Hepatitis B and C infection in first-time blood donors in Karachi – a possible subgroup for sentinel surveillance

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العدوى بالتهاب الكبد "بي" و"سي" بين المتبرعين بالدم لأول مرة في كراتشي – بوصفهم فئة فرعية محتملة للترصُّد المَخْفَري

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الخلاصة: يشكِّل فيروس التهاب الكبد "بي" و"سي" مشاكل صحية كبرى مثيرة للقلق في باكستان. وقد أجرى الباحثون في هذه الدراسة تحليلاً أساسياً للمتبرعين بالدم لأول مرة في بنك الدم في مركز « جناح » الطبي للدراسات العليا في عام ألفَيْن، بهدف إجراء ترصد مخفري منخفض التكاليف للعدوى بهذين الفيروسَيْن. وبيَّنت الدراسة أن 264 من المتبرعين من أصل 7325 متبرعاً (أي نسبة 3.6٪) إيجابيون لأضداد الفيروس "سي"، وأن 344 من المتبرعين (أي نسبة 4.7٪) إيجابيون للمستضدّ السطحي لفيروس التهاب الكبد "بي". وكان الانتشار المصلي لمضادات التهاب الكبد "سي" مترابطاً ترابُطاً إيجابياً يُعْتَدُّ به إحصائياً، بالعمر وبانخفاض مستوى التعليم. كما كانت العدوى بفيروس التهاب الكبد "بي" أكثر انتشاراً بشكل يُعْتَدُّ به إحصائياً بين المتحدثين باللغة السندية أو غيرها من اللغات المحدودة الاستخدام. وخلصت الدراسة إلى أن بيانات بنك الدم يمكنها أن تقدِّم معلومات موثوقة لرصد الاتجاهات والتغيُّرات في انتشار هذه العدوى بين المواطنين البالغين الأصحّاء.

ABSTRACT Hepatitis B virus (HBV) and C virus (HCV) are major public health concerns in Pakistan. We conducted a baseline analysis of first-time replacement blood donors at the blood bank of Jinnah Postgraduate Medical Centre in the year 2000 with the view to developing low-cost sentinel surveillance for these infections. Among 7325 such donors, 264 (3.6%) were positive for anti-HCV and 344 (4.7%) for HBsAg. HCV seroprevalence was significantly positively associated with age and lower education. Those speaking Sindhi or other minor languages had a significantly higher prevalence of HBV infection. Blood bank data could provide reliable information to monitor trends in prevalence of these infections.

Infections par les virus des hépatites B et C chez des nouveaux donneurs de sang à Karachi – sous-groupe possible pour la surveillance sentinelle

RÉSUMÉ Les virus des hépatites B et C (VHB, VHC) constituent des préoccupations de santé publique majeures au Pakistan. Nous avons effectué en 2000 une analyse de base parmi les nouveaux donneurs de compensation à la banque de sang du Centre hospitalo-universitaire pour les spécialités médicales de Jinnah en vue de mettre en place une surveillance sentinelle à faible coût pour ces infections. Sur 7325 donneurs, 264 (3,6 %) étaient positifs pour les anticorps anti-VHC et 344 (4,7 %) pour l'Ag HBs. La séroprévalence du VHC était associée de façon positive et statistiquement significative avec l'âge et un niveau plus faible d'instruction. Chez les personnes parlant le sindhi ou d'autres langues minoritaires, la prévalence de l'infection par le VHB était significativement plus élevée. Les données de la banque de sang ont permis de fournir des informations fiables pour suivre les tendances de la prévalence de ces infections.

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Received: 01/08/04; accepted: 04/04/05

Introduction

Bloodborne pathogens like hepatitis B virus (HBV), hepatitis C virus (HCV) and human immunodeficiency virus (HIV) are considered major but preventable public health problems in the developing world [*1,2*]. Routes of transmission include unsafe injections, blood, sex and transmission from infected mothers to their babies. In Pakistan, national efforts have been made to reduce potential transmission of HBV, HCV and HIV infection, e.g. HBV vaccination programmes, public health education programmes on safe sex, blood and injection practices, and legislation to standardize and ensure safety in blood banks [*3,4*]. A common element of these programmes and initiatives is a baseline situation analysis using routine surveillance data, or data from surveys or studies, typically followed by a repeat analysis to determine if any change has occurred as a result of an intervention [*5*].

The ideal public health approach to disease prevention and control is to use routine population-based surveillance data to: i) monitor the magnitude and distribution of disease; ii) identify high-risk subgroups; iii) guide national strategic plans for prevention and control; iv) evaluate intervention efforts [*5,6*]. UNAIDS recommends second-generation surveillance for HIV infection, a kind of behavioural and biological surveillance, to explain any trends in biological surveillance and to identify where HIV sentinel surveillance should be focused [*7*]. However, establishing a broad surveillance system requires an ongoing commitment to and allocation of significant financial, logistical and technical resources, which may be difficult for developing countries. Alternatively large-scale cross-sectional surveys can provide prevalence information and categorize risk factors and risk groups; however, these may also be difficult to conduct in resource-poor settings and may need to be repeated [*8*]. Small or *ad hoc* studies are sometimes used in the absence of sound epidemiological data as a basis for planning, monitoring and evaluation. Comparisons of such studies by person, place and time are difficult as study designs are not standardized and often lack scientific rigor. While population-based surveillance may not always be feasible, sentinel surveillance of selected subgroups can serve as a cost-effective and viable alternative. For bloodborne pathogens such as HCV, HBV and HIV sentinel groups often include blood donors, antenatal clinic attendees, commercial sex workers and military recruits [*8,9*]. Sentinel surveillance is based on selected population samples chosen to represent the relevant experience of particular groups.

In Pakistan, both HBV and HCV pose major risks as bloodborne pathogens, while an outbreak of HIV infection among injecting drug users has recently been reported in Larkana, Sindh [*10*]. Widespread practices such as unsafe injections, improper disposal of hazardous waste, recycling of used syringes without proper sterilization, sharing of needles by injecting drug users and unsafe sex are believed to facilitate the transmission of these infections, resulting in high prevalence rates in the country [*11–14*]. No large-scale surveillance data for these diseases currently exist. Small surveys and studies have estimated prevalence with a wide range of variation [*9,12–16*]. Given the paucity of surveillance data in Pakistan, blood donors are an excellent subgroup for sentinel surveillance of bloodborne pathogens to determine trends in prevalence and disease distribution defined on social, demographical, geographical, and biological variables.

We therefore conducted a baseline analysis of blood donors at the Jinnah Post-

graduate Medical Centre (JPMC) as part of a pilot phase to develop a sentinel surveillance system for HBV, HCV and HIV infections. Similar analyses are expected to follow of data in subsequent years to allow comparisons based on time, place and person to determine trends and evaluate interventions.

Methods

JPMC is a federally administered tertiary care facility located in Karachi, the largest city (approximate population 12 million) and economic centre of Pakistan. It houses 1100 hospital beds, and services patients in the low to middle socioeconomic bracket, primarily from Sindh province although not exclusively. As a public sector hospital, it provides free medical care services.

All first-time replacement blood donors (between 17 and 65 years of age) who donated blood at JPMC blood bank in the year 2000 (1 January to 31 December) specifically for their family or their community members were included in the study. All repeat blood donors and voluntary blood donors were excluded from the study because they differ from first-time replacement donors in that first-time donors are ignorant of their bloodborne infection status before donation of blood. As a policy of the JPMC blood bank, commercial blood donors are excluded from all kinds of blood donations.

All donors were first screened by use of a structured questionnaire. Data collected included information on age, sex, highest educational level achieved, number of donations, place of residence, and donor type, i.e. voluntary or replacement (commercial donors are routinely excluded). Information on mother tongue was also sought to explain geographical variation of blood-transmitted infections in the country [*9*].

Donors who fulfilled the inclusion criteria were tested for HBV, HCV and HIV infection using HBV surface antigen (HBsAg) (Biotech Laboratories Ltd., United Kingdom), antibodies to HCV (anti HCV) (BioChem ImmunoSystems Inc., Canada) and antibodies to HIV (anti HIV) (Trinity Biotech plc, Ireland). Samples positive for any of the above were re-tested. Samples repeatedly reactive for anti-HIV were confirmed according to the national protocol (positive by 3 methodologically different tests); samples repeatedly reactive for HBsAg or anti-HCV were considered positive for HBV and HCV respectively.

Occupational groups were defined and categorized arbitrarily into 3 major groups, representing 3 major occupations in the country. Unclassified groups were placed in another category.

- Group I: professional/health care provider
- Group II: uniformed (e.g. armed forces, police)/skilled worker
- Group III: agriculture worker/labourer
- Group IV: others (student/housewife/unemployed).

For education, the highest level reached in religious schools (*madressahs*) was included in the equivalent level for government schools. Numbers may not add to 100% owing to rounding errors. Missing observations were omitted from analyses.

Data were coded and entered in *Epi-Info* and *SPSS*, version 10 for frequencies and univariate analysis.

Results

During 2000, there were 7325 first-time replacement donors at JPMC, 7168 (97.9%) male and only 157 (2.1%) female (Table 1). The majority (7105, 97.0%) was from Sindh province, with approximately 90% from

Table 1 **Anti-HCV and HBsAg in first-time replacement blood donors at Jinnah Postgraduate Medical Centre, 2000**

Variable	No. tested (%) (*n* = 7325)	Anti-HCV		HBsAg	
		% reactive	OR (95% CI)	% reactive	OR (95% CI)
Age group (years)					
17–20	1553 (21.2)	1.9	1.0	4.9	1.0
21–30	4127 (56.3)	3.6	1.90 (1.28–2.83)*	4.6	0.93 (0.71–1.22)
31–40	1294 (17.7)	5.0	2.69 (1.73–4.17)*	5.5	1.13 (0.81–1.57)
41–50	250 (3.4)	5.6	3.01 (1.57–5.76)*	2.4	0.48 (0.21–1.11)
51–65[a]	25 (0.3)	0		4.0	
Missing[b]	76 (1.0)				
Sex					
Male	7168 (97.9)	3.6	1.0	4.7	1.0
Female	157 (2.1)	3.2	0.89 (0.32–2.27)	5.7	1.2 (0.59–2.53)
Education					
None	3092 (42.2)	4.4	1.0	5.3	1.0
Up to primary	249 (3.4)	3.6	0.82 (0.41–1.62)	5.2	0.98 (0.55–1.76)
Up to secondary	2590 (35.4)	3.4	0.76 (0.58–1.01)	4.2	0.79 (0.62–1.01)
More than secondary	1370 (18.7)	2.0	0.44 (0.29–0.66)*	4.1	0.76 (0.56–1.04)
Missing[b]	24 (0.3)				
Profession/employment					
Group I: professional/ health care provider	572 (7.8)	4.2	1.0	3.0	1.0
Group II: uniformed/ skilled worker	2325 (31.7)	3.4	0.80 (0.50–1.28)	5.0	1.73 (1.03–2.90)*
Group III: agriculture worker/labourer	2975 (40.6)	4.3	1.04 (0.66–1.62)	4.5	1.53 (0.92–2.55)
Group IV: others (student/ housewife/unemployed)	925 (12.6)	1.6	0.38 (0.20–0.73)*	5.3	1.83 (1.04–3.20)*
Missing[b]	528 (7.2)				
Mother tongue					
Urdu	2938 (40.1)	1.7	1.0	3.6	1.0
Sindhi	979 (13.4)	5.6	3.44 (2.33–5.08)*	6.2	1.78 (1.28–2.45)*
Punjabi	1042 (14.2)	4.8	2.91 (1.95–4.34)*	4.5	1.26 (0.89–1.80)
Pushto	1056 (14.4)	5.6	3.42 (2.33–5.02)*	4.5	1.27 (0.90–1.80)
Baluchi	292 (4.0)	3.8	2.26 (1.16–4.39)*	10.3	3.06 (2.00–4.68)*
Hindco	379 (5.2)	5.0	3.05 (1.78–5.23)*	4.7	1.33 (0.80–2.22)
Saraiki	223 (3.0)	2.7	1.60 (0.68–3.77)	7.6	2.21 (1.30–3.75)
Other	394 (5.4)	2.8	1.66 (0.86–3.21)	3.6	0.98 (0.56–1.74)
Missing[b]	22 (0.3)				

[a]Excluded from analysis owing to small numbers.
[b]Missing observations excluded from analysis.
****Significant at P < 0.05.***
OR = odds ratio, CI = confidence interval.

Karachi. Where age was determined, over half (4127, 56.3%) were 21–30 years, 1553 (21.2%) were 17–20 years, 1294 (17.7%) were 31–40 years, and < 5% were 41 years and over. Approximately 2 out of 5 donors had no education (42.2%); a few (3.4%) had up to primary level schooling only. However, 2590 (35.4%) had some secondary schooling, and 1370 (18.7%) had higher than secondary schooling. Urdu as mother tongue was reported by 2938 (40.1%) donors, the national language; the major regional languages identified were Sindhi 979 (13.4%), Punjabi 1042 (14%) and Pushto 1056 (14.2%); 894 (12%) spoke minor regional languages.

Donors were employed mostly as agriculture workers/labourers (Group III) 2975 (41%); 2325 (32%) were uniformed/skilled workers (group II) and 572 (8%) were professionals/health care providers (group I); 925 (13%) were grouped as others (Group IV), which comprised a heterogeneous group of students, housewives and currently unemployed donors.

Among all first-time replacement donors, 264 (3.6%) were positive for anti-HCV, 344 (4.7%) for HBsAg and 59 (0.8%) positive for both. One first-time replacement donor (0.01%) was positive for HIV infection.

Prevalence of HCV infection in group IV (1.6%) was significantly lower than the baseline group I (4.2%), while prevalence of HBV infection in group II (5.0%) and group IV (5.3%) was significantly higher than the baseline group I (3.0%).

Based on the chi-squared test, anti-HCV seroprevalence was directly related to age. Also, persons with above secondary schooling had a lower prevalence compared with those with no schooling. Where mother tongue was any language other than Urdu, anti-HCV prevalence was higher. In contrast, for HBsAg prevalence, there was no difference between age groups or education levels. Only those whose mother tongue was Sindhi or a minor language had a higher prevalence level compared to those whose mother tongue was given as Urdu.

Discussion

Our results confirm HBV and HCV as high priority concerns in Pakistan. For HCV, prevalence clearly increased with age and decreased with higher education level. Mujeeb reported that exposure to unsafe injections also increased with age as the total number of injections increased per person per year [*17*].

At JPMC, first-time replacement donors can be characterized as mainly young adult males (> 75%, 17–30 years old), with 45% having up to primary-level schooling. The most frequent employment given was that of an agriculture worker/labourer (41% overall). These results reflect not only the socioeconomic sector that JPMC serves, but also the working population of Pakistan as a whole.

If educational level is taken as a proxy marker for socioeconomic status, higher prevalence of HCV among the less educated suggests a higher vulnerability to infection in these subgroups. Earlier studies have established a linkage between unsafe injection practices with high prevalence of HCV [*13,14*]. There was no comparable relationship between HBV infection and age group and education. Earlier, Zuberi reported an 8% prevalence of HBsAg in pregnant women. Among them, 21% were HBeAg positive [*18*], suggesting possible early childhood transmission of hepatitis B infection in the country. One first-time replacement donor was found positive for HIV confirming a low prevalence of HIV in the blood donor population.

A statistically significantly higher seroprevalence of HCV was found in those speaking any other language compared to Urdu, concurring with findings of earlier studies suggesting a high prevalence of HCV infection in the semi-rural part of Karachi which has a high proportion of the non-Urdu speaking population [*9*]. HBV prevalence was higher in people speaking Sindhi or a minor language versus Urdu. These variations of HBV and HCV infections among different linguistic groups are interesting findings and demand further studies. They suggest some confounding effect of perhaps mean age, low socioeconomic status, education level, etc.

The different prevalence rates of HCV infection among different professional groups seems to suggest more the over all age group, linguistic background and literacy level rather then the profession itself.

Blood donors are not considered representative of the general population, as exclusion criteria such as age, behaviour and disease history limit participation, and social, cultural, medical and biological factors limit women's participation in blood donation. Fist-time family blood donors also suffer similar kinds of biases, but to a lesser extent particularly with regard to hepatitis B and C infection, mainly for 2 reasons. First, these 2 infections have a prolonged asymptomatic phase of illness and first-time family blood donors remain ignorant about the disease until they donate blood and are thus diagnosed for these blood-transmitted infections. Second, the prevalent routes of transmission of these 2 infections in the country are unsafe injection and blood transfusion practices and from infected mothers to their babies, which allows categorization of "high-risk donors" [*3,11–14*]. For HIV infection, however, unsafe sex is the most common mode of transmission [*3,4*], which can easily be assessed by the donors themselves who can voluntarily withdraw from donation if they have had unsafe sex in the previous 3 months. Therefore, first-time family blood donors may not be dissimilar to other blood donors and consequently not a suitable population for any assessment HIV infection among the general population.

In light of these limitations, first-time family blood donors, as well as other kinds of blood donors, may not seem suitable for sentinel surveillance for the healthy adult population. However, considering the ready availability of stable and reliable data and the low impact of selection bias for hepatitis B and C infection, first-time blood donor data can effectively be used to monitor the trend of these infection and impact of intervention programmes in the healthy adult general population.

Although in Pakistan both HCV and HBV are diseases of public health importance, no large-scale systematic epidemiological or surveillance data are available for these diseases. In the absence of national epidemiological surveys, a selection of blood banks throughout Pakistan could serve as sentinel centres for serosurveillance of HBV and HCV infection. Analysis of JPMC data, as one of the largest blood banks operating in the country, would provide a cost-effective method for monitoring the prevalence, pattern of distribution, and trends of these infections in Pakistan.

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