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Experiences of Screening for Human Immunodeficiency Virus, Viral Hepatitis B, and Viral Hepatitis C Infections at a Hospital in Thailand: Test Utilization and Outcomes

Authors' Contribution:
Study Design A
Data Collection B
Statistical Analysis C
Data Interpretation D
Manuscript Preparation E
Literature Search F
Funds Collection G

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Background: To prevent the transmission of HIV and hepatitis B and C viruses, early detection is necessary; however, in the early stage, most infected people are symptomless. Screening for these infections should be targeted to certain clinical settings to increase the early detection rate.

Material/Methods: This retrospective study was conducted by analyzing data from patients' medical records to determine how the screening tests for these viral infections were utilized and what the clinical outcomes from the test utilization were.

Results: From 11 676 collected records, the screening tests for HIV, HBV, and HCV infections were utilized in 871, 556, and 236 cases, respectively. The tests for HIV and HCV were utilized the most in people with chronic non-infectious diseases, while the test for HBV infection was utilized the most in pregnant women. The positive results of these tests were highly found in the group of patients with acute non-infectious diseases. HIV infection was newly detected in 1.38% of patients, and HBV and HCV infections were newly detected in 5.58% and 2.12%, respectively.

Conclusions: Screening for HIV and HBV infections was performed according to the guidelines of the national HIV and HBV programs. The Outpatient Department (OPD) and medical ward may be the most appropriate clinical settings for HIV screening because most patients are there and blood tests are often ordered there, too. The national programs helped slow the rates of HIV and HBV infections in this community.

MeSH Keywords: **Hepatitis B Virus • Hepatitis C Virus • HIV Infections • Laboratories, Hospital**

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Background

Human immunodeficiency virus (HIV), hepatitis B virus (HBV), and hepatitis C virus (HCV) are well-known blood-borne viruses worldwide because they cause infections with high prevalence and mortality rates [1]. Furthermore, these viral infections account for most cases of occupationally acquired blood-borne infection in health care workers [2,3]. Thailand is an endemic area of these infections. Asia was estimated to have the second-highest HIV burden after Africa, and Thailand is estimated to have highest HIV prevalence in Asia (~1.1% in 2012) [4]. The World Health Organization (WHO) estimated that in 2013 the prevalence of HBV infection in Thailand was 6.4% and the prevalence of HCV infection was 2.7% [5–7].

Screening, early detection, and initiation of treatment are crucial to prevent further transmission of these viruses and to reduce morbidities and mortalities among infected individuals [1,8]. One factor that delays detection and treatment is that people who are infected by these viruses are initially asymptomatic; thus, they do not know they are infected and do not seek treatment [8–11]. Recent reports show that the levels of undiagnosed infections for these virus infections are unsatisfactorily declined. Globally, many people that have these viruses are undiagnosed and unaware that they are infected [12–16]. Failure of timely diagnoses of these blood-borne viruses leads to continued transmission of infections and worse clinical outcomes [12]. The Centers for Disease Control and Prevention (CDC) recommended that HIV testing become a routine procedure and that all adults be screened for the presence of antibody to HIV [17]. Screening for HIV infection was suggested in some clinical settings, particularly emergency departments [12]. Moreover, a previous report [18] suggested that preoperative screening for these blood-borne viral infections be done in patients undergoing orthopedic surgery to prevent transmission to healthcare workers.

Utilization of laboratory testing principally relies on the physician's decision for either medical or non-medical reasons. The present study aimed to determine how physicians in a hospital in Thailand utilized the screening tests for HIV, HBV, and HCV infections. The study also aimed to evaluate the outcomes of utilization of these screening tests in terms of frequency of use and their positive rate and to determine prevalence of these viral infections in the hospital's service area.

Material and Methods

The study was conducted at the HRH Princess Maha Chakri Sirindhorn Medical Centre under the approval of the Srinakharinwirot University Ethics Committee for Human Research. Medical records of patients admitted from 2013 to

2018 that included data on laboratory tests were systematically sampled. Patient sex and age, diagnosis, laboratory tests performed and their results, and the location (ward/OPD) where tests were ordered were anonymously extracted from the records. Utilizations of the tests for anti-HIV Ab (anti-HIV antibody), HBsAg (hepatitis B surface antigen), and anti-HCV Ab (total) (total anti-HCV antibody) were analyzed for associations between test utilization and diagnosis, test order and location of order, and test order and testing result. The anti-HIV Ab was determined using the Elecsys instrument (Roche Diagnostics, Mannheim, Germany) and the HBsAg and anti-HCV Ab (total) were analyzed by use of the Architect ci8200 instrument (Abbott Laboratories, Abbott Park, IL, USA). All anti-HIV Ab-positive results were confirmed by testing with the Serodia anti-HIV Ab diagnostic test (Fujirebio Inc, Tokyo, Japan). Positive anti-HIV Ab was reported when results from both Elecsys and Serodia were positive.

Results

There were 11 676 collected records. Ages of patients ranged from 1 to 99 years, with an average age of 57.77 ± 20.41 years. There were more females than males, with a ratio of 3: 2 (Table 1). Diagnoses presented in the records were classified into 4 groups: health checkup, infection, non-infection, and unspecified (diagnoses of non-specified inflammatory diseases, nonspecific signs/symptoms, and others). Most of the patients were in the group of patients with non-infectious diseases (Table 2), which was further divided into 4 main conditions, and, as shown in Table 3, most of the patients in this group had a chronic non-infectious disease or non-communicable disease (NCD), including diabetes (13.88%) and hypertension (12.16%). Only 8.50% were in the infection group (Table 2), including HIV, chronic HBV (CHB), and chronic HCV (CHC) infections (Table 4).

The anti-HIV Ab test was ordered for 536 females (mean age=46.32 years) and 335 males (mean age=52.23 years). The HBsAg test was ordered for 393 females (mean age=46.56 years) and 163 males (mean age=55.57 years). The test for anti-HCV Ab (total) was ordered for 121 female (mean age=60.97 years) and 115 males (mean age=55.63 years)

Eighteen percents of patients had laboratory tests ordered at the Emergency Department (ED), and only a small proportion of them were ordered for anti-HIV Ab (Figure 1). Similarly, 5% and 2% of all cases were orthopedic and eye disease patients, respectively. Among these cases, the anti-HIV Ab test was moderately utilized in the orthopedic cases but was highly utilized in the eye disease cases (Figure 2), who were mostly (53%) diagnosed with senile cataract.

Table 1. Sex and age of the patients.

Year	Male		Female	
	N (%)	Mean age (years) ±SD	N (%)	Mean age (years) ±SD
2013	678 (34.52%)	67.63±19.01	1286 (65.48%)	62.83±16.74
2014	638 (35.92%)	66.42±18.54	1138 (64.08%)	62.01±17.50
2015	704 (36.36%)	65.69±18.07	1232 (63.64%)	60.29±17.13
2016	905 (45.25%)	54.42±21.58	1095 (54.75%)	51.24±20.92
2017	877 (43.85%)	53.94±21.71	1123 (56.15%)	52.24±19.78
2018	842 (42.10%)	52.95±22.82	1158 (57.90%)	50.47±20.98
Total	4644 (39.77)	59.35±21.54	7032 (60.23%)	56.72±19.57

Table 2. Number of patients based on the group of diagnoses.

Year	Health checkup (N, %)	Infectious diseases (N, %)	Non-infectious diseases (N, %)	Unspecified (N, %)
2013	50 (2.55%)	142 (7.23%)	1534 (78.11%)	238 (12.12%)
2014	59 (3.32%)	122 (6.87%)	1339 (75.39%)	256 (14.41%)
2015	58 (3.00%)	168 (8.68%)	1434 (74.07%)	276 (14.26%)
2016	81 (4.05%)	182 (9.10%)	1392 (69.60%)	345 (17.25%)
2017	69 (3.45%)	183 (9.15%)	1445 (72.25%)	303 (15.15%)
2018	89 (4.45%)	196 (9.80%)	1384 (69.20%)	331 (16.55%)
Total	406 (3.48%)	993 (8.50%)	8528 (73.08%)	1749 (14.98%)

Table 3. Number of patients diagnosed with certain non-infectious diseases.

Year	Acute (N)	Chronic (N)	Pregnancy (N)	Tumor (N)
2013	125	1274	18	117
2014	128	1087	33	91
2015	154	1092	37	151
2016	180	844	67	301
2017	199	911	77	258
2018	176	860	103	245
Total	962	6068	335	1163

The anti-HIV Ab test was utilized the most in patients with chronic non-infectious diseases at the Outpatient Department (OPD) and medical ward, followed by patients who were pregnant and those who had acute non-infectious diseases (Figure 3). Most of the patients in acute non-infectious diseases group were severely ill and were admitted to the critical/intensive care unit or surgical ward. HBsAg was screened the most in pregnant women, followed by patients attending a regular health checkup and those with chronic non-infectious diseases. The anti-HCV Ab

was utilized the most in patients with chronic non-infectious diseases, followed by the unspecified group.

The percentages of anti-HIV Ab-positive cases were high in 2016 and 2018 (Table 5), with an average of 1.09% per year and 1.38% within 6 years. Most of them were diagnosed with an acute non-infectious disease (Table 6). The HBsAg test was utilized in 556 cases, including 7 cases of CHB infection; thus, it was used to screen for new HBV infection in 549 cases. The percentages of

Table 4. Number of patients diagnosed with HIV, chronic HBV, and chronic HCV infections.

Year	HIV (N, %)	CHB (N, %)	CHC (N, %)
2013	14 (16.87%)	13 (10.32%)	1 (4.00%)
2014	11 (13.25%)	20 (15.87%)	3 (12.00%)
2015	14 (16.87%)	36 (28.57%)	2 (8.00%)
2016	12 (14.46%)	11 (8.73%)	5 (20.00%)
2017	22 (26.51%)	31 (24.60%)	10 (40.00%)
2018	10 (12.05%)	15 (11.90%)	4 (16.00%)
Total	83	126	25

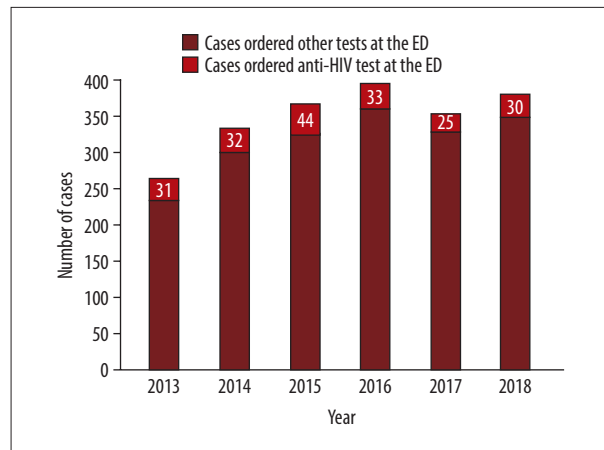


Figure 1. Utilization of the anti-HIV Ab test at the Emergency Department (ED).

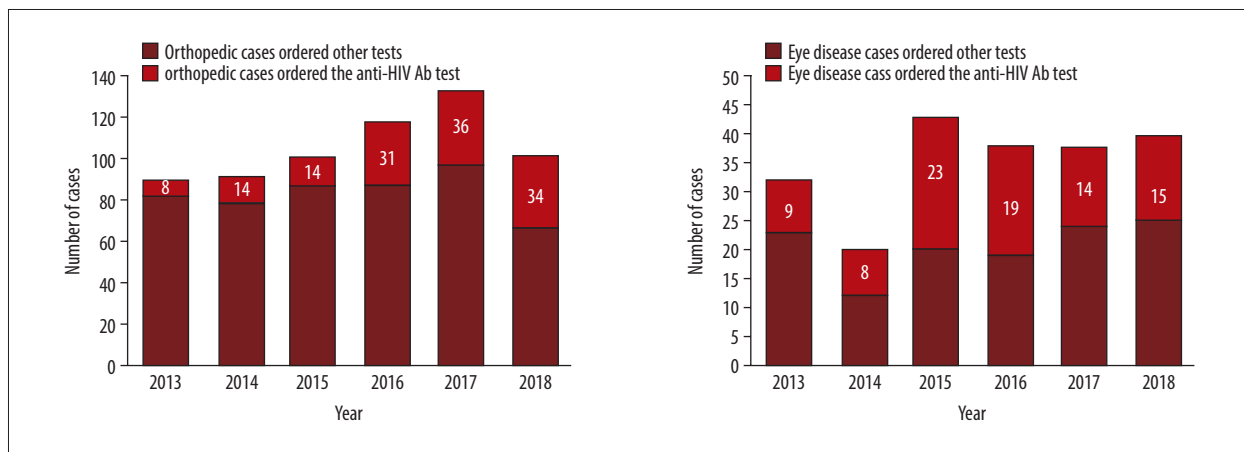


Figure 2. Utilization of the anti-HIV Ab test in orthopedic and eye disease cases.

positive HBsAg cases were high in 2016 and 2017, with an average of 5.41% per year and 5.65% within 6 years. Twelve of the HBsAg-positive cases were confirmed by finding a high HBV viral load. Patients who were newly infected with HBV were predominantly found in the acute non-infectious disease group and the health checkup group. The anti-HCV Ab test was used in 236 patients; 1 was the CHC-infected case. High percentages of anti-HCV Ab-positive patients were found in 2014 and 2018, with an average of 2.08% per year and 2.13% within 6 years.

Discussion

The HRH Princess Maha Chakri Sirindhorn Medical Centre, where this study was conducted, is a public hospital. It is located in Nakhon Nayok, one of the central provinces of Thailand, and services people in the province and from the provinces nearby. As seen in Table 1, the average age of patient has declined in recent years. More young people were admitted to the hospital in the past few years, which might result from

the expansion of the hospital services and the implementation of the national universal healthcare policy with financial support from the Thai government in this hospital. This policy allows Thai people to get access to health care with payment according to their ability to pay [19]. The average age of all female patients was 57 years (Table 1), but those tested for anti-HIV Ab and HBsAg were younger, with average ages of 46 and 47 years, respectively. According to the test utilization (Figure 3), these tests were utilized frequently in young pregnant women.

Although Thailand is an endemic area for various infections, less than 10% of the patients were specifically diagnosed with an infectious disease (Table 2). High numbers of patients with HIV, HBV, and HCV were found in 2017 (Table 4), which, as seen in Table 5, might result from the high numbers of screened cases in the previous year, 2016. This supports the CDC recommendation [17] that increasing the number of tests performed, particularly for the HIV infection, can increase the number of cases detected and, consequently, the number of diagnosed patients seeking treatment.

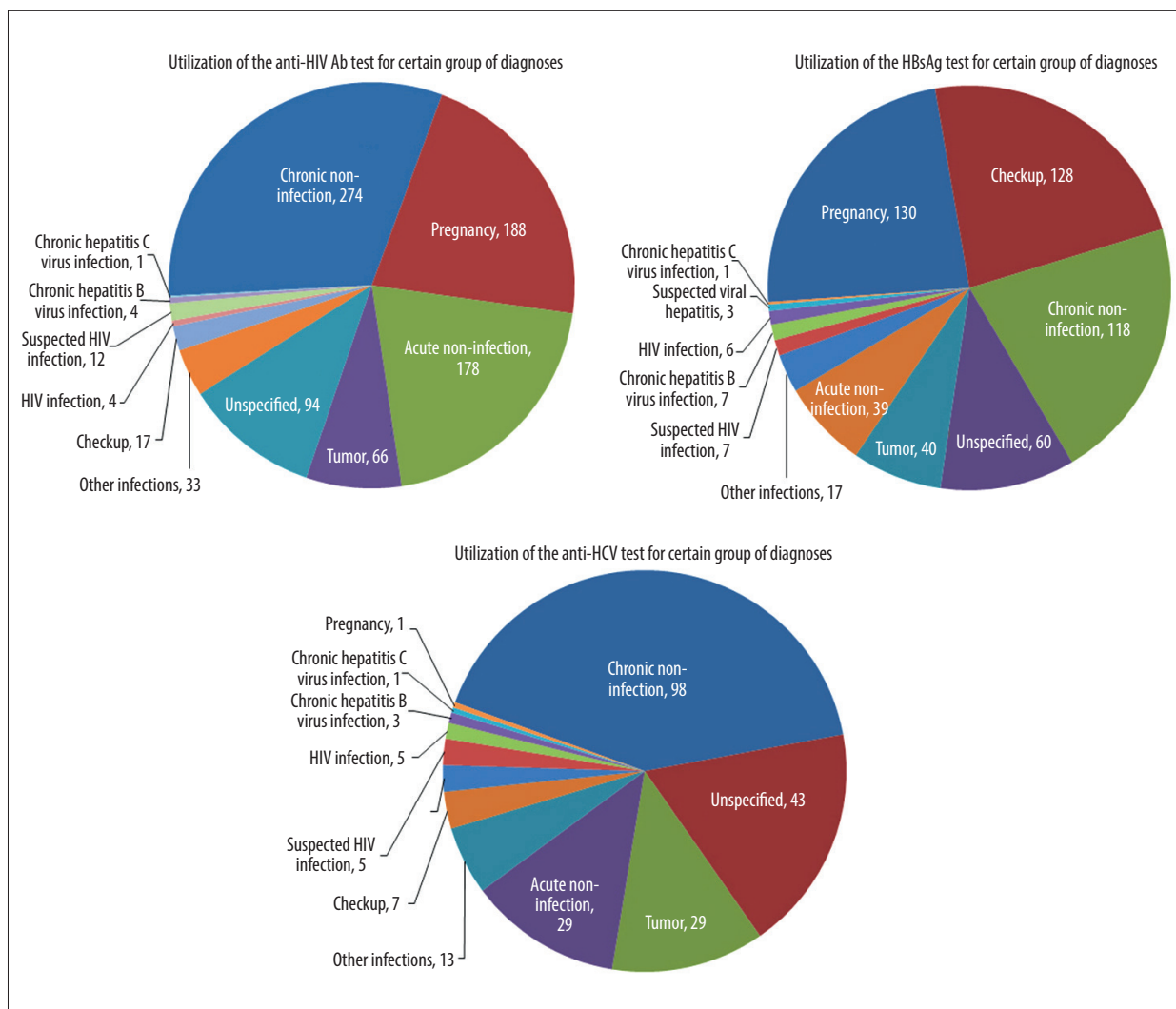


Figure 3. Utilization of the tests for anti-HIV Ab, HBsAg, and anti-HCV Ab (total) based on the diagnosis.

Table 5. Number of patients screened and positive for anti-HIV Ab, HBsAg, and anti-HCV Ab.

Year	Anti-HIV Ab (N, %)		HBsAg (N, %)		Anti-HCV Ab (N, %)	
	Screened	Positive	Screened	Positive	Screened	Positive
2013	73	1 (1.37%)	84	1 (1.19%)	43	0
2014	78	0	76	3 (3.95%)	32	2 (6.25%)
2015	100	0	72	4 (5.56%)	22	0
2016	217	6 (2.76%)	109	9 (8.26%)	49	1 (2.04%)
2017	190	1 (0.53%)	102	8 (7.84%)	41	0
2018	213	4 (1.88%)	106	6 (5.66%)	48	2 (4.17%)
Total	871	12 (1.38%)	549	31 (5.65%)	235	5 (2.13%)

Table 6. Number of newly detected cases of HIV, HBV, and HCV infections based on diagnosis.

Diagnosis	HIV infection (N, %)	HBV infection (N, %)	HCV infection (N, %)
Checkup	2 (16.67%)	6 (19.35%)	0
Pregnancy	0	4 (12.90%)	0
Acute non-infectious diseases	4 (33.33%)	7 (22.58%)	1 (20.00%)
Chronic non-infectious diseases	0	4 (12.90%)	2 (40.00%)
Tumor	2 (16.67%)	5 (16.13%)	0
Infectious disease	3 (25.00%)	2 (6.45%)	0
Unspecified	1 (8.33%)	3 (9.68%)	2 (40.00%)

At the ED, most patients are registering for the first time, thus they are suitable candidates for HIV screening in order to bring HIV-infected persons into care, to offer opportunities for prevention of the secondary spread of infection, and to provide the opportunity for counseling non-infected persons to reduce the risk of virus acquisition [11,12,20]. In this study, laboratory tests were not often utilized at the ED, and the anti-HIV Ab test was also not often ordered at the ED (Figure 1). Most patients come to the ED with severe illness or pain requiring urgent care; therefore, time and resources, including laboratory tests, are necessarily devoted to alleviate patient suffering or saving lives, and the ED may not be an appropriate clinical setting for HIV and hepatitis virus screening.

Likewise, laboratory tests were not frequently utilized in orthopedic and eye disease patients. About 22% of orthopedic patients had anti-HIV Ab testing ordered. This finding does not support the previous suggestion [18] that screening for blood-borne virus infections is necessary for orthopedic patients. However, the anti-HIV Ab test was ordered very frequently in the eye disease patients (~42% of all patients for whom laboratory tests were ordered). Most of them were diagnosed with senile cataract, which is a degenerative disease found in elderly patients. This finding suggests that HIV screening may be necessary for patients undergoing eye examination and treatment. High numbers of positive results for anti-HIV Ab and HBsAg were found in patients with acute non-infectious diseases (Table 6); therefore, testing for HIV and HBV infections as preoperative screening in people who may undergo surgery might benefit patient care and protect healthcare workers. A finding of negative serological status in surgical patients following screening of these viruses can alleviate the fear of occupational exposure among healthcare workers and offers them intra-operative safety [18].

Since HIV, HBV, and HCV infections can be symptomless, screening for these viral infections is recommended for all patients, even in apparently healthy individuals [17,21]. In this hospital, the HBsAg test was frequently utilized for patients

attending a regular health checkup. A small number of health checkup patients were screened for HIV and HCV infections. Due to the social stigma originally associated with HIV infection and testing [17], most apparently healthy people do not want to be tested for HIV infection. Indeed, some who have a high risk of HIV infection try to avoid having their blood tested or seek to hide their infection status. The anti-HIV Ab and anti-HCV Ab tests were ordered the most in the group of patients with chronic non-infectious diseases (Figure 3), which was also the group with the third-highest rate of HBsAg testing ordered. Certain blood tests are regularly ordered for patients in this group, so adding the screening for these blood-borne viruses does not seriously inconvenience the patients. The results suggest that for convenience and increasing the screening rate, an appropriate clinical setting for the blood-borne virus screening is a place where blood tests are often ordered, such as at the OPD and medical ward. Screening of patients with chronic non-infectious diseases is convenient but may not be cost-effective, since the positive rates of these tests in this group are low (Table 6).

Newly detected cases of HIV infection were found up to 2.76% of patients during the 6-year period, with the average of 1.09% per year, which is close to the estimated rate [4]. The high number of HIV infections detected in the past few years may be associated with the decreasing age of patients, as well as the free hospital services for poor people during these years. The number of new HIV infections has been steadily declined worldwide due to the reduced infectiousness of people living with HIV who are on antiretroviral drugs, the expansion of programs for prevention of mother-to-child transmission of HIV, and the introduction of harm-reduction programs focusing on safer sex and outreach to high-risk populations [4,10]. Beginning in 2000, the Thai government has continuously implemented a national AIDS program and a national antiretroviral (ARV) treatment program to increase access to health care and treatment. The latter program provides ARV treatment for all eligible patients free of charge [22]. Additionally, some patients can be screened for HIV infection under the universal

healthcare policy. In addition, the hospital has a policy of keeping data of all HIV infected patients confidential. Consequently, screening for HIV infection in this hospital will not burden patients economically and psychologically. However, the findings of the present study suggest that these policies and practices have been unable to reduce the infection rate, and they could not stop people from engaging in risky behaviors such as unsafe sex and cannot persuade some high-risk people to get testing or treatment.

The prevalence and endemicity of HBV infection can be assessed by serological surveys and defined by the presence of HBsAg [23,24]. Early detection of asymptomatic CHB infection will allow treatment with antiviral drugs, which can stop viral replication and minimize liver damage [11]. In this study, newly detected HBV infection was found in an average of 5.41% of patients per year, which is below the estimate [5–7]. In areas of high endemicity such as Thailand, HBV is mostly transmitted perinatally from infected mothers to neonates [25,26]; thus, an effective way to reduce the HBV transmission in these areas is the prevention of mother-to-child transmission. In Thailand, the hepatitis B vaccination for newborns has been introduced as part of Thailand's expanded program on immunization (EPI) since 1988. The EPI is managed by the national health security office as a mother-to-child prevention program, with the government pharmaceutical organization in charge of the distribution of all vaccines to public hospitals. The vaccines are administered to infants free of charge. Implementation of this program has dramatically reduced the prevalence of HBV infection in Thailand [27]. The EPI is implemented in this hospital, thus the HBsAg test was performed the most in pregnant women. Due to the availability of effective HBV vaccines, the test was also utilized frequently for people attending regular health checkups. Apparently healthy people who are negative for the HBsAg and anti-HBs antibody are vaccinated to prevent infection. When the HBsAg is positive, as seen in 6 cases in the present study (Table 6), patients will receive appropriate treatment. These actions help prevent transmission and reduce the prevalence of HBV infection in the community.

Similar to HBV, the prevalence of HCV infection can be assessed by serological surveys and is defined by the presence of total anti-HCV Ab [6,28,29]. The test for anti-HCV IgM has not been

widely used because the test results were found to be positive even in the chronic HCV-infected cases [30]. An average of 2.08% of patients had newly detected HCV infection per year, which is lower than the estimate [5–7]. Unlike HIV and HBV infection, there is no a national program for prevention the HCV infection in Thailand. Although no vaccine and available prophylaxis exist for HCV, it is crucial to identify HCV exposure and infection and to consequently propose early treatment to prevent disease complications and reduce the spread of infection [2,11]. Since blood transfusion is a highly effective means of transmitting HCV infection [28], screening for HCV-contaminated blood products is the most effective way to prevent transfusion-transmitted HCV infection [1]. The anti-HCV Ab seroprevalence reported by the national blood bank of Thailand, which reflects the positive rate of anti-HCV Ab in healthy blood donors, was 0.94% in 2014 [31]. By using HCV-free blood products, the incidence of HCV infection has been tremendously decreased worldwide [1]. In this community, the anti-HCV Ab test was not utilized often in people attending regular health checkups, so the HCV infection rate found in this study may be underestimated.

Conclusions

From the experiences of utilizing the screening tests for HIV, HBV, and HCV infections in this community hospital, it was found that the tests for HIV and HBV infections were utilized appropriately in accordance with world and national health programs and policies. The anti-HCV Ab test was possibly underutilized since there was no a program or policy to support. A suitable clinical setting for HIV screening was found to be the OPD or medical ward, where blood tests were often ordered, but most of the positive results were found in patients with acute non-infectious diseases. Although national HIV health care programs have been implemented, the rate of HIV infection in this community did not decline.

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