood anaemia caused by a variety of different conditions. Many patients requiring transfusion do not have timely access to safe blood; this unavailability has led to deaths and to patients suffering from ill health.[1]

All countries need to ensure that their blood supplies are sufficient and free from the human immunodeficiency virus (HIV), hepatitis viruses and other infections that can be transmitted through transfusion. An adequate, reliable supply of safe blood can only be assured through a stable base of regular voluntary and unpaid donors, as this group has the lowest prevalence of blood-borne infections.[1] In 2009 and 2010, the World Health Organization (WHO) and various interested stakeholders and experts recommended that all countries should strive for 100% voluntary blood donation by 2020 and that family replacement and paid blood donation should be phased out by this date.[2,3] By 2012, however, 72 countries were still obtaining less than 50% of their blood supplies from voluntary unpaid donors, with much of the blood supply still dependent on family replacement and paid blood donors.[1]

Kiribati, an island country in the Central and North-East Pacific, has three main hospitals where blood transfusion services are located. All potential blood donors are screened through an algorithmic approach (see Setting), and may be deferred (i.e., not allowed to donate blood) at each step.

For many years, the blood transfusion services in Kiribati have mainly relied on family replacement donors (FRD), resulting in a significant proportion of donors being deferred. In 2009, the WHO led a global consultation urging countries to adopt 100% voluntary non-remunerated blood donation.[4] A large number of countries participated in this consultation, including Kiribati, which signed the Melbourne Declaration.[3] A National Blood Policy was developed, which resulted in changes to the information collected about family-based or voluntary blood donation in registers and worksheets as well as increased advocacy about the importance of voluntary blood donations.

We were therefore interested to find out whether, in the last few years, from 2011 to early 2016, there were any changes in the number and proportion of voluntary non-remunerated blood donors (VNRBD), any changes in the number and proportion of deferrals and documented reasons for these deferrals. Specific objectives were to determine 1) the number of potential blood donors in each full year from 2011 to 2015 who were VNRBD or FRD and the number and proportion who were deferred; 2) the characteristics of all potential blood donors and those who were deferred from January 2011 to March 2016; and 3) the principal reasons for their deferral, stratified by VNRBD and FRD.

METHODS

Study design

This was a retrospective cross-sectional study of potential blood donors and deferrals between January 2011 and March 2016 using already collected data.

Setting

General setting

Kiribati is an island republic comprising 33 coral atolls, reef islands and one raised coral atoll stretching along the equator. It has a total land area of 800 km^2 (310 square miles), with the islands dispersed over 3.5

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million km² (1 351 000 square miles).[5] In 2010, Kiribati had a total population of 103 058. South Tarawa, the capital, had a population of 34 427; the population of Line and Phoenix Islands was 5791, and that of Tabiteuea North island was 1290.[5,6] The population of Kiribati has a life expectancy at birth of 60 years (57 for males and 63 for females) and an infant mortality rate of 54 deaths per 1000 live births.[5] In 2014, the country had a gross domestic product of USD 1605 per capita.[7]

Study setting and blood transfusion services

The National Blood Transfusion Service (NBTS) is an integral part of the national health delivery system, which operates under the government of Kiribati through the Ministry of Health and Medical Services (MHMS).[8] The NBTS operates through three hospitals located on three different islands—South Tarawa, Christmas Island and Tabiteuea North Island—and delivers transfusion services to the general public. The blood transfusion programme is overseen by the National Blood Transfusion Committee, and is implemented by various stakeholders within the MHMS clinical departments and other government and non-government organisations, including the Kiribati Red Cross Society (KRCS).

The current study was carried out at the Tungaru Central Hospital, situated on the capital island of South Tarawa where almost half the total population of Kiribati lives. Potential blood donors either present voluntarily to the blood bank, on their own or with notification from families, or are actively recruited by the KRCS. At the Tungaru Central Hospital Blood Bank Laboratory (BBL), all potential blood donors (eligibility criteria are ages 18–50 years) undergo a three-step algorithmic screening. In the first step, potential blood donors complete a medical questionnaire; any person who ticks any of the stated exclusion criteria is deferred (i.e., not allowed to donate blood). The medical questionnaire criteria for deferral are shown in Table 1. In the second step, the remaining potential blood donors are tested for haemoglobin (Hb) and white blood cell count (WBC); anyone with Hb $<$ 12.0g/dl or WBC $\geqslant$ 11.0 $\times$ 10^9/l is deferred. In the third and final step, the remaining potential blood donors are tested serologically for hepatitis B virus (Alere Determine™ HBsAg, Alere, Waltham, MA, USA), hepatitis C virus (SD Bioline HCV rapid diagnostic test, Standard Diagnostics Inc, Gyeonggi-do, Korea), HIV (Alere Determine™ HIV-1/2) and syphilis (Alere Determine™ Syphilis TP test). Anyone positive for these viruses or bacteria is also deferred.

Potential donors who pass through these three steps are accepted for blood donation. The blood is grouped and cross-matched, stored at the BBL centre and processed in accordance with the BBL standard operating procedures.[9] Blood donors with Hb $<$ 12 g/dl, WBC $\geqslant$ 11.0 $\times$ 10^9/l or a positive rapid serological test result are deferred from blood transfusion and referred to the general health services. The potential blood donor information and screening results are recorded by the blood bank laboratory technician in standardised forms, registers, worksheets and an electronic database and kept at the BBL.

Study population

All potential blood donors registered at Tungaru Central Hospital, South Tarawa, Kiribati, between January 2011 and March 2016 were included in the study.

Data variables, sources of data and data collection

Data variables for each potential blood donor included year of registration, type of blood donor (FRD, VNRBD), age, sex, deferral (and for those who were deferred, the reason), the medical questionnaire criteria, blood test results for Hb (test performed, Hb $<$ 12 g/dl), WBC (test performed, WBC $\geqslant$ 11.0 $\times$ 10^9/l) and HBsAg, HCV, HIV and syphilis serology (test performed, positive). The sources of data were the BBL for Blood Donor Register(s) 2011–2014, interview forms and the electronic database 2015–2016 at Tungaru Central Hospital, South Tarawa. Data were collected into a paper-based structured spreadsheet.

Analysis and statistics

Data were single-entered into Epi Info Version 7.0 (Centers for Disease Control and Prevention, Atlanta, GA, USA). A descriptive analysis was performed using absolute numbers, frequencies and proportions. Characteristics of blood donors who were deferred and those not deferred were compared using the χ^2 test; differences at the 5% level were regarded as significant.

Ethics approval

Permission for the study was obtained from the director of Tungaru Central Hospital, Tarawa, Kiribati. Ethics approval was obtained from the local Medical Council of Kiribati, Tarawa, and the Ethics Advisory Group of the International Union Against Tuberculosis and Lung Disease, Paris, France. Patient consent was not required, as this was secondary data obtained from registers and an electronic database.

TABLE 1 Criteria listed in the medical questionnaire for deferring potential blood donors

Criteria
Previously rejected as a blood donor
In the past 6 months: having sex with more than one sexual partner; having sex with someone the donor is unsure about and/or having a tattoo or body piercing
Having ever had a sexually transmitted infection
Having any of the following: weight loss (unknown cause); heart disease and/or chest pain; feeling faint or dizzy; persistent diarrhoea; abnormal bleeding; any defined blood disorder; diabetes mellitus; any defined kidney disorder; malaria, dengue or chikungunya; leprosy
Being pregnant

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Conflicts of interest: none declared.

TABLE 2 The number of potential blood donors and those deferred* each year at Tungaru Central Hospital, Tarawa, Kiribati, 2011–2015, stratified by those who were VNRBD, those who were FRD and those whose type of donor status was not recorded

Characteristics of blood donors	2011 *n* (%)	2012 *n* (%)	2013 *n* (%)	2014 *n* (%)	2015 *n* (%)
Potential blood donors	1896	1883	1367†	1064†	2314
Deferred	836 (44)	789 (42)	595 (44)	504 (47)	1321 (57)
Potential blood donors who were FRD	1326	1103	1285	976	1870
Deferred	461 (35)	448 (41)	543 (42)	449 (46)	995 (53)
Potential blood donors who were VNRBD	35	151	65	70	294
Deferred	16 (46)	55 (36)	38 (58)	44 (63)	193 (66)
Potential blood donors whose status was not recorded	535	629	19	18	150
Deferred	359 (67)	286 (45)	14 (74)	9 (50)	133 (89)

*Not allowed to donate blood.
†Some of the registers were missing and the numbers for these 2 years are therefore incomplete.
VNRBD = voluntary non-remunerated blood donors; FRD = family replacement donors.

RESULTS

From January 2011 to the end of March 2016, 8531 potential blood donors were registered at Tungaru Central Hospital. The numbers of potential donors and those who were deferred each year from 2011 to 2015, stratified by VNRBD, FRD and type of blood donor status unknown, are shown in Table 2. Some of the data for 2013 and 2014 were incomplete due to missing registers. Despite the incomplete data, the proportion of VNRBD was low throughout the 5 years, although in 2015 it increased to 13% of all potential blood donors. In the first 2 years, the proportion with unknown type of donor status was respectively 28% and 33%, but this declined, and in 2015 it was 6% of all potential blood donors. There was a steady increase in all deferrals from 2012 to 2015; this was the same for those who were VNRBD and FRD. Although there were few donors with no type of donor status recorded from 2013 to 2015, the proportion deferred was high, ranging from 50% to 89%.

The characteristics of all potential blood donors and those who were deferred during the study period are shown in Table 3. For sex, age and type of donor, there was a large amount of missing data. Where data were available, there was a significantly higher proportion of females being deferred ($P < 0.001$). Similar proportions were deferred between the three main eligible age groups. Sixty potential blood donors were either too young (age <18 years) or too old (age >50 years) to give blood, and 62% of these were deferred. A significantly higher proportion of VNRBD than FRD were deferred ($P < 0.001$).

Reasons for deferral amongst those deferred are shown in Table 4. Over 50% were deferred as a result of the initial medical questionnaire. Of the 26% who were deferred because of low Hb (<12.0 g/dl) and/or high WBC ($\geqslant 11.0 \times 10^9$/l), the reason was mainly high WBC. Of the 21% who were deferred because of a positive viral or bacterial serological test result, positive HBsAg and/or syphilis serology were the predominant causes. Table 5 shows the different reasons for deferral in VNRBD and FRD. A significantly higher proportion of VNRBD were deferred at the first step, through the medical questionnaire, and a significantly higher proportion of FRD were deferred at the second step, due to anaemia and/or high WBC. Both the VNRBD and the FRD deferrals were similar with respect to positive viral and/or bacterial serological test results.

DISCUSSION

This is the first study from Kiribati to assess the profile of potential blood donors, the proportions deferred and the reasons for deferral over a 5-year period. There were some important findings. First, although Kiribati agreed to the WHO recommendations in 2009 to increase the proportion of the VNRBD, this proportion remained low, and, although it increased in 2015, it still only reached 13%. It is difficult to find recently published information about the rates of VNRBD amongst blood donors from other countries. In Egypt, only 12% of a cohort of 17 000 donors screened in 2010–2011 were VNRBD.[10] In Guangdong Province, China, however, where blood donations increased by nearly 40% between 2006 and 2014, the proportion of FRD had decreased from 40% to 20%.[11] We can find no recent information from the Pacific region about trends in blood donor status during the last 5 years to compare with our findings.

TABLE 3 Characteristics of all potential blood donors and those deferred* at Tungaru Central Hospital, Tarawa, Kiribati, January 2011–March 2016

Characteristics	Potential blood donors *n*	Potential blood donors who were deferred *n* (%)
All blood donors	8531	4050 (47)
Sex		
Male	6717	2873 (43)
Female	1426	848 (59)
Not recorded	388	329 (85)
Age, years		
<18	25	19 (76)
18–28	5928	2732 (46)
29–39	1482	653 (44)
40–50	522	235 (45)
>50	35	18 (51)
Not recorded	539	393 (73)
Type of blood donor		
FRD	6565	2902 (44)
VNRBD	615	347 (56)
Status not recorded	1351	801 (59)

*Not allowed to donate blood.
FRD = family replacement donors; VNRBD = voluntary non-remunerated blood donors.

TABLE 4 Reasons for deferral* amongst all donors deferred at Tungaru Central Hospital, Tarawa, Kiribati, January 2011–March 2016

Characteristics	*n* (%)
All deferrals	4050
First step	
Deferrals due to exclusion criteria in medical questionnaire	2145 (53)†
Second step	
Deferrals due to Hb < 12.0g/dl and/or WBC ⩾ 11.0 × 10^9/l	1054 (26)†
Hb < 12.0 g/dl	247‡ (23)§
WBC ⩾ 11.0 × 10^9/l	836‡ (77)§
Third step	
Deferrals due to positive viral and/or bacterial blood test	851 (21)†
Positive HBsAg serology	633¶ (74)#
Positive syphilis serology	224¶ (26)#
Positive HIV serology	5¶ (<1)#
Positive HCV serology	2¶ (<1)#

*Not allowed to donate blood.
†Denominator is total number of deferrals (*n* = 4050)
‡29 donors had both Hb < 12.0 g/dl and WBC ⩾ 11.0 × 10^9/l.
§Denominator is number of deferrals due to Hb < 12.0 g/dl and WBC ⩾ 11.0 × 10^9/l (*n* = 1083).
¶12 donors had both positive HBsAg serology and positive syphilis serology; 1 donor had both positive syphilis serology and positive HCV serology.
#Denominator is number of deferrals due to positive viral or bacterial blood test (*n* = 864).
Hb = haemoglobin; WBC = white blood cell count; HBsAg = hepatitis B surface antigen; HIV = human immunodeficiency virus; HCV = hepatitis C virus.

Second, the total number of potential blood donors deferred during this 5-year period increased steadily from 2012 to 2015; this increase was apparent in both FRD and VNRBD. Moreover, when analysing all the blood donors together, there were significantly more deferrals in the VNRBD compared with the FRD group. A strong reason for advocating for VNRBD is that these donors have a lower prevalence of transfusion-transmissible infections than FRD,[2] so our results may seem surprising. There are, however, other reasons for potential blood donors being deferred, and in Kiribati these included failing the medical questionnaire assessment, being anaemic or having a high WBC. Anaemia might be one reason why more females were deferred in our study compared with males; this observation has been reported elsewhere.[12] In our study, a further reason for deferral was that some people registering for potential blood donation were in fact not eligible due to age restrictions (age <18 years or >50 years).

Third, of those who underwent serological tests for transfusion-transmissible infections, the most common reasons for deferral were being HBsAg-positive and/or positive for syphilis. These findings are in line with reports from countries where HIV is not endemic.[13,14]

Finally, there were differences between VNRBD and FRD in reasons for deferral, with more VNRBD deferred due to the medical questionnaire and more FRD deferred due to anaemia or high WBC. There were no differences with respect to transfusion-transmissible infections.

The strengths of this study were the large number of blood donors referred from different parts of South Tarawa, an island inhabited by half the population of Kiribati, and as such we feel that the results are probably representative of blood donor practices in the country. The conduct and reporting of our study ad-

TABLE 5 Reasons for deferral* amongst VNRBD and FRD deferred at Tungaru Central Hospital, Tarawa, Kiribati, January 2011–March 2016

	VNRBD	FRD	
Characteristics	*n* (%)	*n* (%)	*P* value
All deferrals	347 (100)	2902 (100)	
First step			
Deferrals due to exclusion criteria in medical questionnaire	223 (64)†	1570 (54)‡	<0.001
Second step			
Deferrals due to Hb < 12.0g/dl and/or WBC > 11.0 × 10^9/l	60 (17)†	745 (26)‡	
Hb < 12.0 g/dl	20§ (33) ¶	192# (25)**	
WBC > 11.0 × 10^9/l	41§ (67) ¶	575# (75)**	<0.001
Third step			
Deferrals due to positive viral and/or bacterial blood test	64 (19)†	587 (20)‡	0.43
Positive HBsAg serology	53 (83)††	424‡‡ (71)§§	
Positive syphilis serology	11 (17)††	165‡‡ (28)§§	
Positive HIV serology	0	4 (<1)§§	
Positive HCV serology	0	2‡‡ (<1)§§	

*Not allowed to donate blood.
†Denominator is total number of deferrals (*n* = 347).
‡Denominator is total number of deferrals (*n* = 2902).
§One donor had both Hb < 12.0 g/dl and WBC ⩾ 11.0 × 10^9/l.
¶Denominator is number of deferrals due to HB < 12.0 g/dl and WBC ⩾ 11.0 × 10^9/l (*n* = 61).
#22 donors had both Hb < 12.0g/dl and WBC ⩾ 11.0 × 10^9/l.
**Denominator is number of deferrals due to HB < 12.0 g/dl and WBC ⩾ 11.0 × 10^9/l (*n* = 767).
††Denominator is number of deferrals due to a positive viral or bacterial blood test (*n* = 64).
‡‡One donor had both positive syphilis serology and positive HCV serology; seven donors had both positive syphilis serology and positive HBsAg serology.
§§Denominator is number of deferrals due to a positive viral or bacterial blood test (*n* = 595).
VNRBD = voluntary non-remunerated blood donors; FRD = family replacement donors; Hb = haemoglobin; WBC = white blood cell count; HBsAg = hepatitis B surface antigen; HIV = human immunodeficiency virus; HCV = hepatitis C virus.

hered to the RECORD guidelines.[15] There were some limitations related to the operational nature of the study, using routinely collected secondary data. There were large numbers of missing data for sex, age and type of blood donor status, although this had improved by 2015 compared with earlier years. There were also registers missing for 2013 and 2014. Finally, we included donors who returned on more than one occasion to donate blood, as their donation status could change from one visit to the next.

There are a number of implications for the blood donation practices in Kiribati. First, given the small proportion of VNRBD and the fact that deferrals were higher in this group than for FRD, there is a case for encouraging both types of donor in Kiribati. A recent review provided compelling evidence that VNRBD are no safer than FRD and that only repeat donation provides improved blood safety.[16] Further studies have confirmed that FRD are no different from VNRBD, that they may be more directly motivated and that they constitute a legitimate and important source for improving blood supplies in resource-poor countries.[17,18] Second, given the large amount of missing data, especially for blood donor status, there is an important and urgent need to improve documentation and coding. The system in the Tungaru Central Hospital BBL is now electronic, and the issue of the missing registers should not recur. The electronic system needs strengthening, however, and reliable data back-up systems are essential. Finally, we need to understand more about why half the donors who are deferred are excluded at the first step through the medical questionnaire, and whether donors with high WBC are a potential threat for donation.

In conclusion, this 5-year study in Kiribati has shown that despite WHO recommendations, the proportion of VNRBD is low and deferrals are higher than among FRD. There is a strong case for encouraging both types of donor in the country.

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Contexte : Banque du sang de l'hôpital central de Tungaru, Kiribati.
Objectif : Déterminer les caractéristiques, exclusions et motifs d'exclusion parmi les donneurs de sang de 2011 à 2016.
Schéma : Etude transversale basée sur des données recueillies en routine.
Résultats : Il y avait 8531 donneurs de sang potentiels enregistrés entre janvier 2011 et mars 2016. Pour chaque année, la proportion de donneurs de sang bénévoles non rémunérés (VNRBD) a été inférieure à 10%, en dehors d'une augmentation à 13% en 2015. La proportion de donneurs de sang qui ont été exclus a augmenté chaque année au cours des 5 années de l'étude, de 44% à 57%, avec une augmentation similaire des exclusions chez les VNRBD et les donneurs de remplacement familiaux (FRD). Si l'on considère l'ensemble des donneurs, une plus grande proportion de femmes que d'hommes (59% contre 43%) et de VNRBD comparés aux FRD (56% contre 44%) ont été exclus ($P < 0{,}001$). Les exclusions ont été causées par un rejet lié aux réponses au questionnaire médical (53%), une anémie et/ou un nombre élevé de globules blancs (26%) ou une infection transmissible par la transfusion (21%). Davantage de VNRBD ont été refusés à cause du questionnaire médical, plus de FRD ont été rejetés à cause d'une anémie et/ou d'un nombre de globules blanches trop élevé et les exclusions ont été similaires en ce qui concerne les infections transmissibles par transfusion.
Conclusion : Cette étude sur 5 ans a montré que la proportion de VNRBD était faible et que les exclusions y étaient plus fréquents que chez les FRD. Il y a là un motif sérieux pour encourager les deux types de donneurs dans le pays.

Marco de referencia: El laboratorio del banco de sangre del Hospital Central de Tungaru, en Kiribati.
Objetivo: Determinar las características de los donantes, la frecuencia de los aplazamientos y sus razones en las donaciones de sangre realizadas del 2011 al 2016.
Método: Un estudio transversal a partir de los datos recogidos en la práctica corriente.
Resultados: Se registraron 8531 posibles donantes de sangre de enero del 2011 a marzo del 2016. En cada año completo, la proporción de donantes de sangre voluntarios no remunerados (VNRDB) fue inferior al 10%, pero en el 2015 aumentó al 13%. La proporción de donantes aplazados aumentó cada año durante los 5 años de 44% a 57% y el aumento de los aplazamientos fue equivalente en los VNRDB y los donantes familiares o de sustitución (FRD). Al considerar todos los donantes de sangre, se observó una mayor proporción de aplazamientos de mujeres que de hombres (59% contra 43%) y de VNRDB que de FRD (56% contra 44%; $P < 0{,}001$). Las causas del aplazamiento fueron el resultado del cuestionario médico (53%), la presencia de anemia o leucocitosis (26%) y las infecciones transmisibles mediante transfusión (21%). Los VNRDB se aplazaron con mayor frecuencia por causa del cuestionario médico y los FRD por anemia o leucocitosis; los aplazamientos por riesgo de transmisión de infecciones fueron equivalentes en ambos grupos.
Conclusión: El presente estudio de 5 años reveló una baja proporción de VNRDB y puso en evidencia que los aplazamientos son más frecuentes en este grupo que en los FRD. Existen argumentos sólidos que respaldan la promoción de ambos tipos de donantes en el país.

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