# Prevalence and Factors Associated with Viral Suppression of Perinatally Infected Thai Adolescents Living with HIV/AIDS in Lower North-Eastern Region

**นิพนธ์ต้นฉบับ**

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**Original Article**

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## บทคัดย่อ

**วัตถุประสงค์:** เพื่อศึกษาความชุกของการกดไวรัสและปัจจัยที่มีความสัมพันธ์กับการกดไวรัสของวัยรุ่นไทยที่ติดเชื้อเอชไอวี/เอดส์จากมารดาในเขตภาคอีสานตอนล่าง **วิธีการศึกษา:** งานวิจัยแบบภาคตัดขวาง ใช้แบบสอบถามและแบบเก็บข้อมูลทางคลินิกเก็บข้อมูลในกลุ่มวัยรุ่นติดเชื้อเอชไอวี/เอดส์จากมารดาที่มารับบริการ ณ คลินิกภูมิคุ้มกัน โรงพยาบาลในเขตจังหวัดสุรินทร์ บุรีรัมย์ และร้อยเอ็ด ระหว่างเดือน มกราคม ถึง เมษายน 2557 วิเคราะห์ข้อมูลโดยใช้สถิติเชิงพรรณนาและวิเคราะห์การถดถอยโลจิสติกส์ **ผลการศึกษา:** วัยรุ่นไทยที่ติดเชื้อเอชไอวี/เอดส์จากมารดาในเขตภาคอีสานตอนล่างจำนวน 245 คน จากโรงพยาบาลแห่งจากจังหวัดสุรินทร์ บุรีรัมย์ และร้อยเอ็ด จำนวน 11, 7 และ 3 แห่ง ตามลำดับรวม 21 แห่ง ส่วนใหญ่เป็นเพศหญิง (ร้อยละ 57.55) อายุเฉลี่ย 15 ปี(15.41 ± 2.41) กำลังศึกษาอยู่ (ร้อยละ 76.73) ไม่มีผู้ดูแลกำกับในการรับประทานยา (ร้อยละ 62.45) มีอัตราการกดไวรัสเท่ากับร้อยละ 85.31 ปัจจัยที่มีความสัมพันธ์กับการกดไวรัสอย่างมีนัยสำคัญทางสถิติได้แก่ ความร่วมมือในการรักษาด้วยยาต้านไวรัสตั้งแต่ร้อยละ 95 เป็นต้นไป (OR = 12.73; 95%CI = 5.01 – 32.40) ระดับเม็ดเลือดขาวชนิดซีดีโฟร์มากกว่า 600 เซลล์ต่อมล. (OR = 11.10; 95%CI = 3.70 – 33.25) และระดับเม็ดเลือดขาวชนิดซีดีโฟร์ 401 – 600 เซลล์ต่อมล. (OR = 6.20; 95%CI = 1.92 – 20.00) **สรุป:** วัยรุ่นไทยที่ติดเชื้อเอชไอวี/เอดส์จากมารดาในเขตภาคอีสานตอนล่างมีอัตราการกดไวรัสร้อยละ 85.31 ปัจจัยที่มีความสัมพันธ์กับการกดไวรัสอย่างมีนัยสำคัญทางสถิติได้แก่ ความร่วมมือในการรักษาด้วยยาต้านไวรัสและระดับเม็ดเลือดขาวชนิดซีดีโฟร์

**คำสำคัญ:** การกดไวรัส, วัยรุ่น, เอชไอวี/เอดส์, ความร่วมมือในการรักษา

## Abstract

**Objective:** To explore prevalence of viral suppression and to identify factors associated with viral suppression among perinatally infected Thai adolescents living HIV/AIDS (ALWHs) in Lower North-Eastern Region, Thailand. **Methods:** A cross-sectional study. Questionnaires and clinical data collection form were employed to collect data from perinatally infected Thai ALWHs at immunology clinic of public hospitals in Surin, Buriram and Roiet province from January – April 2014. Data were analyzed with descriptive statistics and logistic regression analysis. **Results:** A total of 245 perinatally Thai ALWHs from 21 hospital sites were included into study. There were 11, 7 and 3 sites from Surin, Buriram and Roiet province, respectively. The majority of them were female (57.55%), mean age was 15-year-old (15.41 ± 2.41), studying at school (76.73%), and not having a caregiver (62.45%). The prevalence of viral suppression was 85.31%. Factors significantly associated with viral suppression were adherence level ≥ 95% (OR = 12.73; 95%CI = 5.01 – 32.40), CD4 level more than 600 cell/ml. (OR = 11.10; 95%CI = 3.70 – 33.25) and CD4 level 401 - 600 cell/ml. (OR = 6.20; 95%CI = 1.92 – 20.00). **Conclusions:** Viral suppression was found in 85.31% of perinatally infected Thai ALWHs in Lower North-Eastern Region, Thailand. Factors associated with viral suppression were adherence to ART and CD4 level.

**Keywords:** viral suppression, adolescents, HIV/AIDS, adherence

## Introduction

Antiretroviral drugs (ARV) are pharmacologic agents that have led to dramatic improvements in health of persons living with HIV/AIDS. The treatment goal is to reduce HIV-associated morbidity and prolong the duration and quality of survival.[1] Several studies showed viral suppression with ARV has reduced HIV-related morbidity and mortality.[2-5]

Viral suppression in an ART-naïve patient remains that a viral load < 50 RNA copies per ml or a load below the limit of detection of the most sensitive assay available with the first 12 – 24 weeks of therapy.[6,7] Previous studies showed several predictors of viral suppression including high potency of ARV regimen, excellent adherence to treatment regimen[8], low baseline viremia[9], higher baseline CD4 cell count[10] and rapid reduction of viremia in response to the treatment.[8,11]

Older children and adolescents are the group at risk of treatment failure.[12-14] Only 50% of adolescents were reported to have maintained an undetectable viral load at one year after achieving optimal control in a U.S. cohort.[15] Recent data from a study in Europe showed that the rate of ART treatment failure in children was about two times higher than that in adults with heterosexually transmitted HIV.[16]

Care for this group is more complex than that of infected adults. Especially during the transition from children to adolescence, the ability to accept themselves as an HIV-infected person is troublesome because they have never had

a normal life without the disease, while all adults are infected through the experience of the foregoing.[17,18]

In Thailand, although perinatally HIV-infected rate declined from 3.2% in 2010 to 2.4%, 2.3% and 1.8% in 2011, 2012 and 2013, respectively[19], but a cumulative number of children living with HIV/AIDS were raising from 10,886 cases in 2008 to 14,751 cases in 2013.[19] Most of them were in North-Eastern region (30.07%).[19] However, we have limitation of data resource for the number of all ALWHs in Thailand because the cut point of age for children and adults in national program report was 15 years.[19] Therefore, the quality of HIV care report in ALWHs could not be evaluated and compared with other areas. In this study we collected data from public hospitals in the lower North-Eastern region of Thailand where the prevalence of HIV positive persons was high (5,418, 5,695 and 5,744 cases for Surin, Buriram and Roiet provinces) and the number of prenatally infected ALWHs was at 160, 123 and 115 for Surin, Buriram and Roiet provinces.

In Thailand, 69% of patients living with HIV/AIDS had adequate adherence, but the older children aged 10 - 19 years were significantly less adherent than younger children [14]. At Surin Hospital, its' 2010 report showed that seven out of 110 HIV-infected children (6%) stopped taking antiretroviral drugs. All of them were later found to have drug-resistance HIV.[20] Regarding treatment adherence, teenagers are different from adults. Programs which are successfully implemented in adults may be inapplicable to young people. Regular practice of healthcare providers in Thai public hospitals starts from informing HIV-infected patients about their disease and treatment options. For the infected children, this is not always the case. Some children might have not been informed about the condition because they are not ready, both physically and mentally. They might not recognize their own illness. Each child is informed at different ages, mostly in the range of 9-10 years.[21] Care for infected children is more complex than that of infected adults. Especially during the transition into adolescence, the ability to accept themselves as an HIV-infected person is troublesome. This is because they have never had a normal life without the disease, while all adults are infected through the experience of the foregoing.[17,18] Their attitudes and beliefs on HIV/AIDS are very important to improve the HIV/AIDS-caring systems designed for adolescents and may place a burden of HIV infection in Thailand in the future.

Several studies showed that psychosocial factors including depression, stigma and discrimination, family relationships and disclosure of HIV status with others played important roles in ART adherence.[22-26] This corresponds to studies conducted in Thailand showing that access to health services, good relationships in the family, and disclosure of HIV status with others were factors contributing to better ART adherence.[27] Most teens wanted their provider to ask them about their spiritual beliefs during some visits, especially when dealing with death/dying or chronic illness, but only 18% had ever shared these beliefs with their healthcare provider.[28] Thus, to improve long-term adherence with ART, the healthcare team has to pay attention to both the patients' medical and psychosocial factors.[29] Among various psycosocial factors, those from the Health Belief Model and the Theory of Planned Behavior (TPB) are promising determining factors for adherence. The HBM was guided by Rosenstock, Strecher & Becker[30] and the TPB was guided by Ajzen.[31]

HBM perception variables were significantly associated with adherence to antiretroviral and use of alternative therapies. Perceived susceptibility to AIDS was positively associated with adherence to antiretroviral and use of alternative therapies. Additionally, patients who perceived higher barriers to using antiretroviral were significantly more likely to use alternative therapies. Among older HIV-infected patients, those who perceived themselves vulnerable to AIDS also demonstrated greater adherence to prescribed antiretroviral. A higher perception of susceptibility to AIDS was also associated with use of alternative therapies. These factors can be utilized in the development of specific strategies to maximize treatment adherence among older HIV patients, as well as patients in younger age groups. Data also show that reducing patient perceived barriers to the use of antiretroviral should increase treatment adherence and outcomes.[32]

The utility of TPB in HIV continues to be identifying influential factors in HAART adherence by individual in-depth interviews. Previous studies show that participants identified seven outcomes of treatment adherence (e.g., feeling good and controlling the virus), six groups of influence to adherence (e.g., family, partner/spouse), and nine impediments to adherence (e.g., appointment scheduling, side effects of treatment). Results also showed perceiving costs of services and barriers to communication affected

both HAART adherence and HIV testing.[33] Some studies used TPB to improve patients behavior in HIV testing[34] and to enhance the success of programs for behavioral change in HIV[35] These studies included an element of how attitudes may affect the perceptions of this disease and how these attitudes influence behavior and behavioral intent of HIV/AIDS.[36]

Adherence with ART is an important factor to achieve the goal of ART treatment. Literature suggests that long-term ART with at least 95% adherence is concordant with a good clinical outcomes.[37-39] It helps reducing HIV/AIDS related mortality and morbidity.[40,41] In addition to adherence, whether any of psychosocial factors previously mentioned could directly associate with viral suppression is critical in identifying patients with potential to have viral suppression problem.

Studies related to factors affecting viral suppression of Thai adolescents living with HIV/AIDS (ALWHs) remains very limited. This study aimed to explore viral suppression rate and to assess factors, including psychosocial ones, affecting viral suppression of Thai ALWHs in Lower North-Eastern Region, Thailand.

# Methods

***Study Design and Sample***

A questionnaire and clinical information collecting form were used in this cross-sectional study. The questionnaire explored ALWHs' demographic characteristics and their knowledge, attitude and belief about disease and medicine. The sample size was calculated using Taro Yamane's formula of which at least 200 cases were required. The study's samples were ALWHs followed up at public hospitals in the Lower North-Eastern Region of Thailand (Surin, Buriram and Roiet provinces) during January – April 2014. Purposive sampling technique was used. We included only hospitals that had permission to collect data from the hospital directors.

Inclusion criteria consisted of those ALWHs who (1) were perinatally infected with HIV-1, (2) had been taking antiretroviral therapy for at least one year, (3) were at the age between 10 - 18 years, (4) had already disclosed their infection status, (5) were able to read and write in Thai, and (6) were willing to participate in the study with their informed consent and the assent from their guardian such as parent, grandparent, or other relatives. Only those whose informed consents gained from themselves and their guardians were invited to participate to the study.

We selected the age group of 10 – 18 years because most of immunology clinics in the Lower North-Eastern Region public hospitals serve HIV infected children from their early age to up to 18 years. HIV-infected persons older than 18 years are transferred to adult immunology clinic.

***Procedure***

We developed a questionnaire about attitudes and beliefs in HIV/AIDS disease and medicine based on constructs of the Health Belief Model (HBM) and the Theory of Planned Behavior (TPB). These HBM constructs included *perceived susceptibility* (one's subjective perception of the risk of contracting a health condition), *perceived severity* (feelings concerning the seriousness of contracting an illness or of leaving it untreated, including evaluations of both medical and clinical consequences and possible social consequences), *perceived barriers* (potential negative consequences that may result from taking particular health actions, including physical, psychological, and financial demands), *perceived benefits* (believed effectiveness of strategies designed to reduce the threat of illness), *self-efficacy* (belief in being able to successfully execute the behavior required to produce the desired outcomes), and *cue to action* (vents, either internal factors, e.g., physical symptoms of a health condition, or external factors, e.g., media publicity and healthcare team relationship, that motivate people to take action). The constructs from TPB included *subjective norm* (in a form of perceived stigma and discrimination) and *perceived behavioral control*.

All questions of attitudes and beliefs included those measuring 8 domains, namely perceived susceptibility (3 items), perceived severity (3 items), perceived benefit (1 item), perceived susceptibility (3 items), perceived barriers (11 items), self-efficacy (4 items), cue to action (4 items), and stigma and discrimination (3 items). Examples of these questions are as follows: if not taking medicine on time, I will not stay healthy (perceived susceptibility), if I do not take medicine, I will get complication (perceived severity), medicine helps boost my immune so that I will not get sick often (perceived benefit), I have difficulty showing at the appointment (perceived barrier), I think that taking medicine on time is not difficult to do (self-efficacy), if there is

someone reminding me to take medicine, I will be more likely to take the medicine (cue to action), and I feel that I am isolated from the group (stigma and discrimination).

All items were assessed by a 5-point Likert-type scale, ranging from 1-strong disagree to 5-strongly agree. Score of each domain was obtained by summing scores of all items in that domain divided by total number of items in the domain, resulting in a possible range of 1 – 5. The validity was assessed by three experts, specifically, two university faculty members with experience in health behavior research and a pediatrician with experience in caring ALWHs at the immunology clinic, Surin Hospital. These constructs based BHM and TPB possessed high reliability levels with Cronbach's alpha coefficients ranging from 0.65 to 0.82, except for perceived benefit which had only 1 item.

Questionnaire on knowledge consisted of 22 items with true/false answer covering 3 domains HIV/AIDS, namely transmission, progression, and treatment and medicine. Reliability of these knowledge questions was high with Kuder-Richardson-20 coefficient of 0.81.

Patient's medical record was used to collect clinical information, including age at the start of ARV, duration of ARV, CD4 level and adherence level. Average score of the last two visits were used to calculate the patient's CD4 level. Adherence for each participant was calculated by using average percentage of pill count adherence in the last two visits and co1nfirmed with an interview record. If the interview data do not agree with the pill count data, the interview data were used. Adherence was a proportion of corrected doses taken by total doses. The most recent viral load was used for identifying the individual's viral suppression status.

The researcher or healthcare practitioners who worked at immunology clinics described the study protocol for the eligible ALWHs and their guardians while they were waiting to see their doctor. Those who agreed to participate were asked to sign the assent and consent forms and to fill in the questionnaire. Clinical data were collected later on and matched with questionnaire by an assigned code for concealing the individual identities.

### *Data Analysis*

Individuals with a viral load less than < 50 copies/ml was identified as having viral suppression. Knowledge, attitudes and beliefs were grouped into "High" and "Low to moderate" groups based on a cut-off at 75$^{th}$ percentile. Descriptive statistics including frequency, percent and mean ± SD, were used. Logistic regression analysis was used to identify factors affecting viral suppression. A statistical significance level of 0.05 was set.

### *Ethics approval*

This study received ethics approval from the Ethical Review Committee of the Faculty of Pharmacy, Chiang Mai University and the Ethical Committee of Surin Hospital. Permission from the director of community hospitals were gained from the hospitals with no ethical committee.

## Results

There were a total of 245 participants (61.56%) from 398 cases of target population (Table 1). Data were gathered from 21 sites, specifically, 11, 7 and 3 hospitals from Surin, Buriram and Roiet province, respectively. The majority of them were female (57.55%) with a mean age of 15 years old (15.41 ± 2.41). They were enrolled in school (76.73%), -

**Table 1** Demographic characteristics of study participants (n = 245)

| Characteristics | Number (%) |
|---|---|
| Gender | |
| Male | 104 (42.45) |
| Female | 141 (57.55) |
| Age (year) | |
| 10 - 15 | 123 (50.20) |
| 16 - 18 | 122 (49.80) |
| Education status | |
| Enrolled | 188 (76.73) |
| Dropped out | 57 (23.27) |
| Transportation | |
| Convenient | 176 (71.84) |
| Distressful | 57 (23.27) |
| Very distressful | 12 (4.89) |
| Friend disclosure | |
| Yes | 167 (68.16) |
| No | 78 (31.84) |
| Community disclosure | |
| Yes | 187 (76.33) |
| No | 58 (23.67) |
| Having a caregiver* | |
| Yes | 92 (37.55) |
| No | 153 (62.45) |
| Family income (baht/month) | |
| Unknown | 158 (64.49) |
| Known | 87 (35.51) |
| Range | 300 – 30,000 |
| ≤ 1,000 | 25 (28.74) |
| 1,001 – 3,000 | 34 (39.08) |
| 3,001 – 6,000 | 14 (16.09) |
| > 6,000 | 14 (16.09) |

* A person who take care ALWH for medicine management

having convenient transportation to the hospital (71.84%) and not having a caregiver to help with their medicine management (62.45%). The average family income was 4,161 baht/month (4,160.90 ± 5,119.49). Most of them were reported that they had disclosed their disease conditions to their friends (68.16%) and community (76.33%). The demographic characteristics of participants were shown in Table 1.

For clinical characteristics, almost 80.41% of the respondents had the adherence level ≥ 95 %. The mean of adherence level was 94.64 ± 12.03. From the medical records, 50.61% had started their ARV at age 12 – 96 months, and 47.35% had been on the ART for 49-96 months.

According to their ARV regimen treatment, most of them got the first line drugs (66.22%) which was a combination of two nucleoside reverse-transcriptase inhibitors (NRTIs) plus a non-nucleoside reverse-transcriptase inhibitor (NNRTI). The mean CD4 level was 656 cells/ml (± 293.45), where 59.18% of respondents had CD4 level at more than 600 cell/ml and 24.09% of them had CD4 level at 401 - 600 cell/ml. Viral suppressed was found in 209 cases from a total of 245 cases (85.31%). The clinical characteristics of study participants are shown in Table 2.

**Table 2** Clinical characteristics of study participants (n = 245)

| Characteristics | Number (%) |
|---|---|
| Adherence level (%) | |
| < 95 | 48 (19.59) |
| ≥ 95 | 197 (80.41) |
| Age at started ARVs (months) | |
| 12 - 96 | 124 (50.61) |
| 97 - 114 | 100 (40.82) |
| 145 - 192 | 21 (8.57) |
| Duration of ARVs (months) | |
| 12 - 48 | 41 (16.73) |
| 49 - 96 | 116 (47.35) |
| 145 - 192 | 88 (35.92) |
| ARV Regimen | |
| First line* | 162 (66.22) |
| Second line** | 83 (33.88) |
| CD4 level (cell/ml.) | |
| ≤ 400 | 41 (16.73) |
| 401 - 600 | 59 (24.09) |
| > 600 | 145 (59.18) |
| Viral suppressed | |
| Yes | 209 (85.31) |
| No | 36 (14.69) |

* First line drugs is a combination of two nucleoside reverse-transcriptase inhibitors (NRTIs) plus a non-nucleoside reverse-transcriptase inhibitor (NNRTI).

** Second line drugs is a combination of two nucleoside reverse-transcriptase inhibitors (NRTIs) plus protease inhibitors (PIs).

Knowledge, attitudes and beliefs regarding disease and medicines were classified into 2 groups using the 75$^{th}$ percentile because they were not normally distributed. Majority of them had high level of perceived severity (72.24%) and perceived benefit (70.20%), low to moderate level of knowledge (73.47%), perceived susceptibility and barriers (59.18% and 72.27%, respectively). Furthermore, they also had low to moderate level of self-efficacy (73.06%), cue to action (69.80%) and perceived stigma and discrimination (69.39%). Knowledge, attitudes and beliefs of study participants were shown in Table 3.

**Table 3** Knowledge, attitudes and beliefs of study participants (n = 245)

| Items | Number of participants (%) by score level | |
|---|---|---|
| | High level | Low to moderate level |
| Knowledge | 65 (26.53) | 180 (73.47) |
| Perceived susceptibility | 100 (40.82) | 145 (59.18) |
| Perceived severity | 177 (72.24) | 68 (27.76) |
| Perceived barrier | 68 (27.76) | 177 (72.27) |
| Perceived benefit | 172 (70.20) | 73 (29.80) |
| Self–efficacy | 66 (26.94) | 179 (73.06) |
| Cue to action | 74 (30.20) | 171 (69.80) |
| Perceived stigma and discrimination | 75 (30.61) | 170 (69.39) |

Findings from univariate regression analysis revealed that education status, having caregiver, cue to action, CD4 level and adherence level were statistically significant associated with viral suppression (Table 4). There were noted that ALWHs with studying status (OR = 2.84; 95%CI = 1.35 – 5.98), having caregiver (OR = 3.59; 95%CI = 1.72 – 7.51), CD4 level 401 – 600 cell/ml. (OR = 7.80; 95%CI = 2.87 – 21.18), CD4 level more than 600 cell/ml (OR = 17.98; 95%CI = 7.03 – 46.02), adherence level ≥ 95% (OR = 20.35; 95%CI = 8.78 – 47.15) were more likely to have viral suppression.

Finally, the results from multivariate regression analysis showed that adherence level and CD4 level were independently associated with viral suppression. Patients with adherence level ≥ 95% were more likely to have viral suppression (OR = 12.73; 95%CI = 5.01 – 32.40) after controlling for the effects of study status, having care giver and CD4 level. Moreover, patients with CD4 level more than 600 cell/ml. and 401 - 600 cell/ml., compared to those with CD4 level 400 cell/ml or less, were more likely have viral suppression (OR = 11.10; 95%CI = 3.70 – 33.25; and OR =

6.20; 95%CI = 1.92 – 20.00, respectively), after controlling for the effects other factors. (Table 4)

**Table 4** Univariate and multivariate regression analysis of characteristics and viral suppression of study participants (n = 245)

| Characteristics | Crude OR (95%CI) | Adjusted OR** (95% CI) |
|---|---|---|
| **Demographic characteristics** | | |
| Female (ref. = male) | 1.86 (0.91 – 3.80) | - |
| Age 16 – 18 years (ref. = 10 - 15) | 0.67 (0.33 – 1.367) | - |
| Enrolling in school (ref.=dropped out) | 2.84 (1.35 – 5.98)* | 1.65 (0.59 – 4.57) |
| Convenient transportation (ref. = very distressful) | 1.21 (0.25 – 5.84) | - |
| Distress transportation (ref. = very distressful) | 1.07 (0.20 – 5.71) | - |
| Friend disclosed (ref. = no) | 0.68 (0.30 – 1.52) | - |
| Community disclosed (ref. = no) | 0.75 (0.31 – 1.81) | - |
| Having a caregiver (ref. = no) | 3.59 (1.72 – 7.51)* | 2.20 (0.84 – 5.76) |
| **Knowledge, attitudes and beliefs** (ref. = low to moderate) | | |
| High knowledge level | 0.51 (0.24 – 1.06) | - |
| High perceived susceptibility level | 0.84 (0.41 – 1.71) | - |
| High perceived severity level | 0.71 (0.31 – 1.65) | - |
| High perceived barrier level | 0.85 (0.39 – 1.84) | - |
| High perceived benefit level | 1.04 (0.48 – 2.25) | - |
| High self-efficacy level | 0.95 (0.43 – 2.10) | - |
| High cue to action level | 0.84 (0.40 – 1.79) | - |
| High perceived stigma and discrimination level | 1.00 (0.47 – 2.16) | - |
| **Clinical characteristics** | | |
| ≥ 95% adherence (ref. = < 95%) | 20.35 (8.78 – 47.15)* | 12.73 (5.01 – 32.40)* |
| Age at started ARV 97 – 114 months (ref. = 12 – 96) | 0.83 (0.40 – 1.75) | - |
| Age at started ARV 97 – 114 months (ref. = 145 – 192) | 0.95 (0.25 – 3.59) | - |
| Duration of ARV 49 - 96 months (ref. = 12 – 48) | 0.49 (0.14 – 1.79) | - |
| Duration of ARV more than 96 months (ref. = 12 – 48) | 0.33 (0.09 – 1.20) | - |
| CD4 level 401 – 600 cell/ml. (ref. = ≤ 400) | 7.80 (2.87 – 21.18)* | 6.20 (1.92 – 20.00)* |
| CD4 level more than 600 cell/ml. (ref. = ≤ 400) | 17.98 (7.03 – 46.02)* | 11.10 (3.70 – 33.25)* |

* Statistically significant (*P*-value < 0.05)

## Discussions and Conclusions

This study found that Thai ALWHs in Lower North-Eastern Region have high level of viral suppression (85.31%). The rate was higher than HIV-infected youth in the United States (37%).[42] This might suggest that the practice guideline of national policy on HIV/AIDs of caring HIV/AIDs infected person is very effective for health care team. These were supported by the National Access to Antiretroviral Program for people living with HIV/AIDS (NAPHA) in Thailand which implemented with all major program components; ARV protocol development, healthcare professional training, drug supply chain management, laboratory network formation, monitoring and evaluation and multi-sector and PHA involvement since 2001.[43]

Our study finding highlight that adherence level ≥ 95 % was strongest associated with viral suppressed as in the relevant predictor from several studies[22-26] and guidelines.[6,44] Previous studies noted viral suppressed required at least 95% adherence.[6,45,46] Additional finding, data indicated that patients with CD4 level of 401 - 600 cell/ml. was also the predictor of viral suppressed compared with those with CD4 level ≤ 400 cell/ml. and those with CD4 more than 600 cell/ml gained the most benefit from the treatment. The guidelines of HIV treatment recommended that CD4 is the indicator of immune function in HIV-infected patients[6,44] and also predictor of viral suppressed, disease progression and survival according to findings from clinical trials and cohort studies.[47,48]

The findings found that viral suppression was not associated with knowledge, attitudes, beliefs, and others demographics. Therefore, to gain favorable viral suppressed in ALWHs, healthcare providers should focus on improving patient's adherence and using CD4 as an outcome indicator. It could also be attributable to the fact that these psychosocial factors assert their effects trough adherence.

### Strengths and limitations

This study had a large number of participants from the pool of the target population (61.56%). Although we included several psychosocial characteristics from the theories, those factors had shown no significant effect on ALWH's viral suppression. The questions might not be adequately sensitive to detect the nature of these factors. Additionally, since it was a self-administered questionnaire, it could be a bias where the respondents did not tell the truth. In addition, information bias might exist as several other demographics were not included. Finally, with a quasi-experimental design, there was a limitation due to a lack of true control group to ensure the study results from the intervention program.

### Conclusion

Among perinatally infected Thai ALWHs in Lower North-Eastern Region, there was 85.31% viral suppression. Factors associated with viral suppression were adherence level of ≥ 95% and a CD4 level higher than 400 cells/ml.

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