ASSESSMENT OF A SELF-DEFERRAL FORM FOR SCREENING BLOOD DONORS, CHIANG MAI UNIVERSITY HOSPITAL, THAILAND

Lakkana Thaikruea[1], Niwes Nantachit[2], Nipapan Leetrakool[3], Ladda Fongsatitkul[3], Prakai Sompan[3], Andrew Heaton[4] and Kenrad E Nelson[5]

[1]Department of Community Medicine, [2]Department of Internal Medicine, [3]Blood Bank Section, Faculty of Medicine, Chiang Mai University, Chiang Mai, Thailand; [4]Chiron Blood Testing, Emeryville, California, USA; [5]Department of Epidemiology, Bloomberg School of Public Health, Johns Hopkins University, Baltimore, Maryland, USA

Abstract. A self-deferral form has been used to screen Chiang Mai University Hospital blood donors and was improved in 2005. It has never been evaluated. The study aimed to assess the self-deferral form procedures in detecting infected donors. Sera from 5,083 donors, who passed the self-deferral screening form, were tested with the routine immuno-assays (serology) for HIV 1 and 2 antibodies, P24 antigen, HCV antibodies, HBV surface antigen, and syphilis. Antibody negative sera were also tested individually with the the Procleix Ultrio Assay for HIV-1 DNA, HCV RNA, and HBV DNA. The donors who had discrepant results between serology and NAT were evaluated with additional tests, including a more sensitive Alternative Nucleic Acid Test, AntiBcore IgM, AntiBcore IgG, HBsAg and Anti HBs. Among 5,083 donors, 331 (6.5%) had at least one positive marker. In multiple logistic regression analysis, the statistically significant factors (adjusted odds ratio and 95% CI) for infection were age 30 years or below [1.45 (1.03, 2.03)], male gender [2.73 (1.64, 4.56)], primary school or lower education [1.56 (1.09, 2.23)], first-time donation [1.82 (1.25, 2.67)], and frequent donation [0.80 (0.70, 0.92)]. The safest donors were females, older than 30 years, with an education more than primary school, and frequent donation. Because of missing responses to some sensitive questions, there remains a need for further improvement of the self-deferral form.

INTRODUCTION

Northern Thailand has experienced the most severe HIV/AIDS epidemic in the country (Weniger *et al,* 1991; Nelson *et al,* 1993) Maharaj Nakhon Chiang Mai Hospital of Chiang Mai University (CMU) is the largest medical school and has one of the largest blood banks in northern Thailand. There are approximately 25,000 blood donors per year. The majority of CMU blood donors are replacement donors. They have higher marker rates for HIV, HCV and HBV than those of the volunteer donors. The prevalence of HBsAg varied from 3.8% to 9.6% among male blood donors and 4.0 - 12.6% among female blood donors between 1990 and 2001 (Nantachit *et al,* 2003). Thaikruea *et al* (2004) conducted a matched case-control study among blood donors to determine risk factors for HCV infection. They found that a history of intravenous drug use (IDU) was strongly associated with HCV infection among blood donors. Other risk factors among donors without a history of IDU included histories of blood transfusion, immediate family with a history of hepatitis/jaundice, and six or more lifetime sexual part-

Correspondence: Dr Lakkana Thaikruea, Department of Community Medicine, Faculty of Medicine, Chiang Mai University, Chiang Mai 50200, Thailand.
Tel: 66-53-945471 to 4; Fax: 66-53-945476
E-mail: lthaikru@mail.med.cmu.ac.th

ners (Thaikruea *et al,* 2004). Generally, the donors who pass the screening self-deferral form should not have a history of IDU or other high risk exposures for transfusion-transmission diseases, such as HIV, HBV, HCV and syphilis. However, in this study the authors invited donors who passed screening with the self-deferral form to have a further face-to-face interview. Many donors who initially denied risk behaviors, such as IDU, admitted having these behaviors in the past during the in-depth follow-up interview after the serological screening results were available. Other studies have found that the residual risk for transfusion-transmission viral infection was linearly related to the incidence of HIV, HBV, HCV, and HTLV-I and II in repeat blood donors (Schreiber *et al,* 1996). The donors at high risk were more likely to have a high incidence rate of viral infections (Van den Burg *et al*, 1998). A self-deferral form is used to screen CMU blood donors to reduce the risk of transfusion associated infection. The screening form has 2 parts. The first part concerns the health status of the donor and is completed by the donor. The second part includes questions about high-risk behavior that may lead to transfusion-transmissible infections. The health personnel perform a face-to-face interview for this part. This was slightly improved in 2005 based on the findings of Thaikruea *et al* (2004), however, it has never been evaluated. This study aimed to assess the self-deferral form for detecting HIV/HBV/HCV/syphilis infection among blood donors who donated blood at the Blood Bank of Chiang Mai University Hospital.

MATERIALS AND METHODS

The study period was from April 2005 to February 2006. Eligible donors were those who signed the self-deferral form acknowledging that his/her information would be part of the study. Samples of 5,083 donors who passed the self-deferral screening process were tested with the current CMU Blood Bank's routine immuno-assays (serology) for HIV 1 and 2 antibodies (HIV), p24 antigen, HCV antibodies (HCV), HBV surface antigen (HBs Ag), and syphilis (EIA). The routine tests were the HIV 1/2 combitest (Abbott Labs, Abbott Park, IL), HCV-EIA-3rd generation test (Diagnostic Biotechnology, Singapore), HBsAg Auszyme EIA (Abbott Labs, Abbott Park, IL), HIV p24 antigen (Abbott Labs, Abbott Park, IL), and the VDRL carbon antigen EIA for syphilis (Cambridge, Bioscience, Cambridge, MA). Positive screening assays for HIV and HCV were repeated in duplicate and positive tests were evaluated with an EIA from another manufacturer. All donor samples were tested individually with the Procleix Ultrio Assay (NAT) for HIV-1 DNA, HCV RNA and HBV DNA. Donors who had discrepant results between serology and NAT were evaluated with additional tests, including the Chiron Target Capture HBV DNA assay, AntiBcore IgM, AntiBcore IgG, HBsAg, or Anti HBs. The Chiron Target Capture HBV DNA assay (Chiron Corp, Emeryville, CA) has a 95% detection limit of 2.2 IU/ml (1.5-5.5 IU/ml) and a 50% detection limit of 0.8 IU/ml (0.6-1.2 IU/ml) (Shyamada *et al*, 2004; Fong *et al*, 2006). The 95% detection limit for HBV DNA on the NAT assay has been reported to be 11 IU/ml (Koppelman *et al,* 2005; Brojer *et al,* 2006).

A donor was determined to have an infection when he/she had positive tests for HBV, HCV, HIV or syphilis by routine serological tests of the blood bank, NAT and/or additional tests as described above.

Data analysis

Descriptive analysis included chi-square tests, Fisher's exact tests, the Student's *t*-test, or Kruskal-Wallis tests according to the normality of the data with an alpha risk at 0.05%. The univariate risk ratio and 95% confidence interval (95% CI: lower, upper) for each potential factor were calculated. Unconditional logistic regression analysis was used to adjust for confounding. Statistical significance of

independent potential factors and potential confounding variables were assessed using likelihood ratio tests and/or Wald tests. Collinearity was assessed using the variance inflation factor. Step-wise selection was used to guide the selection of potential factors with alpha levels of 0.05 for entry and over 0.05 for removal. Model checking was conducted, including the Pearson's goodness of fit test. Data management and analyses were performed using Epi Info version 6 (CDC, Atlanta, GA) and STATA version 7 (Statacorp. 2001, Stata Statistical Software: release 7.0, College Station, TX: Stata Corporation).

RESULTS

Demographic characteristics of the participants

There were 5,083 blood donors. Of the 5,064 with a known age, the range was from 17 to 68 years old and the mean age was 30.11 years (SD 9.97 years). Most of them were males (82.2%). Almost half (48.4%) were single, 35.4% were married and 14.4% had an unknown marital status. The majority of donors had a high school level of education. About 58% were repeat donors. About 97% donated as replacement donors for relatives/friends (Table 1). There were 331 blood donors (6.5%) with HBV (5.7%), HCV (0.7%), HIV (0.3%), or syphilis (1.6%) (Table 1). First-time donors had a higher prevalence of infection than repeat donors (Table 2).

Table 1
Demographic characteristics and serological screening results of blood donors (*n*=5,083).

Characteristics	Number	Percent
Male gender	4,719	82.2
Marital status		
Single	2,458	48.4
Married	1,799	35.4
Widow/divorced	93	1.8
Unknown	728	14.4
Education		
Primary school	995	19.6
High school	1,709	33.6
University	1,344	26.4
Unknown	1,035	24.4
Occupation		
Employee	1,691	33.3
Student/jobless	891	17.5
Farmer	557	11.0
Others	1,944	38.2
Donor type		
Repeat	2,926	57.6
First time	1,995	39.2
Unknown	162	3.2
Reason for donation		
Replacement for relative/friend	4,392	97.0
Charity	138	2.8
Unknown	13	0.2
Hepatitis B viral infection	291	5.7
Hepatitis C viral infection	34	0.7
HIV infection	13	0.3
Syphilis infection	82	1.6

Table 2
Infections among first-time and repeat donors.

Infections	First-time donors		Repeat donors	
	Yes (%)	No (%)	Yes (%)	No (%)
HIV	8 (0.4)	1,987 (99.6)	5 (0.2)	2,921 (99.8)
HBV	162 (8.1)	1,833 (91.9)	107 (3.7)	2,818 (96.3)
HCV	22 (1.1)	1,973 (98.9)	10 (0.3)	2,916 (99.7)
Syphilis	41 (2.1)	1,954 (97.9)	41 (1.4)	2,885 (98.6)

Table 3
Association between potential factors and infection (HBV, HCV, HIV, syphilis) in blood donors.

Factors	Total	Infection with Yes answer (%)	Infection with No answer (%)	Relative risk (95% confidence interval)
Male gender	5,075	298 (7.1)	33 (3.7)	1.94 (1.37, 2.77)[a]
Primary school versus higher education	4,047	91 (9.1)	186 (6.1)	1.50 (1.18, 1.91)[a]
First-time donor	4,920	193 (9.7)	126 (4.3)	2.25 (1.81, 2.79)[a]
Donated for relative/friend	5,069	328 (6.7)	1 (0.7)	9.18 (1.30, 64.89)[b]
Frequency of donation [median number of times (range)]	4,006	1 (1, 9)	2 (2, 65)	p-value < 0.001[c]
Ever been refused or asked not to donate blood	887	4 (21.1)	48 (5.5)	3.81 (1.53,9.49)[d]
Had tattoo/ear or body piercing/acupuncture (not by physician) within 1year	5,076	8 (13.6)	322 (6.4)	2.11 (1.10,4.06)[c]

[a]Chi-square p-value < 0.001; [b]Chi-square p-value < 0.01; [c]Kruskal-Wallis test for two groups; [d]Fisher's exact test p-value < 0.05

Table 4
Multiple logistic regression analysis of relationship between potential factors and viral infection (HBV, HCV, HIV, syphilis) in blood donors.

Factors	Adjusted odds ratio	95% Confident interval[a] lower, upper
Age ≤ 30 years	1.45	1.03, 2.03
Male gender	2.73	1.64, 4.56
Primary school education	1.56	1.09, 2.23
First-time donation	1.82	1.25, 2.67
Frequency of donations	0.80	0.70, 0.92

[a]p-value < 0.05

Univariate analysis

There were 5,082 donors with available data for evaluating factors associated with infection, since one donor had an indeterminate result. The potential factors that were statistically associated with having infection were male gender [RR (95%CI) = 1.94 (1.37, 2.77)], had a primary school education or less [1.50 (1.18, 1.91)], were a first-time donor [2.25 (1.81, 2.79)], replacement donor (donated for a relative/friend versus volunteer) [9.18 (1.30,64.89)], had a history of being refused or asked not to donate blood [3.81 (1.53,9.49)], and had a history of a tattoo/ear or body piercing/acupuncture done by a non-physician within 1 year [2.11 (1.10,4.06)] (Table 3). The factor that was statistically associated with absence of an infection was frequent donation (p-value < 0.001) (Table 3).

The factors that were not statistically associated with viral infection were: the donor's belief that his/her blood was not safe for transfusion, drinking alcohol within 12 hours of donation, a history of close contact with a person with jaundice or a carrier of hepatitis, a history of having sex with a same gender/prostitute/illicit drug user within 6 months, a history of snorting illicit drugs, a history of

using a needle to inject an illicit drug, a history of being held in a jail/prison, a history of having an operation and a history of having a blood/blood product transfusion within one year.

Multivariate analysis

The variables included in the unconditional logistic regression analysis were age (≤30 versus >30 years), gender (male versus female), education (primary school versus higher), first-time donor (first time versus repeated donor), reason for donation (replacement versus volunteer), frequency of donation (number), and tattooing/body piercing (yes/no). No colinearity was found. A stepwise regression analysis was done using a log likelihood ratio at >0.05 probability of removing and 0.05 probability of entering. The potential factors left in the model which were statistically significant were gender, education, first-time donor, and frequent donations. The donors age 30 years or below, having male gender, having had a primary school or lower education, and first-time donation were 1.45 times, 2.73 times, 1.56 times, and 1.82 times more likely to be infected. The factor which had a negative association with infection was a history of frequent donations [0.8 (0.70, 0.92)]. The greater the number of donations, the less likely they had infection (Table 4). Model checking was conducted and the p-value of the Pearson's goodness of fit test was 1.00.

DISCUSSION

The majority of CMU blood donors were replacement donors. They had higher marker rates for HIV, HCV and HBV than those of volunteer donors. The prevalence of HBsAg varied from 3.8-9.6% among male blood donors and were 4.0 to 12.6% among female blood donors between 1990 and 2001 (Nantachit *et al,* 2003). The CMU blood bank has used a self deferral form and improved it in 2005. The main propose of using a self deferral form is to reduce the risk of a transfusion transmitted infection by transfusing blood from a donor who is at high risk for infection. Historically, the risk for transfusion transmitted infection has been reduced substantially by excluding high risk donors, such as men who have sex with men or injection drug users. Therefore donor screening by questionnaire has become a common and usual practice to improve transfusion safety in blood banks throughout the world. The objective of this study was to assess a self-deferral form in detecting possible infected donors after a sensitive NAT assay has been implemented for donor screening. Our study found a rate of 6.5% of transfusion-transmitted infections among donors at CMU hospital. This rate is probably significantly lower than that in the general adult population of northern Thailand, but it is higher than among blood donors in western developed countries. Blood collection facilities in Thailand attempt to exclude IDUs, however donor questionnaires generally focus on current behavior or those in the past year or past 3 years (Mundee *et al,* 1995; Laosombat *et al,* 1997; Apichartpiyakul *et al,* 1999). However, more remote injection behaviors are significant risk factors for current HCV, HIV, or HBV infection. Based on univariate analysis, the potential factors statistically associated with having infection were male gender, low education, first-time donor, and being a replacement donor. These factors were similar to other studies in the literature. (Conry-Cantilena *et al,* 1996; Delage *et al,* 1999; Murphy *et al*, 2000; Terrault, 2002). A history of ever having been refused or asked not to donate blood and a history of a tattoo/ear or body piercing/acupuncture done by a non-physician within one year were also statistically associated with having infection. Tattooing was found to be a risk factor for HCV infection among donors in northern Thailand (Thaikruea *et al,* 2004). Although these factors were removed from the model in multivariate analysis, they should be

considered for donor screening in Thailand. Those who answered "yes" to the question "history of ever been refused" should be excluded from donation. They are 9 times more likely to have infection (Table 3). Frequent repeat donors have also been found to have a lower risk of infection in other studies (Usha *et al,* 2001). The donors without infection had higher numbers of donations than those of donors with infection.

Infected donors who passed the self deferral forms may have under reported their risk behaviors, not recognized their risk, not read the self deferral form thoroughly, were not aware of the risks for infection, or ignored their risks (Usha *et al,* 2001; Hakiza *et al*, 2003). Hakiza *et al* (2003) surveyed 34,726 allogeneic donors. They provided donor educational materials and found that even though 78% reported reading all the material, most donors indicated only skimming the forms. Some high risk donors may still continue donating in spite of the educational materials. Usha *et al* (2001) surveyed 92,581 blood donors (57% responded). They found that 60% of donors knew the screening tests might not detect a recent infection and 37% either did not know or felt it was acceptable to donate blood to obtain HIV testing (Usha *et al,* 2001).

The main limitation of this study was the cross-sectional design. Thus, we cannot guarantee that risk behavior occurred prior to infection. The advantages of this study were that it was inexpensive to perform and could be done in a short period of time. The false positive test results may be less than in studies that determined infection status based on routine screening tests without NAT and had no follow-up.

Based on our findings, the donors who admitted high risk behaviors when filling out the self deferral form should not donate blood. The high risk behaviors included histories of IDU and having been refused or asked not to donate blood. Further studies should be performed to evaluate the knowledge and test-seeking of the donor and cost effectiveness of the self deferral form.

In conclusion, preferable donors are female and those with a history of frequent donations. History of tattooing/body piercing or ever having been refused/asked not to donate blood should probably be added as exclusion criteria.

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