PO Box 2345, Beijing 100023, China
www.wjgnet.com
wjg@wjgnet.com

ELSEVIER

World J Gastroenterol 2005;11(26):4085-4089
World Journal of Gastroenterology ISSN 1007-9327

• *BRIEF REPORTS* •

Prevalence of hepatitis C virus infection and its related risk factors in drug abuser prisoners in Hamedan - Iran

Amir Houshang Mohammad Alizadeh, Seyed Moayed Alavian, Khalil Jafari, Nastaran Yazdi

Amir Houshang Mohammad Alizadeh, Research Center for Gastroenterology and Liver Disease, Shaheed Beheshti University of Medical Sciences, Tehran, Iran
Seyed Moayed Alavian, Baghiatalah University of Medical Sciences, Tehran, Iran
Khalil Jafari, Nastaran Yazdi, Hamedan University of Medical Sciences, Hamedan, Iran
Correspondence to: Amir Houshang Mohammad Alizadeh, Research Center for Gastroenterology and Liver Disease, Shaheed Beheshti University of Medical Sciences, 7th Floor, Taleghani Hospital, Yaman Str., Evin, Tehran 19857, Iran. article@rcgld.org
Telephone: +98-21-2418871 Fax: +98-21-2402639
Received: 2004-10-12 Accepted: 2004-10-26

2005; 11(26): 4085-4089
http://www.wjgnet.com/1007-9327/11/4085.asp

Abstract

AIM: Recent studies in Iran has shown that prevalence of hepatitis C virus (HCV) infection among Iranian prisoners is high, in spite of low HCV seroprevalence in general population.

METHODS: This study was carried out in the central prison of Hamedan - Iran, in year 2002. Inmates were interviewed using a standard questionnaire including demographic, imprisonment history and HCV-related risk behaviors items. Thereafter, the sera drawn from the participants were tested for anti-HIV and anti-HCV antibodies.

RESULTS: A total number of 427 drug abuser inmates participated in our study. Three hundred and ninety-seven (93%) were men and 30 (7%) were women. Total number of IV drug abusers (IDA) and non-IV drug abusers (NIDA) was 149 (34.9%) and 278 (65.1%), respectively. The overall rate of antibody positivity among inmates was 0.9% for HIV and 30% for HCV. Of all IDAs, 31.5% and of NIDAs, 29.1% had serological evidence of HCV infection.

CONCLUSION: The seroprevalence of HCV infection among drug abuser prisoners in comparison with the general population in Iran, is very high (30% *vs* in italics 0.2%). Our results indicate the importance of policies to prevent transmission of HCV infection during and following incarceration.

Key words: Hepatitis C virus; Prisoners; Drug abusers; Iran

Alizadeh AHM, Alavian SM, Jafari K, Yazdi N. Prevalence of hepatitis C virus infection and its related risk factors in drug abuser prisoners in Hamedan - Iran. *World J Gastroenterol*

INTRODUCTION

Hepatitis C virus (HCV) infection is increasingly recognized as a major health care problem throughout the world. Approximately 85% of individuals infected with HCV will develop chronic HCV infection[1,2]. Identified risk factors for HCV infection include intravenous drug use, exposure to infected blood/blood products, and intranasal drug use[3]. Surveys of HCV infection among IDU have reported prevalence rates as high as 70-90%[4-6] among habitual injectors. High risk sexual activity (multiple sexual partners), history of sexually transmitted disease, tattooing, and skin piercing have also been suggested to be associated with increased risk for HCV; however, study results have been contradictory[7].

Whereas the overall seroprevalence of HCV among Iranian blood donors has been estimated to be 0.12%[8] the prevalence of HCV has been shown to be as high as 45% in populations of incarcerated IV drug users[9]. HCV seroprevalence among prison inmates varies markedly from country to country[10,11]. Worldwide hepatitis C data similarly report significant prevalence figures in high risk populations ranging from 30% to 50%, with intravenous drug use being the predominant risk factor[12-15]. High risk populations are individuals most at risk for hepatitis C, including those medically underserved, have a history of IV drug injection and high-risk behaviors. A dramatic growth in the number of prisoners associated with high-risk behaviors and high rates of community re-entry emphasizes the need for detection and treatment of hepatitis C virus infection in this unique group.

This study could be of particular interest, as in comparison with worldwide hepatitis C data, the seroprevalence of hepatitis C infection among Iranian general population is low. However, recent studies in Iran has shown that the level of hepatitis C infection among Iranian prisoners is as high as HCV seroprevalence in incarcerated population of countries with high prevalence of HCV infection in their general population.

MATERIALS AND METHODS

This study was carried out in the central prison of Hamedan (one of the largest penal institutions in Iran), from mid-June to mid-September 2002. The study protocol conforms to the ethical guideline of the 1975 Declaration of Helsinki, as revised in 1983. The sample was selected by drawing the numbered individual prison files, available to investigators,

in intervals determined by a random number generator. There were 427 drug abuser inmates in our study. Participation in this study was voluntary and confidentiality was guaranteed. All inmates were counseled about the study and they were required to provide signed informed consent. Thereafter, inmates were interviewed using a standard questionnaire including demographic items, specific questions relative to their imprisonment history and HCV-related risk behaviors such as intravenous drugs abuse, having received blood and/or blood products, tattoos, body piercing, sexual activity, and history of sexually transmitted diseases.

Physical examination was performed on all participants and afterward 8 mL of blood was taken. The sera were tested for anti-HIV and anti-HCV antibodies by using an enzyme-linked immunosorbant assay (ELISA) 3rd generation (for anti-HCV antibodies we used HCV 3.0 ELISA Test System with Enhanced SAVe; ORTHO®, Raritan, NJ, USA). All anti-HCV Ab positive sera were retested, using recombinant immunoblot assay (RIBA) 2nd generation (HCV Blot 3.0; Genelabs® Diagnostics, Singapore) as a complementary test. Patients with both ELISA and RIBA positive reports were considered to be infected with HCV.

Microsoft Access 2000 database software was used (Microsoft Corp., Redmond, WA, USA). Basic descriptive statistics were performed using SPSS for Windows (version 11.0; SPSS Inc., Chicago, IL, USA) software. Risk factors prevalences were generated using data from all consented study participants. Standard χ^2 and χ^2 trend tests were performed to assess the univariate relationship of demographic and behavioral variables and HCV seroprevelance. Univariate ORs were computed with 95% confidence intervals (CIs) for each risk factor.

RESULTS

A total number of 427 drug abuser inmates participated in our study. Three hundred and ninety-seven (93%) were men and 30 (7%) were women. Total number of IV drug abusers (IDA) was 149 (34.9%). The remaining 278 individuals (65.1%) were non-IV drug abusers (NIDA). Demographic characteristics of drug abuser inmates are depicted in Table 1.

The overall rate of antibody positivity among inmates for HIV was 0.9% (4/427) and for HCV was 30% (128/427). Of all IDAs, 31.5% (47/149) had serological evidence of HCV infection and in NIDAs seropositivity for HCV was 29.1% (81/278). There were no significant statistical differences for HCV seropositivity between the two groups.

About HIV infection in the two groups, only one inmate (out of 149, 0.67%) was seropositive for HIV in IDA group and in NIDA we found three inmates with anti-HIV antibodies (3/278, 1.07%). Because the number of HIV infected participants was small, no statistical comparisons were conducted. Among three HIV positive individuals, all were male and their ages were between 30 and 49 (mean 37.5), one was IV drug abuser for 36 mo, one reported history of tattoos and one had received blood transfusion, they spent 2-26 mo in prison.

As shown in Table 1, the pattern of HCV antibody prevalence differed within each demographic characteristic.

The mean±SD of participants was 37.9±9.7 (range 15-77 years old). Most participants belonged to 30-39 years old age group (34.7%) and HCV seropositivity in ⩽20 years and 40-49 years old age group was highest (40% and 31.6%, respectively; $P = 0.70$).

None of the inmates had high risk job (health-care related) be infected by HCV or HIV. 42.6% of HCV seropositive participants were labourers and 41% had private business, 8.2% were farmers, 6.6% housekeepers, and 1.6% were unemployed (no significant difference, $P = 0.4$).

As depicted in Table 2, we studied the association between some behavioral characteristics and HCV seropositivity. The

Table 1 Demographic characteristics and their association with HCV seropositivity among drug abuser inmates, Hamedan, Iran

Variable	Total (n = 427)		HCV positive[1] (n = 128)[2]	
	n	%	n	%
Sex				
Male	397	93	119	93
Female	30	7	9	7
Age group (yr)				
<20	5	1.2	2	1.6
20-29	83	19.6	26	20.4
30-39	148	34.9	45	35.1
40-49	136	32.1	43	33.5
50-59	41	9.7	11	8.6
60 or more	11	2.6	1	0.8
Marital status				
Single	136	31.9	48	37.5
Married	291	68.1	80	62.5
Education level				
Uneducated	141	33	32	25
Primary school	191	44.8	60	46.9
High school	89	20.8	33	25.8
University	6	1.4	3	2.3
Total	427	100	128	30

[1]We found no significant statistical difference. [2]Basis of numbers and %s may be slightly smaller due to missing values.

Table 2 Behavioral characteristics and their association with HCV seropositivity among drug Abuser prisoners in Hamedan, Iran

Variable	Total (n = 427) n (%)	HCV positive[1] (n = 128)[2]		
		n (%)	P	(OR, 95%CI)[3]
Months of imprisonment			0.02	
<12	49 (12.5)	11 (22.4)		
12-23	75 (19.1)	26 (34.7)		
24-35	70 (17.9)	19 (27.1)		
36-47	57 (14.5)	14 (24.6)		
48-59	42 (10.7)	13 (31)		
60-71	21 (5.4)	7 (33.3)		
72-83	25 (6.4)	10 (40)		
84-95	9 (2.3)	1 (11.1)		
96-107	6 (1.5)	5 (83.3)		
108-119	2 (0.5)	2 (100)		
>120	36 (9.2)	8 (22.2)		
History of blood transfusion			0.1	(1.5, 0.8-2.8)
No	300 (89)	110 (28.9)		
Yes	47 (11)	18 (38.3)		
History of phlebotomy			0.7	(1.1, 0.5-2.2)
No	387 (90.6)	115 (29.7)		
Yes	40 (9.4)	13 (32.5)		
History of getting wounded			0.4	(0.8, 0.5-1.2)
No	238 (55.7)	75 (31.5)		
Yes	189 (44.3)	53 (28)		
History of STD[4]			0.5	(1.4, 0.4-3.9)
No	378 (95.9)	113 (29.9)		
Yes	16 (4.1)	6 (37.5)		
History of tatooing			0.8	(1.05, 0.7-1.6)
No	184 (43.1)	54 (29.3)		
Yes	243 (56.9)	74 (30.5)		
History of surgery			0.2	(1.3, 0.8-2.01)
No	285 (66.7)	80 (28.1)		
Yes	142 (33.3)	48 (33.8)		
History of dental procedure			0.9	(0.9, 0.4-2.2)
No	26 (6.1)	8 (30.8)		
Yes	401 (93.9)	120 (29.9)		
Months of IV drug abuse			0.1	(1.7, 0.9-3)
<12	104 (69.8)	29 (27.9)		
⩾12	45 (30.2)	18 (40)		
Sharing needles			0.6	(0.8, 0.4-1.7)
No	77 (18.3)	26 (33.8)		
Yes	72 (16.8)	22 (30.6)		

[1]Hepatitis C Virus. [2]Basis of numbers and %s may be slightly smaller due to missing values. [3]Odds ratio, 95% confidence interval. [4]Sexually transmitted disease.

seroprevalence of HCV was associated with duration of imprisonment (P = 0.02). Remarkably, 100% of the individuals who reported 108-119 mo of imprisonment were infected with HCV.

DISCUSSION

High risk populations are individuals most at risk of contracting hepatitis C, including those who come from medically underserved and minority communities and /or have a history of IV drug injection, alcohol abuse, and multiple sex partners[16]. IV drug abusing remains the predominant mode of HCV transmission risk in prison systems[17].

In this study we evaluated the seroprevalence of HCV and HIV among drug abuser inmates (IV drug abusers (IDA) and non-IV drug abusers (NIDA)). Prevalence of HCV antibody positivity among all participants was 30%. HCV seroprevalence in IDA and NIDA groups was 31.5% and 29.1%, respectively, and confirms the high prevalence of blood borne disease in those with imprisonment history[18-20]. Different studies have estimated the seroprevalence of HCV antibody among the general population (blood donors, mostly) to be about 0.16-6% world-wide[8,21-24]. In high risk population in comparison to the general population, IV drug abusing, sharing needles and tattooing may increase risk status.

We found only one published similar investigation on Iranian prisoners. In Zali *et al*. study[9], the seroprevalence of HCV among IDAs was 45%. In the studies on prisoners of Australia, Brazil, France, India, Ireland, UK and United States the HCV seroprevalence were about 38%, 6.3%, 30%, 16%, 37%, 30%, and 41%, respectively[25-28,10,12,13]. According to other investigations worldwide, hepatitis C antibody positivity prevalence in high risk ranges from 31% to 50%, while intravenous drug abuse is the predominant risk factor[11,29-33].

Limited available data indicate the majority of HCV infections are acquired before incarceration[16]. Blood serum evaluations among 265 male prison inmates in Maryland

(USA) revealed a hepatitis C prevalence of 38% at intake[34].

In our study, the overall rate of HIV antibody among prisoners was 0.9% (4/427). In IDA and NIDA groups, we found 0.67% and 1.07% positive HIV antibodies. The HCV prevalence rate in our study was higher than HIV prevalence. However, the findings are in accordance with those in many countries - including Germany, Nederland, Switzerland and Australia[35,36]. In Iran we have no similar investigation on HIV seroprevalence of prisoners in comparison with our results.

Prevalence of antibodies of HIV in Irish and Brazilian prisoners was 2% and 3.2%, respectively[13,26]. The HIV prevalence reported in prison studies from other developed countries is similar[37-40].

Some limitations of our study should be considered. As with any convenience sample, this study had the limitation of being a self-selected group and may not be a representative of all Iranian prisoners. In addition, because of religious beliefs and security problems of prisons, many individuals could not respond properly to the questions containing sex behavior characteristics. Therefore we excluded the sex behavior related risk factors from statistical analysis. Because of financial problems we couldn't perform PCR on our samples.

In our investigation we studied some risk factors related to HCV and HIV infection. Participants who had spent more time in prison, however, and those who had history of hospitalization were significantly more likely to be positive for antibodies to HCV. Being in prison in Iran may be an independent risk factor for hepatitis C infection. We found no statistical association between HCV and other risk factors and there was no significant difference in HCV seropositivity prevalence between IV drug abusers and non IV drug abusers recommending the possibility of some other unknown etiologic factors. The high percentage of HCV positive cases with no apparent risk factor further emphasizes the need for further investigation on the routes of transmission and other factors, which have not yet been concerned. It should be noted that in some investigations, there were considerable numbers of HCV infected cases with no apparent risk factors, depicting the complex nature of HCV transmission[41-45].

Although the inmates participating in this study cannot be considered representative of all prisoners in Iran, the results obtained have important implications for penal and public health administrators, indicating the importance of policies to prevent transmission of these infections during and following incarceration. These policies must include primary concern on not only identification of those most at risk but also on provision of appropriate treatment[8,12,16,26]. Specific harm-reduction strategies directed toward preventative education and counselling are also crucial. In addition, testing programs in prisons, which should be seen as an opportunity to improve the health outcome of those infected and prevent further transmission of infectious agents[46-48].

There are few studies involving large multicentre sampling that provided epidemiological aspects of HCV infection among prison inmates in Iran. In conclusion, prospective studies with meticulous assessment of confounding risk factors are required to assess the potential risk factors of HCV and HIV infections in prisons of Iran, effectively.

REFERENCES

1 **Conry-Cantilena C,** VanRaden M, Gibble J, Melpolder J, Shakil AO, Viladomiu L, Cheung L, DiBisceglie A, Hoofnagle J, Shih JW, Kaslow R, Ness P, Alter HJ. Routes of infection, viremia, and liver disease in blood donors found to have hepatitis C virus infection. *N Engl J Med* 1996; **334**: 1691-1696

2 **Alter MJ,** Margolis HS, Krawczynski K, Judson FN, Mares A, Alexander WJ, Hu PY, Miller JK, Gerber MA, Sampliner RE. The natural history of community-acquired hepatitis C in the United States. The Sentinel Counties Chronic non-A, non-B Hepatitis Study Team. *N Engl J Med* 1992; **327**: 1899-1905

3 **Alter HJ,** Conry-Cantilena C, Melpolder J, Tan D, Van Raden M, Herion D, Lau D, Hoofnagle JH. Hepatitis C in asymptomatic blood donors. *Hepatology* 1997; **26**(Suppl 1): 29-33

4 **Crofts N,** Hopper JL, Milner R, Breschkin AM, Bowden DS, Locarnini SA. Blood-borne virus infections among Australian injecting drug users: implications for spread of HIV. *Eur J Epidemiol* 1994; **10**: 687-694

5 **Goldberg D,** Cameron S, McMenamin J. Hepatitis C virus antibody prevalence among injecting drug users in Glasgow has fallen but remains high. *Commun Dis Public Health* 1998; **1**: 95-97

6 **Samuel MC,** Doherty PM, Bulterys M, Jenison SA. Association between heroin use, needle sharing and tattoos received in prison with hepatitis B and C positivity among street-recruited injecting drug users in New Mexico, USA. *Epidemiol Infect* 2001; **127**: 475-484

7 **Alter MJ.** Hepatitis C virus infection in the United States. *J Hepatol* 1999; **31**: 88-91

8 **Alavian SM,** Gholami B, Masarrat S. Hepatitis C risk factors in Iranian volunteer blood donors: a case-control study. *J Gastroenterol Hepatol* 2002; **17**: 1092-1097

9 **Zali MR,** Noroozi A, Amirrasooli H, Darvishi M. Prevalence of Anti-HCV antibody and routes of hematological transmission in addicts of Ghasr prison[in persian]. *Pajouhesh* 1998; **22**: 26-32

10 **Skipper C,** Guy JM, Parkes J, Roderick P, Rosenberg WM. Evaluation of a prison outreach clinic for the diagnosis and prevention of hepatitis C: implications for the national strategy. *Gut* 2003; **52**: 1500-1504

11 **Crofts N,** Stewart T, Hearne P, Ping XY, Breshkin AM, Locarnini SA. Spread of bloodborne viruses among Australian prison entrants. *BMJ* 1995; **310**: 285-288

12 **Spaulding A,** Greene C, Davidson K, Schneidermann M, Rich J. Hepatitis C in state correctional facilities. *Prev Med* 1999; **28**: 92-100

13 **Allwright S,** Bradley F, Long J, Barry J, Thornton L, Parry JV. Prevalence of antibodies to hepatitis B, hepatitis C, and HIV and risk factors in Irish prisoners: results of a national cross sectional survey. *BMJ* 2000; **321**: 78-82

14 **Weild AR,** Gill ON, Bennett D, Livingstone SJ, Parry JV, Curran L. Prevalence of HIV, hepatitis B, and hepatitis C antibodies in prisoners in England and Wales: a national survey. *Commun Dis Public Health* 2000; **3**: 121-126

15 **Burattini M,** Massad E, Rozman M, Azevedo R, Carvalho H. Correlation between HIV and HCV in Brazilian prisoners: evidence for parenteral transmission inside prison. *Rev Saude Publica* 2000; **34**: 431-436

16 **Reindollar RW.** Hepatitis C and the correctional population. *Am J Med* 1999; **107**: 100-103

17 **Alter MJ.** Epidemiology of hepatitis C. *Hepatology* 1997; **26** (3 Suppl 1): 62-65

18 **Capoccia A,** Ranieri R, Busnelli M, Passaretti B, Milella AM, Vecchi L. Serologic study on the prevalence of HIV, HBV infection and on the false positive reaction of VDRL at a prison. *Minerva Med* 1991; **82**: 125-130

19 **Glaser JB,** Greifinger RB. Correctional health care: a public health opportunity. *Ann Intern Med* 1993; **118**: 139-145

20 **Hoxie NJ,** Chen MH, Prieve A, Haase B, Pfister J, Vergeront JM. HIV seroprevalence among male prison inmates in the Wisconsin Correctional System. *WMJ* 1998; **97**: 28-31

21 **Merino-Conde E,** Orozco JA, Rojo-Medina J, Tovar A.

Prevalence of hepatitis C virus among candidates for blood donation at the Hospital General de Mexico. *In Vivo* 1994; **8**: 621-623

22 **Ito S,** Yao DF, Nii C, Hibino S, Kamamura M, Nisikado T, Honda H, Shimizu I, Meng XY. Epidemiological characteristics of the incidence of hepatitis C virus (C100-3) antibodies in patients with liver diseases in the inshore area of the Yangtze River. *J Gastroenterol Hepatol* 1993; **8**: 232-237

23 **Soni PN,** Tait DR, Kenoyer DG, Fernandes-Costa F, Naicker S, Gopaul W, Simjee AE. Hepatitis C virus antibodies among risk groups in a South African area endemic for hepatitis B virus. *J Med Virol* 1993; **40**: 65-68

24 **Allen SA,** Spaulding AC, Osei AM, Taylor LE, Cabral AM, Rich JD. Treatment of chronic hepatitis C in a state correctional facility. *Ann Intern Med* 2003; **138**: 187-190

25 **Butler TG,** Dolan KA, Ferson MJ, McGuinness LM, Brown PR, Robertson PW. Hepatitis B and C in New South Wales prisons: prevalence and risk factors. *Med J Aust* 1997; **166**: 127-130

26 **Catalan-Soares BC,** Almeida RT, Carneiro-Proietti AB. Prevalence of HIV-1/2, HTLV-I/II, hepatitis B virus (HBV), hepatitis C virus (HCV), Treponema pallidum and Trypanosoma cruzi among prison inmates at Manhuacu, Minas Gerais State, Brazil. *Rev Soc Bras Med Trop* 2000; **33**: 27-30

27 **Claudon-Charpentier A,** Hoibian M, Glasser P, Lalanne H, Pasquali JL. Drug-addicted prisoners: seroprevalence of human immunodeficiency virus and hepatitis B and C virus soon after the marketing of buprenorphine. *Rev Med Interne* 2000; **21**: 505-509

28 **Kar P,** Gangwal P, Budhiraja B, Singhal R, Jain A, Madan K, Gupta RK, Barua SP, Nath MC. Analysis of serological evidence of different hepatitis viruses in acute viral hepatitis in prisoners in relation to risk factors. *Indian J Med Res* 2000; **112**: 128-132

29 **Ford PM,** White C, Kaufmann H, MacTavish J, Pearson M, Ford S, Sankar-Mistry P, Connop P. Voluntary anonymous linked study of the prevalence of HIV infection and hepatitis C among inmates in a Canadian federal penitentiary for women. *CMAJ* 1995; **153**: 1605-1609

30 **Pinducciu G,** Arnone M, Piu G, Usai M, Melis A, Pintus L, Pitzus F. Prevalence of hepatitis virus (HBV and HCV) and HIV-1 infections in a prison community. *Ann Ig* 1990; **2**: 359-363

31 **Nara K,** Kawano M, Igarashi M. Prevalence of hepatitis C virus and human immunodeficiency virus infection among female prison inmates in Japan [In Japanese]. *Nippon Koshu Eisei Zasshi* 1997; **44**: 55-60

32 **Holsen DS,** Harthug S, Myrmel H. Prevalence of antibodies to hepatitis C virus and association with intravenous drug abuse and tattooing in a national prison in Norway. *Eur J Clin Microbiol Infect Dis* 1993; **12**: 673-676

33 [No authors listed]. Seroprevalence of hepatitis C virus infection at the time of entry to prison in the prison population in the north-east of Spain [In Spanish]. *Rev Esp Salud Publica* 1998; **72**: 43-51

34 **Vlahov D,** Nelson KE, Quinn TC, Kendig N. Prevalence and incidence of hepatitis C virus infection among male prison inmates in Maryland. *Eur J Epidemiol* 1993; **9**: 566-569

35 **van den Hoek JA,** van Haastrecht HJ, Goudsmit J, de Wolf F, Coutinho RA. Prevalence, incidence, and risk factors of hepatitis C virus infection among drug users in Amsterdam. *J Infect Dis* 1990; **162**: 823-826

36 **Chamot E,** de Saussure P, Hirschel B, Deglon JJ, Perrin LH. Incidence of hepatitis C, hepatitis B and HIV infections among drug users in a methadone-maintenance programme. *AIDS* 1992; **6**: 430-431

37 **Bird AG,** Gore SM, Burns SM, Duggie JG. Study of infection with HIV and related risk factors in young offenders' institution. *BMJ* 1993; **307**: 228-231

38 **Gore SM,** Bird AG, Burns SM, Goldberg DJ, Ross AJ, Macgregor J. Drug injection and HIV prevalence in inmates of Glenochil prison. *BMJ* 1995; **310**: 293-296

39 **Bellis MA,** Weild AR, Beeching NJ, Mutton KJ, Syed Q. Prevalence of HIV and injecting drug use in men entering Liverpool prison. *BMJ* 1997; **315**: 30-31

40 **Gaughwin MD,** Douglas RM, Liew C, Davies L, Mylvaganam A, Treffke H, Edwards J, Ali R. HIV prevalence and risk behaviours for HIV transmission in South Australian prisons. *AIDS* 1991; **5**: 845-851

41 **Stratton E,** Sweet L, Latorraca-Walsh A, Gully PR. Hepatitis C in Prince Edward Island: a descriptive review of reported cases, 1990-1995. *Can J Public Health* 1997; **88**: 91-94

42 **Garcia-Bengoechea M,** Emparanza JI, Sarriugarte A, Cortes A, Vega JL, Gonzalez F, Arenas JI. Antibodies to hepatitis C virus: a cross-sectional study in patients attending a trauma unit or admitted to hospital for elective surgery. *Eur J Gastroenterol Hepatol* 1995; **7**: 237-241

43 **Crawford RJ,** Gillon J, Yap PL, Brookes E, McOmish F, Simmonds P, Dow BC, Follett EA. Prevalence and epidemiological characteristics of hepatitis C in Scottish blood donors. *Transfus Med* 1994; **4**: 121-124

44 **Chetwynd J,** Brunton C, Blank M, Plumridge E, Baldwin D. Hepatitis C seroprevalence amongst injecting drug users attending a methadone programme. *N Z Med J* 1995; **108**: 364-366

45 **Tsega E,** Nordenfelt E, Hansson BG. Hepatitis C virus infection and chronic liver disease in Ethiopia where hepatitis B infection is hyperendemic. *Trans R Soc Trop Med Hyg* 1995; **89**: 171-174

46 **Cohen D,** Scribner R, Clark J, Cory D. The potential role of custody facilities in controlling sexually transmitted diseases. *Am J Public Health* 1992; **82**: 552-556

47 **Heimberger TS,** Chang HG, Birkhead GS, DiFerdinando GD, Greenberg AJ, Gunn R, Morse DL. High prevalence of syphilis detected through a jail screening program. A potential public health measure to address the syphilis epidemic. *Arch Intern Med* 1993; **153**: 1799-1804

48 **Polonsky S,** Kerr S, Harris B, Gaiter J, Fichtner RR, Kennedy MG. HIV prevention in prisons and jails: obstacles and opportunities. *Public Health Rep* 1994; **109**: 615-625

Science Editor Guo SY **Language Editor** Elsevier HK