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ORIGINAL RESEARCH

FACTORS ASSOCIATED WITH HEPATITIS B AND C CO-INFECTION AMONG PEOPLE LIVING WITH HUMAN IMMUNODEFICIENCY VIRUS IN VIETNAM

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Abstract

Background: Human immunodeficiency virus (HIV), hepatitis B virus (HBV) and hepatitis C virus (HCV) are the leading causes of death from infectious diseases. Because of sharing same transmission routes, the co-infection of HIV with HBV or HCV is common. And the co-infections make HIV infected persons have higher morbidity and mortality than those who infected only with HIV. This study aims to investigate factors that may have influence on the co-infections of HBV or HCV among HIV positive individuals.

Objective: The goals of this study were to identify factors associated with the co-infection of HBV or HCV among people living with HIV.

Methods: Quantitative research method was applied in this study to examine factors associated with HBV or HCV co-infection among HIV infected people. A total of 250 HIV infected individuals in Khanh Hoa province, Vietnam were the sample of this study. It employed the Social Ecological Model (SEM) as a theoretical perspective that focused on multiple levels of factors. Descriptive statistic was used to describe the general characteristics of the respondents. And Binary logistic regression was carried out to measure the influence of factors on the co-infection.

Results: The multivariate analysis of this study showed that HIV-HBV co-infection was associated significantly with residents of Nha Trang (*OR*= 7.179). Regarding HIV-HCV co-infection, being men (*OR*= 7.617), unemployed (*OR*= 4.013), a resident of Nha Trang (*OR*=10.894) and an injecting drug user (*OR*= 16.688) were risk factors of the co-infection.

Conclusions: This study recommended that intervention strategies to prevent HIV-positive individuals from co-infection with either HBV or HCV should focus on altering individuals' risk behaviors and their socio-economic environments. Also, specific preventing programs should be implemented and focus on unemployed populations, injecting drug users, men in general, as well as people living in particular areas, especially cities having a large number of people living with HIV.

KEYWORDS
HIV; HCV; HBV; co-infection; Vietnam

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INTRODUCTION

Human immunodeficiency virus (HIV), hepatitis B virus (HBV) and hepatitis C virus (HCV) are blood-borne viruses, which are one of the top causes leading deaths by infectious disease worldwide (Alter, 2006; Centers for Disease Control and Prevention, 2018). These three viruses can be transmitted in similar ways such as exchange of blood, or other body fluids, during injecting drug use (IDU), sexual contact or mother-to-child transmission during the perinatal period (Centers for Disease Control and Prevention, 2018; Petty et al., 2014; World Health Organization, 2017a, 2017b). Therefore, HIV-positive individuals are more likely to have a risk of co-infection with HBV or HCV (Kamenya et al., 2017; Mohammadi et al., 2009).

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HBV and HCV were as major contributors of liver cirrhosis, liver cancer and liver-related deaths, have become one of the important causes of illness and reduce life expectancy among people living with HIV (Bhaumik et al., 2015; Kim et al., 2017).

In Vietnam, HIV, HBV, HCV, as well as their co-infections remain a major public health issue. Some studies were conducted in Vietnam (Hanoi, and Ho Chi Minh City) to investigate co-infections prevalence. These studies revealed that the overall prevalence of HBV co-infection were 5 - 12.9%; and about 21.2 - 36% experienced HCV co-infection (Huy et al., 2014; Mohan et al., 2017; Quang et al., 2015). Understanding about the situation of HIV co-infection with HBV or HCV among HIV positive people in Vietnam, especially about which factors associated with these co-infection is important for HIV health workers and nurses in developing more effective intervention strategies to prevent HBV and HCV. However, limited studies were conducted in Vietnam to investigate factors associated with these co-infections. Therefore, this study aimed to identify risk factors associated with HBV or HCV co-infection among HIV-positive individuals in Vietnam.

METHODS

Study design

This study was quantitative research to examine factors associated with hepatitis B or hepatitis C co-infection among people living with HIV. It relied on secondary data of the survey from 2016 to 2017 on "HIV, HBV and HCV co-infection of patients receiving ARV and methadone treatment in Khanh Hoa Province", conducted by the Preventing HIV/AIDS Center of Khanh Hoa. The secondary data used in the study was collected in Khanh Hoa Province, situated in the south central coast of Vietnam.

Sample

The study population of this study comprised HIV-positive people receiving ARV treatment in Khanh Hoa Province. These HIV-positive people received a diagnosis of HBV or HCV co-infection. The sample size of this study totaled 250 respondents, which was calculated by the original survey using the Taro Yamane Formula (Yamane, 1973). The study applied all inclusion and exclusion criteria of the sampling method according to the original survey. All HIV positive persons receiving treatment of ARV in Khanh Hoa province before 31 December 2016 were included in this study. However, the sample recruited had some exceptions: people who refused to participate in the survey, and those who died, moved to other provinces or withdrew from treatment.

Instrument

The subjects of this study were drawn from secondary data of the original survey mentioned previously. The original interviews were conducted face-to-face using questionnaires. Trained interviewers collected data from medical reports first, then made appointments with the HIV people for structured interview, using a paper-based questionnaire and took samples for blood testing (confirmed test for HIV, HBV and HCV). The questionnaires included patient's general information, risk factors of HIV, HBV and HCV infection and patient's medical information.

Ethical approval

This study received approval for the secondary use of "HIV, HBV and HCV co-infection data on patients receiving treatment ARV and methadone in Khanh Hoa Province, Vietnam" from Khanh Hoa HIV/AIDS Center, that conducted and managed the original data set. The ethics approval for this present study was granted by the IPSR-Institutional Review Board (IPSR-IRB) of the Institute for Population and Social Research, Mahidol University (COE. No. 2018/05-160).

Data analysis

This study employed the Social Ecological Model (SEM) as a theoretical perspective that focused on multiple levels (personal and environmental) of factors and their complex interplay that influence specific behavior. Total of 12 variables was analyzed in this study, which was categorized into four levels, including intrapersonal levels (age, sex, education, marital status, employment status, sexual orientation, experience of injecting drug use and duration of ARV treatment); interpersonal levels (practicing unsafe sex and partner's history of injecting drugs); organizational level (place of residence); and community level (tattooing).Descriptive statistic was used to describe the general characteristics of the respondents (frequencies and percentages). Multivariate analysis (Binary logistic regression) was carried out to identify the risk factors for the co-infections (HIV co-infection with HBV or HCV).There are 2 models, each model is appropriate with each dependent variable (HIV and HBV co-infection, HIV and HCV co-infection). STATA software version 14 was used for all statistical analyses.

RESULTS

Characteristics of HIV Positive People Co-infected with HBV or HCV

Of 250 HIV infected individuals, over one half of respondents were men (59.6%). The age-range of respondents was from 20 - 70 years with a mean of 38.2. The prevalence of HIV-HBV and HIV-HCV co-infection was 20.8% and 37.6%, respectively. Individual 30-39 years old were at a higher risk of HBV or HCV co-infection compare to those in age group less than 30. Male respondents had a higher rate of HIV co-infection with HBV or HCV than HIV infected female (**Table 1**). Respondents residing in Nha Trang were co-infected with HBV or HCV at a higher frequency compare to those who resided outside Nha Trang. Marital status, education, employment status, history of injecting drug use and tattooing had a relationship with HIV-HCV co-infection ($p<.05$); however, the same did not hold for HIV-HBV co-infection. Meanwhile, sexual orientation had a correlation with co-infection of HBV ($p<.05$), but not with HCV co-infection.

Table 1 Characteristics of HBV and HCV infection in 250 HIV infected people in Vietnam

All factors		Overall sample N (%)	HIV-HBV co-infection Number of possibility(%)	HIV-HCV co-infection N Number of possibility(%)
Intrapersonal Levels				
Age	≤ 29	24 (9.6)	9 (37.5)	9 (37.5)
	30-39	137 (54.8)	26 (19)	56 (40.9)
	≥ 40	89 (35.6)	17 (19.1)	29 (32.6)
	Total	250	52 (20.8)	94 (37.6)
Mean = 38.2, SD = 8.3, Min = 20, Max = 70				
χ^2			4.495	1.581
p			0.106	0.454
Sex	Female	101 (40.4)	21 (20.7)	15 (14.8)
	Male	149 (59.6)	31 (20.8)	79 (53)
	Total	250	52	94
χ^2			0.000	37.377
p			0.998	**0.000***
Marital status	Never married	60 (24)	13 (21.7)	29 (48.3)
	Ever married	190 (76)	39 (30.5)	65 (34.2)
	Total	250	52	94
χ^2			0.036	3.877
p			0.850	**0.049***
Education	Primary school or lower	41 (16.4)	8 (19.5)	17 (41.5)
	Secondary school	101 (40.4)	21 (20.8)	46 (45.5)
	High school or higher	108 (43.2)	23 (21.3)	31 (28.7)
	Total	250	250	94
χ^2			0.057	6.621
p			0.972	**0.036***
Employment status	Employed	192 (76.8)	36 (18.7)	61 (31.8)
	Unemployed	58 (23.2)	16 (27.6)	33 (56.9)
	Total	250	52	94
χ^2			2.111	11.985
p			0.146	**0.001***
Sexual orientation	Heterosexual	234 (93.6)	46 (19.7)	86 (36.8)
	Homosexual	10 (4)	6 (60)	3 (30)
	Total	250	52	89
χ^2			9.307	0.189
p			**0.002****	0.664
Duration of ARV treatment	No	194 (77.6)	39 (20.1)	69 (35.6)
	Yes	56 (22.4)	13 (23.2)	25 (44.6)
	Total	250	52	94
Mean= 4.8, SD= 2.7, Min= 1, Max= 12				
χ^2			0.255	1.527
p			0.613	0.217
History of Injecting drug use	No	156 (62.4)	31 (19.9)	23 (14.7)
	Yes	94 (37.6)	21 (22.3)	71 (75.5)
	Total	250	52	94
χ^2			0.217	92.381
p			0.641	**0.000***
Interpersonal Level				
Practicing unsafe sex	No	76 (31.1)	17 (22.4)	34 (44.7)
	Yes	168 (68.9)	35 (20.8)	55 (32.7)
	Total	244	52	89

All factors		Overall sample N (%)	HIV-HBV co-infection Number of possibility(%)	HIV-HCV co-infection N Number of possibility(%)
χ^2			0.074	3.251
p			0.786	0.071
Partner's history of injecting drug	No	187 (85.8)	39 (20.3)	72 (38.5)
	Yes	31 (14.2)	8 (25.8)	11 (35.5)
	Total	218	46	83
χ^2			0.481	0.103
p			0.488	0.749
Organizational Level				
Place of residence	Others	74 (29.6)	6 (8.11)	15 (20.3)
	NhaTrang	176 (70.4)	46 (26.1)	79 (44.9)
	Total	250	52	94
χ^2			10.278	13.455
p			**0.001***	**0.000***
Community Level				
Tattooing	No	182 (72.8)	33 (18.1)	47 (25.8)
	Yes	68 (27.2)	19 (27.9)	47 (69.1)
	Total	250	52	94
χ^2			2.892	39.547
p			0.089	**0.000***

***p* < .05** is considered as significant

Risk factors associated with the co-infection of HIV with HBV or HCV

The Multivariate analysis in Model 1 (**Table 2**) showed place of residence associated strongly with HIV-HBV co-infection. The risk of HBV co-infection was significantly higher among HIV-positive individuals residing in Nha Trang (*OR*= 7.179, 95% *CI*= 1.982 – 26.009) than among those residing in other areas.

In Model 2 (**Table 3**), of twelve variables, four variables which were categorized as intrapersonal factors (sex, employment status and history of injecting drug use) and organizational factor (place of residence) were significantly associated with HIV and HCV co-infection. Regarding sex, the risk of HCV co-infection was significantly higher among HIV-positive males (*OR*= 7.617, 95% *CI*= 2.345– 24.742) than females. In terms of employment status, being unemployed was significantly associated with a higher risk of HCV co-infection among HIV-positive individuals (*OR*= 4.013, 95% *CI*= 1.228-13.109) compared with being employed. Additionally, HIV-positive individuals residing in Nha Trang had a higher risk of HCV co-infection (*OR*=10.894, 95% *CI*= 3.577-33.186) than those who lived in other areas. Regarding the history of injecting drugs, having injected drugs was significantly associated with increased HCV co-infection among HIV-positive individuals (*OR*= 16.688, 95% *CI*= 5.848 – 46.624) compared with those never having injected drugs.

Table 2 Model 1 - Binary logistic regression analysis of HIV co-infection with HBV (n=218)

Factors		HIV co-infection with HBV		
		OR	95% *CI* Lower	Upper
Intrapersonal Levels				
Age	≤ 29			
	30-39	0.596	0.172	2.06
	≥ 40	0.67	0.170	2.631
Sex	Female			
	Male	0.657	0.257	1.678
Marital status	Never married			
	Ever married	1.503	0.485	4.651
Education	Primary school or lower			
	Secondary school	0.849	0.285	2.532
	High school or higher	0.99	0.329	2.972
Employment status	Employed			
	Unemployed	1.971	0.763	5.095

Factors		HIV co-infection with HBV		
		OR	95% *CI*	
			Lower	Upper
Sexual orientation	Heterosexual			
	Homosexual	3.971	0.409	38.584
History of Injecting drug use	No			
	Yes	0.813	0.279	2.373
Duration of ARV treatment	≤ 6			
	> 6	1.109	0.015	0.687
Interpersonal Levels				
Practicing unsafe sex	No			
	Yes	1.019	0.409	2.539
Partner's history of injecting drug	No			
	Yes	0.813	0.279	2.373
Organizational Level				
Place of resident	Other			
	NhaTrang	**3.139***	1.185	8.316
Community Level				
Tattooing	No			
	Yes	2.157	0.794	5.860
LR chi-square= 16.97		Pseudo R square= 0.0755		
Note: *p <0.05; **p <0.01; ***p <0.001		Degree of freedom= 14		

Table 3 Model 2-Binary logistic regression analysis of HIV co-infection with HCV (n=218)

Factors		HIV co-infection with HCV		
		OR	95% *CI*	
			Lower	Upper
Intrapersonal Levels				
Age	≤ 29			
	30-39	0.604	0.128	2.838
	≥ 40	0.365	0.068	1.96
Sex	Female			
	Male	**7.617****	2.345	24.742
Marital status	Never married			
	Ever married	1.85	0.555	6.169
Education	Primary school or lower			
	Secondary school	0.758	0.22	2.61
	High school or higher	0.374	0.106	1.322
Employment status	Employed			
	Unemployed	**4.013***	1.228	13.109
Sexual orientation	Heterosexual			
	Homosexual	0.541	0.037	7.933
History of Injecting drug use	No			
	Yes	**16.688*****	5.848	46.624
Duration of ARV treatment	≤ 6			
	> 6	1.048	0.401	2.736
Interpersonal Levels				
Practicing unsafe sex	No			
	Yes	1.039	0.353	3.057
Partner's history of injecting drug	No			
	Yes	0.841	0.217	3.261
Organizational Level				
Place of residence	Other			
	NhaTrang	**10.894*****	3.577	33.186

Factors		HIV co-infection with HCV		
		OR	95% *CI*	
			Lower	Upper
Community Level				
Tattooing	No			
	Yes	0.411	0.134	1.257
LR chi-square= 120.27***		Pseudo R square= 0.4152		
Note: *p <0.05; **p <0.01; ***p <0.001		Degree of freedom= 14		

DISCUSSION

This study found that some intrapersonal and organizational factors had strong associations with the co-infections. Particularly, in Model 1, about HIV and HBV co-infection, place of residence was found to be strongly associated with co-infection. Concerning the co-infection of HIV and HCV in Model 2, four variables were strongly associated with co-infection including employment status, residency, sex and history of injecting drugs.

Regarding place of residence, which was grouped in organizational level, the findings from multivariate analysis showed a statistically significant association in both two models, with HIV-HBV and HIV-HCV co-infections. It might have been because of the sample size, among 250 respondents, 176 lived in Nha Trang, accounting for 70.4% of the sample size (**Table 1**). As such, this made the prevalence of co-infection in Nha Trang higher than in other areas.

In Model 2, in terms of the co-infection of HIV and HCV, sex was one of the risk factors strongly associated with co-infection. Specifically, males were more likely to face a higher risk of HIV and HCV co-infection than females. This result was concordant with another related studies conducted in northern Vietnam, China, the US and Africa (Huy et al., 2014; Kim et al., 2008; Umutesi et al., 2017; Wu et al., 2017). This might be because women are less likely than men to adopt health risk behaviors such as consuming alcohol, injecting drugs, engaging in practicing unsafe sex or having multiple sexual partners. Furthermore, due to norms regarding masculinity, men are socially and culturally expected to be strong. Therefore, they rarely perceive themselves as being at risk of health problem. Also, many refuse to admit that they lack sufficient knowledge and information regarding health (Budesa et al., 2008; Courtenay, 2000; Gupta, 2000; Kaplan & Marks, 1995).

Moreover, employment status was strongly associated in Model 2 regarding HIV-HCV co-infection. In particular, unemployed individuals were significantly more likely to have HIV-HCV co-infection than those who were employed. This might be because unemployed individuals usually have lower knowledge levels about disease prevention than those who were employed, and those with higher incomes (Pharr et al., 2012; Sun et al., 2013). In addition, associations were identified between unemployment and risky health behaviors such as consuming alcohol, smoking and risky sexual practices (unprotected sex) (Hammarström & Janlert, 1997; Pharr et al., 2012). Individuals practicing risky behaviors may have an increased risk of contracting diseases like HBV and HCV etc. This result was similar with related studies in other countries like China and Iran (Mohammadi et al., 2009; Zhang et al., 2017).

History of injecting drug was found to be a strong determinant of HIV-HCV co-infection among HIV-positive individuals as illustrated in Models 2 (**Table 3**). This was because, injecting drug was one of risk factors of transmitting diseases like HCV or HIV, in that injecting drug users may share or re-use needles, syringes. Therefore, they can be transmitted diseases through direct contact with the blood of an infected person (Centers for Disease Control and Prevention, 2018; World Health Organization, 2017b). And the results of the present study were similar with related studies in Brazil, Vietnam, China and Thailand (Huy et al., 2014; Kuehlkamp et al., 2014; Sungkanuparph et al., 2004; Zhang et al., 2017).

CONCLUSION

Multivariate analysis revealed specific intrapersonal factors (including sex, employment status and history of injecting drug use), and organizational factor (residency) had a strong relationship with HBV or HCV co-infections among HIV-positive individuals. These findings could help healthcare providers, nurses and policy makers to direct their interventions to focus more on particular risk groups and to alert HIV-positive patients to their potential risks factors. The local government needs to provide preventive education program and campaigns in public to educate those people who are at high risks of the co-infections to become aware of their risks and health outcomes of the co-infections. Also, preventive education programs should emphasize behavioral changes among HIV-positive individuals, especially those who are males, unemployed, injecting drug users. In addition, intervention strategies should focus on particular geographical areas, especially areas with a large number of HIV-positive individuals. Furthermore, the local government should have HBV and HCV screening policy in place. Health care institutions should conduct routine surveillance regarding the rate and prevalence of these three types of co-infections in the HIV epidemic context. Especially for the nurses providing cares for HIV positive patients, knowing about the HIV and hepatitis virus co-infection, as well as the factors associated with these co-infection will help developing a proper care plan for each individual HIV patient. For example, encouraging HIV positive patients to undergo HBV or HCV screening, and providing them safety precautions about what things to do or not in order to do to prevent HBV or HCV transmission.

Declaration of Conflicting Interest
Authors have no conflict of interest to declare.

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Authors Contribution
AHTL: Performed analysis on all samples, interpreted data, wrote manuscript and acted as corresponding author.
ST: Supervised development of work, helped in data interpretation and manuscript evaluation.

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