

MEN HAVING SEX WITH MEN IN SURAKARTA, INDONESIA: DEMOGRAPHICS, BEHAVIORAL CHARACTERISTICS AND PREVALENCE OF BLOOD BORNE PATHOGENS

Afiono Agung Prasetyo^{1,2,3}, Engine Rabindra Ariapramuda¹, Ekkim Al Kindi¹,
Paramasari Dirgahayu^{3,4}, Yulia Sari^{2,3,4}, Ruben Dharmawan^{2,3,4}, Hudiyono^{1,2,3},
Hartono^{2,5} and Seiji Kageyama⁶

¹Department of Microbiology, ²A-IGIC Research Group, ⁴Department of Parasitology,
⁵Department of Physiology, Faculty of Medicine, Sebelas Maret University, Surakarta;
³Center of Biotechnology and Biodiversity Research and Development, Sebelas Maret
University, Surakarta, Indonesia; ⁶Department of Microbiology and Immunology
(Division of Virology), Faculty of Medicine, Tottori University, Yonago, Japan

Abstract. The objectives of this study were to investigate the prevalence of human immunodeficiency virus (HIV), hepatitis B virus (HBV), hepatitis C virus (HCV), hepatitis D virus (HDV), human T-lymphotropic virus types 1 and 2 (HTLV-1/2), Torque teno virus (TTV) and *Toxoplasma gondii* (*T. gondii*) infection among men who have sex with men (MSM) in Surakarta, Indonesia, and the risk factors and sexual behavior associated with these infections. A cross sectional study was performed from October 2009 to October 2011 among 143 MSM by face-to-face interviews to complete an interviewer-administered questionnaire. Subjects were tested for HIV, HBV, HCV, HDV, HTLV-1/2 and toxoplasma infection using serology and for TTV using molecular detection. The seropositive rates for anti-HIV, HBsAg, anti-HCV, anti-HDV, anti-HTLV-1/2, IgM anti-*T. gondii*, IgG anti-*T. gondii* and TTV DNA were 9.1%, 9.8%, 28.0%, 0.7%, 0.7%, 1.4%, 30.8%, and 26.6%, respectively. Risk factors associated with HIV infection were a history of injecting drug use (IDU) [adjusted OR (aOR) 6.0; 95% CI: 1.10-33.01] and have been pierced (aOR 8.1; 95% CI: 1.30-50.04). Having a tattoo (aOR 3.2; 95% CI: 1.28-7.98) and practicing sex without a condom (aOR 2.3; 95% CI: 1.06-4.92) were associated with toxoplasma infection. A history of IDU (aOR 32; 95% CI: 5.93-177.93) was associated with TTV infection. The subjects examined in this study were found to be infected with HIV, HBV, HCV, HDV, HTLV-1/2, TTV, and *T. gondii*. These infections were associated with high-risk behavior.

Keywords: MSM, blood borne virus, *Toxoplasma gondii*, Indonesia

Correspondence: Afiono Agung Prasetyo, Department of Microbiology, Faculty of Medicine, Sebelas Maret University, Jl. Ir. Sutami no 36A, Surakarta, Indonesia 57126.

Tel: 62 271 632489; Fax: 62 271 632489

E-mail: afie.agp.la@gmail.com, afieagp@yahoo.com, afie@staff.uns.ac.id

INTRODUCTION

The prevalence of human immunodeficiency virus (HIV) infection in Indonesia is rapidly increasing. In 2002, there were 1,171 cases, this increased to 5,321 in 2005 and to 92,251 cases by 2012 (Indonesia National AIDS Commission, 2011; Ministry of Health Indonesia, 2012). The AIDS National Commission Indonesia and the 2007 Integrated Biological-Behavioral Surveillance (IBBS) estimated that men who have sex with men (MSM) contributed to the increasing epidemic of HIV prevalence in Indonesia (Indonesia National AIDS Commission, 2007; Ministry of Health Indonesia, 2007).

MSM are defined as gay, bisexual, transgender (TG) and self-identified heterosexual men who engage in sex with other men (Baral *et al*, 2007). Sexual contact and other risk behavior among MSM are important factors for sexual and blood-borne virus (BBV) infections (Baral *et al*, 2007). The Ministry of Health Indonesia divides MSM into two groups, TG and MSM except TG; in 2009 their estimated numbers in Indonesia were: 32,065 TG and 695,026 MSM except TG (Ministry of Health Indonesia, 2007; Indonesia National AIDS Commission, 2011). The Indonesian MSM community was estimated to comprise 5.2% of the population in 2010 (Ministry of Health Indonesia, 2007). Although there is no data about male sex workers (MSW) in Indonesia, the government believes the number of MSW in large cities in Indonesia is increasing (Indonesia National AIDS Commission, 2011). The 2007 IBBS found the number of HIV cases among the MSM community in Indonesia was high: 24.4% in TG and 5.2% in MSM-except TG (Morineau *et al*, 2011). High risk sexual behavior among MSM in-

creases the likelihood of contracting BBV infections and other sexually transmitted infections (STI) (Pisani *et al*, 2004; Baral *et al*, 2007; van de Laar *et al*, 2007).

The prevalences of HBV and HCV infections among healthy blood donors from 21 provinces in Indonesia in 1995 were 5.1% and 2.1%, respectively (Sulaiman *et al*, 1995). HTLV infection has been reported to have a low prevalence in Jakarta (Tanggo *et al*, 2000) but a high prevalence in Irian Jaya, Eastern Indonesia where $\geq 10\%$ of the population in Irian Jaya is believed to be infected (Porter *et al*, 1994). There are no published data about the prevalence of HTLV in Indonesia other than in Jakarta and Irian Jaya. Infections due to HBV, HCV and HTLV have been reported to be more prevalent among MSM in other countries but their prevalences among MSM in Indonesia is unknown (Zunt *et al*, 2006; Kassak *et al*, 2010). Indonesia is located in the tropics where many tropical diseases, such as *Toxoplasma gondii* (*T. gondii*) are reported to occur. *T. gondii* has been reported to have a high prevalence in urban areas (58%) and among inhabitants (70%) of Indonesia (Terazawa *et al*, 2003). However, there are no data concerning the seroprevalence of *T. gondii* in Indonesia among MSM. Therefore, we investigated the prevalence of certain BBV infections among Indonesian MSM: human immunodeficiency virus (HIV), hepatitis B virus (HBV), hepatitis C virus (HCV), hepatitis D virus (HDV), human T-lymphotropic virus types 1 and 2 (HTLV-1/2), Torque teno virus (TTV) as well as *T. gondii* infection. We also investigated the risk factors associated with these infections. This data may be used to guide intervention and prevention programs and inform physicians who treat MSM.

MATERIALS AND METHODS

Study population

We conducted this cross-sectional survey from October 2009 to October 2011 in Surakarta, Central Java, Indonesia. The respondents were recruited from venues, such as hotels, parks and restaurants, where MSM meet one another, using a respondent-driven sampling strategy. Participation in the study was voluntary. Approval for the study was obtained from the institutional ethical committee review boards of the Faculty of Medicine of Sebelas Maret University and Dr Moewardi General Hospital. Written informed consent was obtained from all participants prior to being included in the study. Blood samples were obtained from each participant and kept frozen until analyzed. All procedures were conducted according to the principles of the Declaration of Helsinki.

One hundred forty-three MSM agreed to participate in the study. Respondents underwent face-to-face interviews and completed an interviewer-administered questionnaire. The questionnaire was divided into two parts. The first part included questions that assessed general sociodemographic and epidemiological characteristics associated with HIV, HBV, HCV, HDV, HTLV-1/2, TTV and toxoplasma infection. The second part included questions that assessed knowledge about these diseases and sexual behavior. The questionnaire was administered by a trained interviewer. The interviews were recorded and transcribed verbatim. Data obtained were: age, marital status, educational level, occupation, monthly income, ethnicity, religion, history of being in jail or prison, history of having hepatitis, history of hepatitis in family members or occupational exposure to hepatitis pa-

tients, drug abuse history, history of ear piercing, history of having a tattoo, history of hospitalization, history of surgery, history of having a transfusion, history of sharing toothbrushes and/or shavers, having had a circumcision, smoking history, history of traumatic injuries, history of having hemodialysis, history of travel locally or internationally, health status, consumption of alcohol, drug abuse history, knowledge of HIV, sexually transmitted diseases, and hepatitis, knowledge of transmission, prevention and treatment of HIV, sexually transmitted diseases, and hepatitis, history of sexual promiscuity, sexual orientation, history of not using a condom and sexually related behavior. An incentive equivalent to approximately USD10 was given to each respondent as compensation for time spent being interviewed.

Serological markers for HIV, HBV, HCV, HDV, HTLV-1/2 and toxoplasma infections

Blood samples were collected in EDTA tubes, and examined for: HIV antibodies using a Determine HIV-1/2 Kit (Abbott Diagnostics Japan, Tokyo, Japan) and confirmed using a Vironostika HIV Uniform II Antigen Ag/Ab kit (BioMérieux, Marcy l'Étoile, France). A SERATEC Hepatitis B Quick Test (Gesellschaft für Biotechnologie GmbH, Göttingen, Germany) was used to detect HBsAg. Ortho HCV PA II (Ortho Diagnostics, Tokyo, Japan), HDV Ab ELISA (Diagnostic Automation, Calabasas, CA), MP Diagnostic HTLV-I/II ELISA 4.0 (MP Biomedicals, Singapore), a DRG *T. gondii* IgM Elisa Kit (DRG International, Springfield, NJ), and a DRG *T. gondii* IgG Elisa Kit (DRG International) were used to detect anti-HCV, anti-HDV, anti-HTLV-1/2, IgM anti-toxoplasma, and IgG anti-toxoplasma antibodies, respectively. All assays were performed according to the manufacturer's instructions. All

samples were tested at least in duplicate.

Nucleic acid extraction and molecular detection of TTV

TTV nucleic acid was extracted with a PureLink Viral RNA/DNA Kit (Invitrogen, Carlsbad, CA) according to the manufacturer's instructions. TTV-DNA was detected by nested PCR as described previously (Irshad *et al*, 2008). TTV molecular detection was performed by PCR using the Amplitaq Gold® 360 DNA Polymerase Kit (Invitrogen, Carlsbad, CA). Internal amplification controls were included to exclude any false negative results. The corresponding positive controls and one negative control (sterile water) were included for each group simultaneously. To prevent PCR contamination, the reagent preparation, sample processing and nested PCR assays were performed in rooms separate from those where the amplified products were analyzed. Aerosol-resistant pipette tips were used throughout the assays. The PCR products were subjected to electrophoresis in 2% agarose gels, which were stained with ethidium bromide and visualized under ultraviolet illumination. The specificity was confirmed by sequencing the amplicons. All samples were tested at least in duplicate.

Statistical analysis

Statistical analysis was performed using SPSS version 16 software (SPSS, Chicago, IL). A 95% confidence interval (CI) was used for all data analysis.

RESULTS

Demographics, risk behavior and sexual behavior

One hundred forty-three MSM were included in this study. The subjects were classified into three groups: gay, TG and MSW (Table 1). The mean ages

were 27 years (range, 19-54 years), 32 years (23-48 years), and 30 years (19-49 years) in the gay, TG and MSW groups, respectively ($p=0.018$). None of the participants knew about hepatitis or sexually transmitted infections (STI), and only 57 (57/143, 39.9%) knew about transmission routes and prevention of HIV infection. Participants with less than or equal to a middle school education level were less likely to know about HIV [odds ratios (OR) 2.7; 95% CI: 1.30-5.81]. None of the participants had traveled to another city or internationally during the previous 10 years. None reported a history of contact with blood, being pricked with a needle contaminated with blood, blood transfusions, dialysis, history of traumatic injury or transplantation. The health status of all the participants was reported as good.

All the participants were sexually active (Table 1). The mean ages of first sexual activity were 18 years (range, 14-29), 15.2 years (14-18), and 18 years (8-31) in the gay, TG and MSW groups ($p=0.001$). Of the 143 participants, 48 (48/143, 33.6%) had a history of ejaculating in the anus, 18 (18/143, 12.6%) in the vagina, and 77 (77/143, 53.8%) in a combination of places, such as the anus, vagina, mouth and outside the body (data not shown). According to the self-reported sexual techniques used by the participants, oral-anal-coitus was the most common (86/142, 60.5%), followed by a combination of techniques (oral-anal-coitus with techniques such as blow jobs, petting, French kisses, fist fucking and hand jobs) (49/142, 34.5%) and ordinary coitus (7/142, 5.0%). Nearly all the participants (128/143, 89.5%) performed these sexual techniques for pleasure; the remaining did so to follow orders (6/143, 4.2%) or as a trial (9/143, 6.3%).

Anal sex without a condom was performed by the majority of the par-

Table 1
Sociodemographic, risk behavior and sexual behavior among men who have sex with men (MSM) in Surakarta, Indonesia.

Factors	Sexual orientation gender identity			
	Gay <i>n</i> (%)	TG <i>n</i> (%)	MSW <i>n</i> (%)	Total <i>n</i> (%)
Total cases	77 (53.8)	21 (14.7)	45 (31.4)	143 (100.0)
Age (years)				
≤20	15 (19.5)	0 (0.0)	3 (6.7)	18 (12.6)
21-30	44 (57.1)	14 (66.7)	24 (53.3)	82 (57.3)
31-40	13 (16.9)	3 (14.3)	13 (28.9)	29 (20.3)
41-50	3 (3.9)	4 (19.0)	5 (11.1)	12 (8.4)
>50	2 (2.6)	0 (0.0)	0 (0.0)	2 (1.4)
Marital status				
Married	12 (15.6)	0 (0.0)	13 (28.9)	25 (17.5)
Ever married	1 (1.3)	1 (4.8)	0 (0.0)	2 (1.4)
Not married	64 (83.1)	20 (95.2)	32 (71.1)	116 (81.1)
Education				
Undergraduate	37 (48.0)	1 (4.8)	1 (2.2)	39 (27.3)
Senior high school	27 (35.1)	19 (90.4)	18 (40.0)	64 (44.8)
Junior high school	10 (13.0)	0 (0.0)	16 (35.6)	26 (18.2)
Elementary school	0 (0.0)	0 (0.0)	5 (11.1)	5 (3.5)
Not graduated from elementary school	3 (3.9)	1 (4.8)	5 (11.1)	9 (6.2)
Occupation				
Student	12 (15.6)	1 (4.8)	0 (0.0)	13 (9.1)
Unemployment	0 (0.0)	1 (4.8)	0 (0.0)	1 (0.7)
Formal employee	2 (2.6)	0 (0.0)	0 (0.0)	2 (1.4)
Informal employee	63 (81.8)	19 (90.4)	45 (100.0)	127 (88.8)
Monthly income (USD)				
<100	61 (79.2)	20 (95.2)	30 (66.7)	111 (77.6)
>100	16 (20.8)	1 (4.8)	15 (33.3)	32 (22.4)
Ethnicity				
Javanese	69 (89.6)	21 (100.0)	44 (97.8)	134 (93.7)
Non-Javanese (Ethnic minority)	8 (10.4)	0 (0.0)	1 (2.2)	9 (6.3)
Religion				
Islam	57 (74.0)	20 (95.2)	40 (88.9)	117 (81.8)
Christ	16 (20.8)	1 (4.8)	5 (11.1)	22 (15.4)
Protestant	4 (5.2)	0 (0.0)	0 (0.0)	4 (2.8)
HIV screening				
Never	72 (93.5)	1 (4.8)	26 (57.8)	99 (69.2)
Ever	5 (6.5)	20 (95.2)	19 (42.2)	44 (30.8)
STI screening ^a				
Never	73 (96.1)	1 (4.8)	34 (75.6)	108 (76.1)
Ever	3 (3.9)	20 (95.2)	11 (24.4)	34 (23.9)
STI history ^a				
Never	73 (96.1)	21 (100.0)	30 (66.7)	124 (87.3)
Ever	3 (3.9)	0 (0.0)	15 (33.3)	18 (12.6)

Table 1 (Continued).

Factors	Sexual orientation gender identity			
	Gay <i>n</i> (%)	TG <i>n</i> (%)	MSW <i>n</i> (%)	Total <i>n</i> (%)
Inmate history				
Never	45 (58.4)	20 (95.2)	44 (97.8)	109 (76.2)
Ever	32 (41.6)	1 (4.8)	1 (2.2)	34 (23.8)
Drug abuse				
Never	54 (70.1)	20 (95.2)	35 (77.8)	109 (76.2)
Ever	23 (29.9)	1 (4.8)	10 (22.2)	34 (23.8)
IDU				
Never	67 (87.0)	16 (76.2)	43 (95.6)	126 (88.1)
Ever	10 (13.0)	5 (23.8)	2 (4.4)	17 (11.9)
Tattoo				
Never	60 (77.9)	9 (42.9)	32 (71.1)	101 (70.6)
Ever	17 (22.1)	12 (57.1)	13 (28.9)	42 (29.4)
Piercing				
Never	58 (75.3)	1 (4.8)	30 (66.7)	89 (62.2)
Ever	19 (24.7)	20 (95.2)	15 (33.3)	54 (37.8)
Hospitalize history				
Never	67 (87.0)	21 (100.0)	36 (80.0)	124 (86.7)
Ever	10 (13.0)	0 (0.0)	9 (20.0)	19 (13.3)
Mouth surgery				
Never	77 (100.0)	21 (100.0)	26 (57.8)	124 (86.7)
Ever	0 (0.0)	0 (0.0)	19 (42.2)	19 (13.3)
Surgical operation besides mouth surgery				
Never	75 (97.4)	21 (100.0)	39 (86.7)	135 (94.4)
Ever	2 (2.6)	0 (0.0)	6 (13.3)	8 (5.6)
Share needles				
Never	77 (100.0)	21 (100.0)	44 (97.8)	142 (99.3)
Ever	0 (0.0)	0 (0.0)	1 (2.2)	1 (0.7)
Share toothbrush				
Never	77 (100.0)	21 (100.0)	30 (66.7)	128 (89.5)
Ever	0 (0.0)	0 (0.0)	15 (33.3)	15 (10.5)
Share shaver				
Never	75 (97.4)	1 (4.8)	29 (64.4)	125 (87.4)
Ever	2 (2.6)	20 (95.2)	16 (35.6)	18 (12.6)
Circumcision				
Yes	73 (94.8)	21 (100.0)	45 (100.0)	139 (97.2)
No	4 (5.2)	0 (0.0)	0 (0.0)	4 (2.8)
Smoke history				
Never	12 (15.6)	1 (4.8)	5 (11.1)	18 (12.6)
Ever	65 (84.4)	20 (95.2)	40 (88.9)	125 (87.4)
Alcohol intoxication				
Never	53 (68.8)	19 (90.5)	7 (15.6)	79 (55.2)
Ever	24 (31.2)	2 (9.5)	38 (84.4)	64 (44.8)

Table 1 (Continued).

Factors	Sexual orientation gender identity			
	Gay <i>n</i> (%)	TG <i>n</i> (%)	MSW <i>n</i> (%)	Total <i>n</i> (%)
Vaginal sex without condom				
Never	42 (54.5)	18 (85.7)	18 (40.0)	78 (54.5)
Ever	35 (45.5)	3 (14.3)	27 (60.0)	65 (45.5)
Anal sex without condom				
Never	20 (26.0)	4 (19.0)	14 (31.1)	38 (26.5)
Ever	57 (74.0)	17 (81.0)	31 (68.9)	105 (73.5)
Role during sexual activity				
Largely receptive	42 (54.5)	21 (100.0)	17 (37.8)	80 (56.0)
Largely insertive	35 (45.5)	0 (0.0)	28 (62.2)	63 (44.0)
Frequency of sexual activity				
>1x / week	48 (62.3)	21 (100.0)	45 (100.0)	114 (79.7)
>1x / month	29 (37.7)	0 (0.0)	0 (0.0)	29 (20.3)
Saliva as lubricant				
Never	31 (40.3)	0 (0.0)	22 (48.9)	53 (37.1)
Ever	46 (59.7)	21 (100.0)	23 (51.1)	90 (62.9)
Sex with foreigner ^a				
Never	69 (90.1)	19 (90.5)	28 (62.2)	116 (81.7)
Ever	7 (9.9)	2 (9.5)	17 (37.8)	26 (18.3)
Commercial sex activity with man				
Never	15 (19.5)	0 (0.0)	0 (0.0)	15 (10.5)
Ever	62 (80.5)	21 (100.0)	45 (100.0)	128 (89.5)
Non-commercial sex activity with man				
Never	15 (19.5)	0 (0.0)	0 (0.0)	15 (10.5)
Ever	62 (80.5)	21 (100.0)	45 (100.0)	128 (89.5)
Commercial sex activity with woman				
Never	73 (94.8)	20 (95.2)	0 (0.0)	93 (65.0)
Ever	4 (5.2)	1 (4.8)	45 (100.0)	50 (35.0)
Non-commercial sex activity with woman				
Never	57 (74.0)	19 (90.5)	0 (0.0)	76 (53.1)
Ever	20 (26.0)	2 (9.5)	45 (100.0)	67 (46.9)

^aone missing value.

N, number of participants; TG, transgender; MSW, male sex worker; STI, sexual transmitted infection; IDU, injecting drug user.

participants (Table 1) and was more likely to be performed by participants who were injecting drug users (IDU) (OR 2.0; 95% CI: 0.85-4.54), had an educational level of greater than or equal to senior high school (OR 1.5; 95% CI: 0.67-3.34), or had a monthly income <100 USD (OR 1.8; 95%

CI: 0.48-6.62). The receptive role during sexual activity was performed by 80 participants (Table 1) and was more likely to be performed by participants who were IDUs (OR 1.5; 95% CI: 0.53-4.35), had a tattoo (OR 5.1; 95% CI: 2.14-12.06), had been pierced (OR 4.7; 95% CI: 2.18-12.11),

Table 2
Seroprevalence of HIV, HBV, HCV, HDV, HTLV, anti-toxoplasma_IgG, anti-toxoplasma_IgM, and TTV of men who have sex with men (MSM) in Surakarta, Indonesia.

Factors	Sexual orientation gender identity			
	Gay <i>n</i> (%)	TG <i>n</i> (%)	MSW <i>n</i> (%)	Total <i>n</i> (%)
Total Cases	77	21	45	143
Single Infection				
Anti HIV-1/2 (+)	2 (2.6)	6 (28.6)	5 (11.1)	13 (9.1)
HBsAg (+)	6 (7.8)	3 (14.3)	5 (11.1)	14 (9.8)
Anti HCV (+)	25 (32.5)	7 (33.3)	8 (17.8)	40 (28.0)
Anti HDV (+)	0 (0.0)	1 (4.8)	0 (0.0)	1 (0.7)
Anti HTLV-1/2 (+)	0 (0.0)	1 (4.8)	0 (0.0)	1 (0.7)
Anti-toxoplasma_IgM (+)	2 (2.6)	0 (0.0)	0 (0.0)	2 (1.4)
Anti-toxoplasma_IgG (+)	25 (32.5)	5 (23.8)	14 (31.1)	44 (30.8)
PCR TTV (+)	17 (22.1)	10 (47.6)	11 (24.4)	38 (26.6)
Multiple Infection				
Anti HIV-1/2 (+) + HBsAg (+)	0 (0.0)	1 (4.8)	2 (4.4)	3 (2.1)
Anti HIV-1/2 (+) + Anti HCV (+)	2 (2.6)	1 (4.8)	1 (2.2)	4 (2.8)
Anti HIV-1/2 (+) + Anti HDV (+)	0 (0.0)	1 (4.8)	0 (0.0)	1 (0.7)
Anti HIV-1/2 (+) + Anti-toxoplasma_IgG (+)	0 (0.0)	2 (9.5)	2 (4.4)	4 (2.8)
Anti HIV-1/2 (+) + PCR TTV (+)	0 (0.0)	2 (9.5)	3 (6.7)	5 (3.5)
HBsAg (+) + Anti HCV (+)	2 (2.6)	1 (4.8)	0 (0.0)	3 (2.1)
HBsAg (+) + Anti HDV (+)	0 (0.0)	1 (4.8)	0 (0.0)	1 (0.7)
HBsAg (+) + PCR TTV (+)	6 (7.8)	1 (4.8)	3 (6.7)	10 (7.0)
Anti HCV (+) + Anti HTLV-1/2 (+)	0 (0.0)	1 (4.8)	0 (0.0)	1 (0.7)
Anti HCV (+) + Anti-toxoplasma_IgG (+)	11 (14.3)	2 (9.5)	3 (6.7)	16 (11.2)
Anti HCV (+) + PCR TTV (+)	8 (10.4)	6 (28.6)	2 (4.4)	16 (11.2)
Anti HTLV-1/2 (+) + PCR TTV (+)	0 (0.0)	1 (4.8)	0 (0.0)	1 (0.7)
Anti HTLV-1/2 (+) + Anti-toxoplasma_IgG (+)	0 (0.0)	1 (4.8)	0 (0.0)	1 (0.7)
PCR TTV (+) + Anti-toxoplasma_IgG (+)	5 (6.5)	4 (19)	3 (6.7)	12 (8.1)
Anti HIV-1/2 (+) + HBsAg (+) + Anti HDV (+)	0 (0.0)	1 (4.8)	0 (0.0)	1 (0.7)
Anti HIV-1/2 (+) + HBsAg (+) + PCR TTV (+)	0 (0.0)	0 (0.0)	2 (4.4)	2 (1.4)
Anti HIV-1/2 (+) + Anti HCV + PCR TTV (+)	0 (0.0)	1 (4.8)	1 (2.2)	2 (1.4)
Anti HIV-1/2 (+) + PCR TTV (+) + Anti-toxoplasma_IgG (+)	0 (0.0)	1 (4.8)	0 (0.0)	1 (0.7)
HBsAg (+) + Anti HCV (+) + PCR TTV (+)	2 (2.6)	1 (4.8)	0 (0.0)	3 (2.1)
Anti HCV (+) + Anti HTLV-1/2 (+) + Anti-toxoplasma_IgG (+)	0 (0.0)	1 (4.8)	0 (0.0)	1 (0.7)
Anti HCV (+) + Anti HTLV-1/2 (+) + PCR TTV (+)	0 (0.0)	1 (4.8)	0 (0.0)	1 (0.7)
Anti HCV (+) + PCR TTV (+) + Anti-toxoplasma_IgG (+)	5 (6.5)	2 (9.5)	1 (2.2)	8 (5.6)
Anti HTLV-1/2 (+) + Anti-toxoplasma_IgG (+) + PCR TTV (+)	0 (0.0)	1 (4.8)	0 (0.0)	1 (0.7)
Anti HCV (+) + Anti HTLV-1/2 (+) + Anti-toxoplasma_IgG (+) + PCR TTV (+)	0 (0.0)	1 (4.8)	0 (0.0)	1 (0.7)

N, number of participants; TG, transgender; MSW, male sex worker.

Table 3
Univariate analysis of risk factors for BBV infection among men who have sex with men (MSM) in Surakarta, Indonesia.

Factors	OR (95%CI)	aOR (95%CI) ^a
HIV (+)		
Senior high school education or greater	2.3 (0.48-10.74)	
Monthly income < USD100	1.6 (0.35-7.86)	
Anal sex without a condom	1.2 (0.32-4.72)	
Using saliva as lubricant	2.1 (0.55-7.94)	
Performed receptive role during sex	2.8 (0.75-10.86)	1.3 (0.24-7.3)
IDU	4.0 (1.08-14.82)	6.0 (1.10-33.01)
Tattoo	3.2 (0.99-10.07)	
Piercing	11.1 (2.36-52.45)	8.1 (1.30-50.04)
Participated in a sex party	1.9 (0.47-7.44)	
Mouth surgery	1.2 (0.25-5.93)	
Besides mouth surgery	1.5 (0.17-12.92)	
HBV (+)		
Senior high school education or greater	1.5 (0.39-5.59)	
Anal sex without a condom	1.4 (0.36-5.18)	
Using saliva as lubricant	2.3 (0.62-8.73)	
Tattoo	2.2 (0.57-9.01)	
Mouth surgery	1.3 (0.41-3.87)	
HCV (+)		
Senior high school education or greater	2.8 (1.07-7.29)	
Monthly income < USD100	2.5 (0.88-7.00)	
Anal sex without a condom	2.5 (0.97-6.69)	1.5 (0.42-5.48)
Using saliva as lubricant	4.8 (1.84-12.30)	2.9 (0.87-9.41)
Tattoo	1.7 (0.78-3.67)	2.1 (0.66-6.55)
Piercing	1.8 (0.84-3.69)	
Besides mouth surgery	1.6 (0.36-6.98)	
Toxoplasma (+)		
Middle school education or greater	2.2 (0.79-6.21)	
Vaginal sex without a condom	2.5 (1.23-5.29)	2.3 (1.06-4.92)
Anal sex without a condom	2.4 (0.97-6.00)	2.2 (0.75-6.37)
Using saliva as lubricant	1.9 (0.87-4.09)	1.6 (0.66-4.12)
Drug abuser	1.1 (0.48-2.52)	
Tattoo	2.1 (0.97-4.47)	3.2 (1.28-7.98)
Inmate	1.9 (0.87-3.97)	
Hospitalized	1.8 (0.66-4.78)	
Having injection outside a hospital	2.3 (0.31-16.95)	
Participated in a sex party	1.5 (0.56-3.85)	
TTV (+)		
Senior high school education or greater	1.1 (0.48-2.59)	
Monthly income < USD100	1.7 (0.66-4.67)	
Vaginal sex without a condom	1.5 (0.70-3.12)	
Using saliva as lubricant	2.3 (1.00-5.40)	
Performed the receptive role during sex	1.7 (0.81-3.78)	1.4 (0.49-3.87)
IDU	33.6 (7.18-157.15)	32.5 (5.93-177.93)
Tattoo	1.4 (0.61-3.02)	
Piercing	2.0 (0.94-4.25)	1.6 (0.59-4.62)
Mouth surgery	1.3 (0.46-3.78)	

Only significance factors that are shown. OR, odd ratios; CI, confidence interval; IDU, injecting drug user; USD, US Dollar; aOR, adjusted OR (only shown if >1.0).

had an educational level of greater than or equal to senior high school (OR 1.8; 95% CI: 0.88-3.86), or had a monthly income <USD100 (OR 1.9; 95% CI: 0.85-4.17). Using saliva as a lubricant was performed by 37.1% of participants (53/143) and was more likely to be performed by participants who were IDUs (OR 11.2, 95% CI: 1.45-87.44), had an educational level of greater than or equal to senior high school (OR 1.6; 95% CI: 0.75-3.35), had a tattoo (OR 1.1; 95% CI: 0.51-2.30), had been pierced (OR 1.3; 95% CI: 0.64-2.63) or had a monthly income <USD100 (OR 3.3; 95% CI: 1.47-7.46).

HIV infection and risk behavior

Approximately 15.3% (2/13) of the HIV-infected participants were gay, 46.2% (6/13) were TG and 38.5% (5/13) were MSW ($p=0.029$) (Table 2). The mean age of the HIV-infected participants was 29 years (range, 19-45) ($p=0.735$). Significant differences were found between the HIV-positive and HIV-negative participants: being an IDU (30.8% vs 10.0%, $p=0.027$), having a tattoo (53.8% vs 26.9%, $p=0.042$), having been pierced (84.6% vs 33.1%, $p<0.001$) and having unprotected intercourse (15.4% vs 48.5%, $p=0.022$). Having a history of the receptive role in sexual activity [adjusted OR (aOR) 1.3; 95% CI: 0.24-7.30], being an IDU (aOR 6.0; 95% CI: 1.10-33.01) and having been pierced (aOR 8.1; 95% CI: 1.30-50.04) were significantly associated with HIV infection (Table 3).

HBV infection and risk behavior

Of the 14 HBsAg-positive participants, 42.9% (6/14) were gay, 21.4% (3/14) were TG, and 35.7% (5/14) were MSW ($p=0.992$) (Table 2). The mean age of the HBsAg-positive participants was 25 years old (19-38) ($p=0.059$). HBV infection was more likely to occur in participants who had an education level greater than or

equal to senior high school (OR 1.5; 95% CI: 0.39-5.59), had anal sex without a condom (OR 1.4; 95% CI: 0.36-5.18), used saliva as a lubricant (OR 2.3; 95% CI: 0.62-8.73), had a tattoo (OR 2.2; 95% CI: 0.57-9.01) or had mouth surgery (OR 1.3; 95% CI: 0.41-3.87) (Table 3).

HCV infection and risk behavior

Of the 40 participants infected with HCV, 62.5% (25/40) were gay, 17.5% (7/40) were TG and 20% (8/40) were MSM ($p=0.458$) (Table 2). Seventeen participants (17/40, 42.5%) were IDU. The mean age of the HCV-infected participants was 28 years old (19-48) ($p=0.488$). Having a history of anal sex without a condom (aOR 1.5; 95% CI: 0.42-5.48), using saliva as a lubricant (aOR 2.9; 95% CI: 0.87-9.41) and having a tattoo (aOR 2.1; 95% CI: 0.66-6.55) were correlated with HCV infection (Table 3).

HDV infection, HTLV infection and risk behavior

The HDV-positive participant was a 30 year old transgender, had a tattoo and had been pierced. He had performed anal sex without a condom. The anti-HTLV-positive participant was a 27 year old TG and an IDU. He did not have a tattoo or piercing. He reported that he had performed vaginal and anal sex without a condom.

Toxoplasma seroprevalence and risk behavior

Of the 44 participants who were positive for anti-toxoplasma IgG, 56.8% (25/44) were gay, 11.4% (5/44) were TG and 31.8% (14/44) were MSW ($p=1.000$) (Table 2). The mean age of the HCV-infected participants was 29 years old (20-47) ($p=0.454$). Coitus without a condom (aOR 2.3; 95% CI: 1.06-4.92), anal sex without a condom (aOR 2.2; 95% CI: 0.75-6.37), using saliva as a lubricant (aOR 1.6; 95% CI: 0.66-4.12),

and having a tattoo (aOR 3.2; 95% CI: 1.28-7.98) were associated with positive results for anti-toxoplasma IgG (Table 3).

TTV infection and risk behavior

Among the TTV-infected participants, 44.7% (17/38) were gay, 26.3% (10/38) were TG and 29.0% (11/38) were MSW ($p=0.784$) (Table 2). The mean age of the TTV-infected participants was 31 years old (19-54) ($p=0.137$). Using saliva as a lubricant (76.3% vs 58.1%, $p=0.046$) and being an IDU (39.5% vs 1.9%, $p<0.001$) were significantly more common among TTV-positive than TTV-negative participants. Logistic regression analysis showed having a receptive role in sexual activity (aOR 1.4; 95% CI: 0.49-3.87), being an IDU (aOR 32.5; 95% CI: 5.93-177.93) and having had piercing (aOR 1.6; 95% CI: 0.59-4.62) were independent factors for TTV infection (Table 3).

Multiple infections and risk behavior

Multiple infections were found among participants in this study (Table 2). All (16/16) of the HCV/TTV-positive participants had a tattoo and a history of piercing and had used saliva as a lubricant. All (16/16) of the HCV/anti-toxoplasma IgG-seropositive participants were informal employees and had a monthly income < USD 100. All participants who were coinfecting with HIV/HCV/TTV were IDUs. None of the participants coinfecting with HIV/HDV/TTV, HIV/HDV/TTV or HIV/TTV/*T. gondii* were IDUs.

DISCUSSION

Surakarta, also known as Solo, is one of the largest cities in Central Java Province, Indonesia. Surakarta is a strategic point because of its position connecting Yogyakarta, the capital city of DIY Province in the southern region of Java, with

Semarang, the capital city of Central Java Province in the northern region of Java. Surakarta also connects Yogyakarta with Surabaya, the capital city of East Java Province in the eastern region of Java. Its strategic position has enabled Surakarta to become a business center for other surrounding cities and has resulted in many people from these surrounding cities moving to Surakarta to find work (Government of Surakarta, 2012). The Department of the Population and Civil Registry reported that Surakarta had the highest population density in Central Java Province in 2011 (Department of Population and Civil Registry Surakarta, 2011). Surakarta's role as a transit city has resulted in Surakarta playing an important role in the spread of diseases. Although Surakarta has a vital role in Central Java Province and a high population density, an epidemiological study of selected blood-borne pathogen infections among the population in Surakarta has not been previously performed to the best of our knowledge.

The HIV infection prevalence in our study was higher than that in a previous study in 2007, which reported the prevalence of HIV infection among MSMs in six cities in Indonesia (Jakarta, Bandung, Semarang, Surabaya, Malang and Medan) was 5.2% (Morineau *et al*, 2011); however, the MSM participants in the previous study were not classified into specific groups (gay, TG, MSW) as done here. The difference in the HIV prevalence between our study and the previous study may have been caused by the differentiation of high risk behavior practiced by the community. In our study, the only sexual behavior with a propensity for HIV infection was the receptive role in sexual activity. Risk factors that had a strong association with HIV infection among the MSM

participants in the present study were being an IDU and having been pierced. The prevalence of HIV infection among MSM in this study was also higher than the prevalence of HIV infection among the general population in Indonesia (Ministry of Health Indonesia, 2012), which can be attributed to the observation MSM have higher risk behavior than the general community (Pisani *et al*, 2004; Morineau *et al*, 2011). Our data shows 23.5% of HIV-positive participants were IDUs compared with 7.1% of cases who were not IDUs. Our findings agree with a previous study reporting HIV infection among IDUs in Bandung, Indonesia is common (Iskandar *et al*, 2010), but studies of HIV among MSM in Indonesia have not been reported. Meanwhile, 20.4% of participants that had been pierced had an HIV infection compared with only 2.3% of people who had never been pierced. Previous studies of HIV in Indonesia have not reported an association between HIV infection and a history of having been pierced (Iskandar *et al*, 2010; Nelwan *et al*, 2010; Morineau *et al*, 2011).

Most participants with an HIV-positive infection were co-infected with HBV, HCV, HDV, TTV or *T. gondii*. Practicing high risk sexual behavior is a risk factor of HIV/HCV co-infection among HIV-positive MSM, and the incidence of HCV co-infection among HIV-positive MSM has been reported to be high (van de Laar *et al*, 2007). We also found multiple coinfecting cases: HIV/HBV/HDV (0.7%), HIV/HBV/TTV (1.4%), HIV/HCV/TTV (1.4%) and HIV/TTV/*T. gondii* (0.7%). All participants coinfecting with HIV/HCV/TTV were IDUs, none who were coinfecting with HIV/HBV/HDV, HIV/HBV/TTV or HIV/TTV/*T. gondii* were IDUs. IDU is a known risk factor for triple infection (Nerurkar *et al*, 1999; Sherman *et al*, 2001),

however further studies are needed to find other risk factors.

The prevalence of HBV infection in our study (9.8%) was higher than in a previous study from Indonesia (5.1%) (Nerurkar *et al*, 1999), but Surakarta was not included in that study. None of the participants in our study who were HBsAg positive had ever received HBV vaccination (data not shown). Because the sample number in our study was low, we failed to find a correlation between HBV infection and the risk factors investigated.

The prevalence of HCV infection among MSM participants was 28.0%, higher than in a previous study among prisoners in Bandung, Indonesia (18.6%) (Nelwan *et al*, 2010) and in the general population of Tahuna, Sulawesi Utara Province, Indonesia (0.2%) (Achwan *et al*, 2007). We could not find a previous study of the prevalence of HCV infection among MSMs in Indonesia. Based on multivariate analysis, using saliva as a lubricant during sexual intercourse was correlated with HIV infection. HCV transmission through the saliva is possible; one study found 95% of those positive for HCV had HCV RNA in the saliva (Wang *et al*, 2006). Having a tattoo also increased the risk for having HCV infection, similar to a previous report (Mahfoud *et al*, 2010; Nelwan *et al*, 2010). We found all MSM participants in our study with a history of being IDUs had HCV infection.

One participant infected with HDV was also infected with HIV and HBV. A study from 28 cities on 15 islands in Indonesia, including Surakarta, conducted during 1989-2007 found 0.8% of the population had anti-HDV antibodies (Mulyanto *et al*, 2009); however there are no previous studies of HDV among MSM in Indonesia. The HDV-infected participant in our study was not an IDU, but he had

a tattoo and piercing, and practiced high risk sexual behavior. This finding is in line with a previous study conducted in Taiwan that reported that sexual contact is one of major routes for HDV transmission (Chang *et al*, 2011).

T. gondii infection had the highest prevalence among MSM in the present study. The prevalence of *T. gondii* infection among MSM in our study was lower than the prevalence among the general population in Jakarta (Terazawa *et al*, 2003). In the present study, we did not find any acute cases of *T. gondii* infection by examining with anti-toxoplasma IgM, as has been used to diagnose an acute infection (Lappalainen and Hedman, 2004; Rahbari *et al*, 2012). The risk factor significantly associated with *T. gondii* infection among MSM in this study was having a tattoo, which agrees with a previous report (Mohraz *et al*, 2009). Further studies are needed to investigate *T. gondii* transmission through tattoos or people who have tattoos.

Twenty-six point six percent of the MSM in the present study were positive for TTV infection. The prevalence of TTV infection among MSM in either Indonesia or the world, to the best of our knowledge, has not been reported previously. MSM practice high risk sexual behavior, and sexual contact is consider a mode of TTV transmission (MacDonald *et al*, 1999; Puig-Basagoiti *et al*, 2000; Krekulova *et al*, 2001; Yazici *et al*, 2001).

We found TTV coinfection with HIV, HBV, HCV, HTLV-1/2 and *T. gondii*. TTV infection is often found in people with HBV or HCV infection (Krekulova *et al*, 2001; Salakova *et al*, 2004; Kristian *et al*, 2006; Hussain *et al*, 2012) because these three viruses have the same transmission route (Salakova *et al*, 2004). Seventy-one point four percent of participants positive for HBV were infected with TTV and

52.5% of participants positive for HCV were infected with TTV. One participant positive for HTLV was also infected with TTV. Multiple coinfections among TTV-infected participants were found: HIV/HBV/TTV, HIV/HCV/TTV, HIV/TTV/*T. gondii*, HBV/HCV/TTV, HCV/TTV/*T. gondii* and HTLV/TTV/*T. gondii*. Based on multivariate analysis, the risk factor associated with TTV infection was being an IDU (OR 32.5; 95% CI: 5.93-177.93), similar to a previous study from Iran (Ataei *et al*, 2012). Having been pierced (aOR 1.6; 95% CI: 0.59-4.62) and having had the receptive role in sexual activity (aOR 1.4, 95% CI: 0.49-3.87) also increased the risk for being infected with TTV.

We found one participant coinfecting with HTLV, HCV, TTV and *T. gondii*. The prevalence of HTLV-1/2 infections in this study was much lower than in previous studies in Irian Jaya, eastern Indonesia (Porter *et al*, 1994). HTLV infection among MSM has never been determined in Indonesia. HTLV co-infection with TTV and *T. gondii* among MSM has never been reported.

HCV/*T. gondii* and HCV/TTV coinfections had the highest prevalences in this study. Studies investigating *T. gondii* and HCV co-infection are rare. Most of the participants in our study who had HCV/*T. gondii* co-infection had a history of anal sex without a condom and used saliva as a lubricant during sexual intercourse. However, none were IDUs. No other studies of HCV/TTV co-infection among MSM have been reported. Forty percent of participants in our study who were infected with HCV also had TTV coinfection. Risk factors associated with HCV/TTV co-infection were using saliva as a sex lubricant (OR 13.9; 95% CI: 1.76-110.45), having been pierced (OR 4.4; 95% CI: 1.39-13.95) and having a tattoo (OR 4.0;

95% CI 1.29-12.12).

The MSM in our study had a poor knowledge about sexual health and infectious diseases, including about HIV, hepatitis and STIs. Participants with less than a middle school education were less likely to know about HIV, hepatitis and STIs; middle schools and lower in Indonesia do not provide sexual education about HIV, hepatitis and STIs. This poor knowledge about HIV, hepatitis and STIs may result in unsafe sexual intercourse. The majority of participants in our study had a history of both anal and vaginal intercourse without using a condom. Interestingly, the participants who had unsafe sexual intercourse were more likely to have a senior high school education or greater. This observation indicates formal education in Indonesia may not provide enough basic knowledge about sexual health and the consequences of unsafe sexual intercourse. The Indonesian government, through the Ministry of Education and other related institutions, should design an effective strategy to provide a basic knowledge of sexual health and the consequences of unsafe sexual intercourse.

This was the first study of the prevalence of HIV, HBV, HCV, HDV, HTLV and *T. gondii* infections among MSM in Indonesia. The number of previous studies among MSM is insufficient to draw firm conclusions. Similar surveillance studies with larger sample sizes need to be performed to confirm our findings.

Indonesians consider MSM to be a deviation not be accepted in society (Beyrer, 2010), causing MSM to become a neglected population in the community. Although MSM represent a small proportion of Indonesian society (UNAIDS, 2012), they are a community at high risk for HIV infection, viral hepatitis and STIs (Pisani *et al*,

2004; Morineau *et al*, 2011). The majority of MSMs in our study were bisexuals and practiced high risk sexual behavior. MSM may be a source for infection in the general Indonesian population.

ACKNOWLEDGEMENTS

The authors would like to thank Rochmali Zultan, Alexius Purwoko, Denny Adriansyah, Sofina Kusnadi, Hafriantika Ramadhani, Wike Astrid Cahayani and Tenri Ashari for their technical assistance. This work was supported partially by grants from the Indonesian Directorate of Higher Education (No.322/SP2H/PP/DP2M/VI/2009, 440/SP2H/PP/DP2M/VI/2010, 505/SP2H/PL/Dit.Litabmas/VII/2011, and 197/SP2H/PL/Dit.Litabmas/IV/2012) and from APBN/DIPA UNS (No. 267a/UN27.16/PN/2013).

REFERENCES

- Achwan WA, Muttaqin Z, Zakaria E, *et al*. Epidemiology of hepatitis B, C, and E viruses and human immunodeficiency virus infections in Tahuna, Sangihe-Talaud Archipelago, Indonesia. *Intervirology* 2007; 50: 408-11.
- Ataei B, Naeini EA, Khorvash F, Yazdani MR, Javadi AA. Prevalence of transfusion transmitted virus infection in hemodialysis patients and injection drug users compared to healthy blood donors in Isfahan, Iran. *Gastroenterol Res Pract* 2012; 2012: 671927.
- Baral S, Sifakis F, Cleghorn F, Beyrer C. Elevated risk for HIV infection among men who have sex with men in low- and middle-income countries 2000-2006: A systematic review. *PLoS Med* 2007; 4: e339.
- Beyrer C. Global prevention of HIV infection for neglected populations: men who have sex with men. *Clin Infect Dis* 2010; 50: S108-13.
- Chang SY, Yang CL, Ko WS, *et al*. Molecular epidemiology of hepatitis D virus infec-

- tion among injecting drug users with and without human immunodeficiency virus infection in Taiwan. *J Clin Microbiol* 2011; 49: 1083-9.
- Department of Population and Civil Registry Surakarta. Growth and population density. Surakarta: Department of Population and Civil Registry, 2011. [Cited 2013 Mar 20]. Available from: URL: <http://dispendukcapil.surakarta.go.id/content/jumlah-dan-persebaran-penduduk><http://dispendukcapil.surakarta.go.id/content/jumlah-dan-persebaran-penduduk>
- Government of Surakarta. Overview of Surakarta, 2012. [Cited 2013 Mar 2]. Available from: URL: <http://surakarta.go.id/konten/selayang-pandang>
- Hussain T, Manzoor S, Waheed Y, Huma T, Khushbakht H. Phylogenetic analysis of torque teno virus genome from Pakistani isolate and incidence of co-infection among HBV/HCV infected patients. *Virology* 2012; 9: 320.
- Indonesia National AIDS Commission, Ministry of Indonesia. National prevention strategy for HIV and AIDS 2007-2010. Jakarta: Indonesia National AIDS Commission, 2007.
- Indonesia National AIDS Commission, Ministry of Health Indonesia. Exclusive resume of HIV/AIDS prevention in Indonesia 2006 - 2011: Report of 5 year implementation of Presidential Regulations No. 75/2006 on National AIDS Commission. Jakarta: Indonesia National AIDS Commission, 2011.
- Irshad M, Singh S, Irshad K, Agarwal SK, Joshi YK. Torque teno virus: Its prevalence and isotypes in North India. *World J Gastroenterol* 2008; 14: 6044-51.
- Iskandar S, Basar D, Hidayat T, *et al.* High risk behavior for HIV transmission among former injecting drug users: a survey from Indonesia. *BMC Public Health* 2010; 10: 472.
- Kassak K, Mahfoud Z, Kreidieh K, Shamra S, Afifi R, Ramia S. Hepatitis B virus and hepatitis C virus infections among female sex workers and men who have sex with men in Lebanon: prevalence, risk behaviour and immune status. *Sex Health* 2010; 8: 229-33.
- Krekulova L, Rehak V, Killoran P, Madrigal N, Riley LW. Genotypic distribution of TT virus (TTV) in a Czech population: evidence for sexual transmission of the virus. *J Clin Virol* 2001; 23: 31-41.
- Kristian P, Schréter I, Siegfried L, *et al.* Prevalence, epidemiological aspects and clinical importance of TT virus infection in Slovakia. *Acta Med (Hradec Králové)* 2006; 49: 41-5.
- Lappalainen M, Hedman K. Serodiagnosis of toxoplasmosis. The impact of measurement of IgG avidity. *Ann Ist Super Sanità* 2004; 40: 81-8.
- MacDonald DM, Scott GR, Clutterbuck D, Simmonds P. Infrequent detection of TT virus infection in intravenous drug users, prostitutes, and homosexual men. *J Infect Dis* 1999; 179: 636-44.
- Mahfoud Z, Kassak K, Kreidieh K, Shamra S, Ramia S. Prevalence of antibodies to human immunodeficiency virus (HIV), hepatitis B and hepatitis C and risk factors in prisoners in Lebanon. *J Infect Dev Ctries* 2010; 4: 144-9.
- Ministry of Health Indonesia, Indonesia National AIDS Commission, United Nations Joint Programme on HIV/AIDS. Integrated biological-behavioral surveillance among most-at-risk groups (MARG) in Indonesia, 2007 surveillance highlights MSM (Men Who Have Sex with Men). Jakarta: Ministry of Health Indonesia, 2007.
- Ministry of Health Indonesia. AIDS surveillance report, Ministry of Health, September 2012. Jakarta: Ministry of Health Indonesia, 2012.
- Mohraz M, Mehrkhani F, Jam S, *et al.* Seroprevalence of toxoplasmosis in HIV+/AIDS patients in Iran. *Acta Med Iran* 2009; 49: 213-8.
- Morineau G, Nugrahini N, Riono P, *et al.* Sexual risk taking, STI and HIV prevalence among men who have sex with men in six Indonesian cities. *AIDS Behav* 2011;

- 15: 1033-44.
- Mulyanto, Depamede SN, Surayah K, *et al.* A nationwide molecular epidemiological study on hepatitis B virus in Indonesia: identification of two novel subgenotypes, B8 and C7. *Arch Virol* 2009; 154: 1047-59.
- Nelwan EJ, Van Crevel R, Alisjahbana B, *et al.* Human immunodeficiency virus, hepatitis B and hepatitis C in an Indonesian prison: prevalence, risk factors and implications of HIV screening. *Trop Med Int Health* 2010; 15: 1491-8.
- Nerurkar V, Woodward C, Nguyen HT, *et al.* Lack of association between acquisition of TT virus and risk behavior for HIV and HCV infection in Vietnam. *Int J Infect Dis* 1999; 3: 181-5.
- Pisani E, Girault P, Gultom M, *et al.* HIV, syphilis infection, and sexual practices among transgenders, male sex workers, and other men who have sex with men in Jakarta, Indonesia. *Sex Transm Infect* 2004; 80: 536-40.
- Porter KR, Liang L, Long GW, *et al.* Evidence for anti-*Plasmodium falciparum* antibodies that cross-react with Human T-Lymphotropic Virus type I proteins in a population in Irian Jaya, Indonesia. *Clin Diagn Lab Immunol* 1994; 1: 11-5.
- Puig-Basagoiti F, Cabana M, Guilera M, *et al.* Prevalence and route of transmission of infection with a novel DNA virus (TTV), hepatitis C Virus, and hepatitis G Virus in patients infected with HIV. *J Acquir Immune Defic Syndr* 2000; 23: 89-94.
- Rahbari AH, Keshavarz H, Shojaee S, Mohebbali M, Rezaeian M. IgG avidity ELISA test for diagnosis of acute toxoplasmosis in humans. *Korean J Parasitol* 2012; 50: 99-102.
- Salakova M, Nemecek V, Konig J, Tachezy R. Age-specific prevalence, transmission and phylogeny of TT virus in the Czech Republic. *BMC Infect Dis* 2004; 4: 56.
- Sherman K, Rouster S, Feinberg J. Prevalence and genotypic variability of TTV in HIV-infected patients. *Dig Dis Sci* 2001; 46: 2401-7.
- Sulaiman A, Julitasari, Sie A, Rustam M, Meilani W, Corwin A. Prevalence of hepatitis B and C virus in healthy Indonesian blood donors. *Trans R Soc Trop Med Hyg* 1995; 89: 167-70.
- Terazawa A, Muljono R, Susanto L, Margono SS, Konishi E. High Toxoplasma antibody prevalence among inhabitants in Jakarta, Indonesia. *Jpn J Infect Dis* 2003; 56: 107-9.
- Tanggo Y, Gultom SP, Simanjuntak T, Sibuea WH, Matsuzaki H, Yamaguchi K. Human T Lymphotropic Virus in Indonesia very low seroprevalence in the Jakarta area: Antibodies in healthy blood donors and in various nonhematological diseases. *Intervirology* 2000; 43: 77-9.
- UNAIDS: United Nations Joint Programme on HIV/AIDS, United Nations Development Programme, Asia Pacific Coalition on Men Sexual Health. Indonesia: Country Snapshot – HIV and men who have sex with men December 2012. Geneva: UNAIDS, 2012.
- van de Laar TJ, van der Bij AK, Prins M, *et al.* Increase in HCV incidence among men who have sex with men in Amsterdam most likely caused by sexual transmission. *J Infect Dis* 2007; 196: 230-8.
- Wang CC, Morishima C, Chung M, *et al.* High serum hepatitis C virus (HCV) RNA load predicts the presence of HCV RNS in saliva from individuals with chronic and acute HCV infection. *J Infect Dis* 2006; 193: 672-6.
- Yazici M, Comert MR, Mas R, Guney C, Cinar E, Kocar IH. Transfusion-transmitted virus prevalence in subjects at high risk of sexually transmitted infection in Turkey. *Clin Microbiol Infect* 2001; 8: 363-7.
- Zunt JR, Rosa AML, Peinado J, *et al.* Risk factors for HTLV-II infection in Peruvian men who have sex with men. *Am J Trop Med Hyg* 2006; 74: 922-5.