

High HIV vulnerability of ethnic minorities after a trans-Asian highway construction in remote northern Laos

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Summary: From 2004 to 2008 a new Asian highway was constructed through remote multiethnic areas of north Laos linking a low with higher HIV prevalence areas in bordering Thailand and China. We assessed the HIV vulnerability in four minority villages alongside the new road in Luang Namtha Province using structured interviews and voluntary counselling and testing (VCT) for HIV. Of 470 villagers aged 15–49 years old, 47.0% did not know any ways of HIV transmission yet 82.1% reported sexual contacts. Median age at first sex was 17.5 years. Sex of never-married 15–24 years old was associated with higher age ($P = 0.002$) and ethnicity ($P = 0.013$; Hmong odds ratio [OR] 7.27); 61.9% (86/139) used no condom at last non-cohabitant sex, especially women (OR 17.7, $P < 0.001$) and older villagers ($P = 0.001$). No HIV-infection was detected among villagers who received VCT in 2006 (924 of 933) and 2008 (538 of 1249). Nonetheless our findings reveal an alarming vulnerability for HIV among ethnic minorities alongside the new highway, and further culturally adapted prevention efforts are warranted.

Keywords: HIV, vulnerability, sexual risk behaviour, voluntary counselling and testing, ethnic minorities, road, Laos

INTRODUCTION

Laos is a country of low HIV prevalence with infection among 15–49 years old and men 15–24 years old estimated at 0.2%. The rate among 15–24 year old women ranges at around 0.1%. The majority (over 77%) of HIV-infected people are aged between 20 and 39 years.¹ Bordering China in the north also has an overall low prevalence but shows a geographically heterogeneous HIV prevalence pattern with HIV rates of up to 1.3% reported from areas in neighbouring Yunnan province.² HIV prevalence in Thailand to the west ranges at an overall 1.4%.³ Construction of new roads connecting high with low HIV prevalence areas can be a significant factor for the spread of HIV.⁴ From 2004 till March 2008 the trans-Asian highway R3 was built through Luang Namtha Province (LNP) in remote north Laos connecting China to Thailand (Figure 1). Construction was done by Lao and cross-border workers and was accompanied by awareness campaigns, including the governmental social action plan in 2006–2007.⁵ However, there are only scarce data about sexual risk behaviour and knowledge about HIV transmission among the concerned ethnic minority groups. The national HIV prevention strategy focuses on most-at-risk populations such as sex workers (SW), their clients, men who have sex with men, drug users and young people with multiple concurrent partners, but ethnic

minorities have not yet been estimated to be at special risk.⁶ A study on health risk behaviours among adolescents in LNP in 2008 has described ethnic minority groups as important factors.⁷

The aim of this study was to assess the HIV vulnerability and prevalence among ethnic minority groups living alongside the new highway and to identify subgroups at special risk. Vulnerability was primarily investigated with two indicators: sex of never-married 15–24 years old and non-condom use at last non-cohabitant sex among villagers of reproductive age.

METHODS

Study site and population

LNP is one of the poorest areas of Laos with a multiethnic population of 155,772 people. More than 90% of the 37,000 people in 76 villages alongside R3 belong to 25 different ethnic groups other than lowland Lao, the country's major ethnicity. The largest ethnicities are Khmu groups (Khmu-ou, Nyan and Kwen, 41.5%). Smaller groups include Lanten (4.4%), Hmong (2%) and Phunoi (0.7%). In 2007, a new casino complex with about 900 Chinese and Lao workers was opened, bordering China at R3.⁵ Twenty-eight people tested HIV-positive at the LNP hospital until 2008, mainly with histories of high-risk sex and cross-border migration to/from Thailand.

In 2004, the Namtha district health department selected four out of 18 villages alongside the road construction site in

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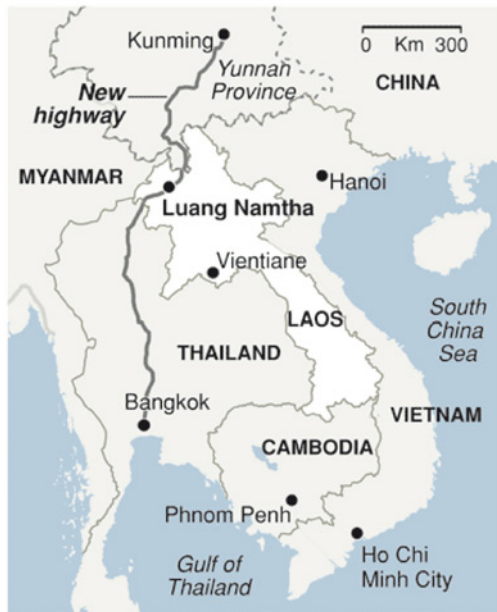


Figure 1 Map showing the new Asian highway R3 through Luang Namtha, Laos (Reproduced with permission from IHT/ NYT Syndicate)

Namtha district for a humanitarian support project by the non-governmental organization Service Fraternel d'Entraide (SFE). Selection criteria were: (i) ethnic minority populations; (ii) average rural village sizes; (iii) unmet needs in health, hygiene, water and/or sanitation; (iv) access within less than two-hour car drive from the LNP capital; and (v) no recent settlement. Villages within LNP showed homogeneously a high level of poverty and livelihood mainly from farming in self-subsistence at that time. Overall education was poor; 41% of villagers along the road construction sites had not completed primary school. Diversity mainly derived from differences in ethnicity and access to services.⁵

Three of the four villages were located directly at the planned new highway (Tavan, Kokmi and Huaidam), one was about 2 km away via improved road (Huaihok). Villages directly at the highway benefited from the governmental social action plan (2006–2007) and a HIV prevention programme by the Lao Red Cross (2004–2006) that included meetings, group discussions, peer educators' trainings with follow-up visits and establishment of a condom distribution network.^{5,8} HIV prevalence data in the general population were lacking. Total population size of the four villages was 993 in 2006 and increased to 1431 inhabitants in 2008, mainly due to settlement from remoter villages.

Study procedure

As part of the project's baseline survey in 2006, universal voluntary group counselling and linked confidential testing for HIV⁹ (VCT, voluntary counselling and testing) was offered by the provincial HIV team. In August 2008 universal VCT for HIV⁹ was repeated individually and performed in separated rooms. At both times VCT was integrated in comprehensive free onsite mobile clinics.

Additionally, to investigate HIV vulnerability, a sexual behaviour survey was performed in 2008. All 15–49 years old

villagers were included if informed oral consent was given and language was reliably understood (Figure 2). A structured, anonymous, pre-tested questionnaire was used regarding: sociodemographic characteristics (including longer or recent settlement defined as before or within the last 2 years), contraception use and type, sexual behaviour, condom use at last non-cohabitant sex (NCS, in Lao language: 'you nök', literally in English: 'outside' meaning sex outside a permanent relationship; casual sex), previous VCT in 2006, change of risky sexual behaviour since VCT in 2006 (change of frequency of NCS, of condom use for NCS and of numbers of sexual partners), knowledge about the ways of HIV transmission (open question) and reception of previous information about HIV. Interviewers were of same sex, some also spoke Khmu language, of the largest minority. Data were kept confidential and unlinked to the VCT data.

Rapid tests used were SD Bioline HIV-1/2 3.0 (Standard Diagnostics, Kyonggi-do, Korea) and Unigold (Trinity Biotech, Bray, Ireland) on finger prick blood, and Determine 1/2 (Abbott Japan Co, Minato-Ku, Tokyo, Japan) on serum. HIV infection was diagnosed according to the national HIV policy if two different tests were positive.

Data analysis

Data were entered and analysed in EpiInfo Version 3.4.3 (CDC, Atlanta, GA, USA) and PASW Statistics Version 17.0.2 (SPSS Inc, Chicago, IL, USA).

HIV vulnerability was investigated primarily with two indicators: firstly, sex of never-married 15–24 years old was chosen as an indicator for sexual abstinence behaviour among young people, and secondly, no condom use at last non-cohabitant sex as an indicator for last unprotected higher-risk sex.^{10,11} Univariate analysis was calculated for the following variables: gender, age, marital status (married), education (schooling), religion, ethnicity (limited to the 3 largest ethnicities), settlement, distance to the road, HIV information, knowledge of sexual HIV transmission and previous VCT. Chi-squared and Fisher's exact tests were used for categorical variables and Student's *t*-test for normally distributed continuous data. We stratified age in five-year groups to check for potential interaction.

Associate factors for sex of 15–24 years old and for last unprotected NCS were analysed using a multivariate analysis approach. Variables with an increased odds ratio (OR) and $P \leq 0.2$ for the two indicators were fitted into a stepwise down multivariate logistic regression model to control for confounding and interaction. Adequate model fit was assessed with the deviance test (likelihood ratio chi-squared). We considered a two-sided $P < 0.05$ as statistically significant.

The study was approved by the Ethical Committee of the University of Health Sciences, Vientiane, Laos.

RESULTS

Voluntary counselling and testing

Of 933, 924 (99.0%) villagers who attended the mobile clinics in 2006 received VCT, and all tested HIV-negative. In 2008, 1249 villagers attended the mobile clinics including 783 (83.9%) of those 933 villagers of the first mobile clinics in 2006. The study flow chart is shown in Figure 2. Of the 1249 attendees in 2008, 538 (43.1%) received VCT and all were HIV-negative;

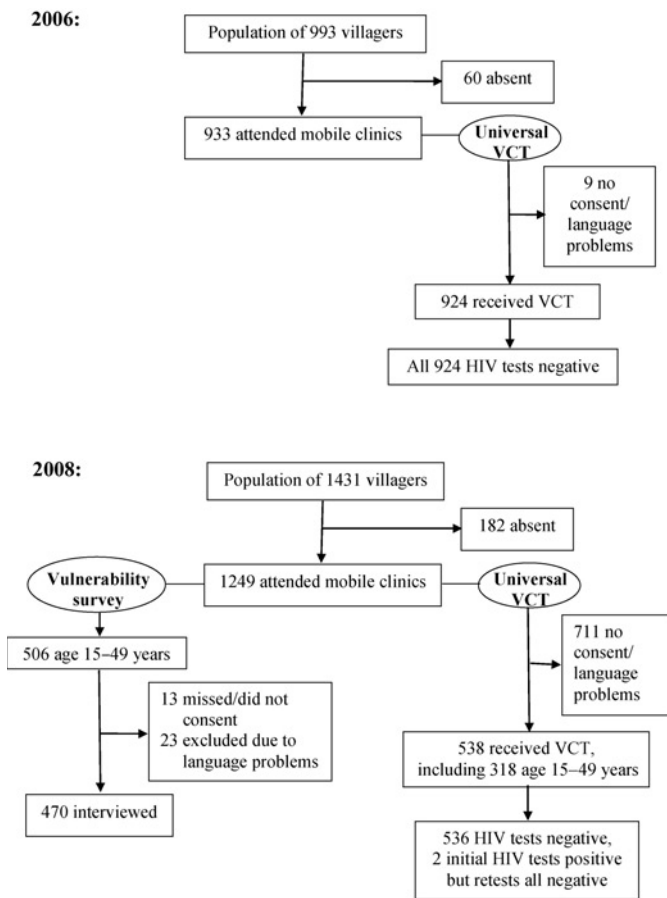


Figure 2 Study flow chart of voluntary counselling and testing (VCT) in 2006 and vulnerability survey plus VCT in 2008 among villagers of the same four minority villages alongside the new Asian highway R3 in Luang Namtha Province, northern Laos

711 (56.9%) villagers refused VCT, especially parents of younger children (mean age \pm SD for refusal: 18.2 ± 18.8 years versus accepted VCT: 25.8 ± 16.4 years, $P < 0.001$). Refusal was similar for gender (55.3%, 361/653 versus 54.4%, 293/539 among female and male participants, respectively, $P = 0.75$). Among 15–49 years old, refusal was similar for age and gender (mean age \pm SD: 29.4 ± 10.0 versus 28.8 ± 9.9 years, $P = 0.50$, and 37.2%, 108/290 versus 37.4%, 80/214, among female and male participants, respectively, $P = 0.97$). Refusal was most frequent in villagers not examined two years before (67.0%, 274/409 versus 48.5%, 380/783, $P < 0.001$) and in the village 2 km away from the new road (80.5%, 214/266 versus 47.5%, 440/926, $P < 0.001$). There the available tests required serum blood sampling, which entailed that children were rarely tested (only 6/121 below age 14 years).

Sexual behaviour survey

Of the 506 attendees at age 15–49 years, 470 (92.9%) could be included and interviewed (Figure 2). Sociodemographic characteristics of the 470 respondents are shown in Table 1: 55.3% (260) were women and 74.3% (349) were married.

Of the 470, 47.0% (221) did not know any ways of HIV transmission; 48.9% (230) were not aware of sexual transmission of HIV. Poor HIV knowledge was more common among villagers 2 km away from the new road (65.2%, 60/92 versus 43.2%,

161/373: OR 2.46, 95% CI 1.50–4.11, $P < 0.001$) and those who had not receive VCT two years before (60.0%, 108/180 versus 39.8%, 113/284: OR 2.27, 95% CI 1.52–3.39, $P < 0.001$). Eighty-two percent (386) already had sexual contacts, and 68.5% (322) within the previous three months. Median age at first sex among villagers aged 15–24 years old was 17.5 years in both female and male participants.

Primary abstinence rate among 15–19 years old was 65.6% (61/93) and was similar between genders (62%, 21/34, versus 68%, 40/59, for female and male participants, respectively, $P = 0.36$).

Abstinence of never-married 15–24 years old was higher among female (79%, 44/56) than male participants (59%, 27/46, $P = 0.025$). Factors associated with sex in this group were older age and ethnicity, especially the Hmong group (Tables 2 and 3).

Of 386 sexually experienced villagers, 53.4% (206) used contraceptives: oral contraceptives (32.9%, 127), injections (18.1%, 70), tubal ligation (1.8%, 7), intrauterine devices (1.3%, 5), condoms and others (1.6%, 6).

Of 139 who had non-cohabitant sexual intercourse 38.1% (53) used a condom at last non-cohabitant sexual contact. Condom use at NCS was associated with gender and age (Tables 4 and 5); it was lower in women (9%, 5/53 versus 56%, 48/86, $P < 0.001$) and decreased with age; 32.0% (8/25) of never-married 15–24 years old reported not having used a condom at last sexual contact.

Previous VCT in 2006 was found to be not associated with behavioural change towards safer sex in the survey two years later. Increased condom use for NCS was similarly reported by those with and without previous VCT (7/89 versus 3/50, $P = 1.00$), as well as always using condoms (13/89 versus 9/50, $P = 0.60$), reduced frequency of NCS (9/89 versus 8/50, $P = 0.31$) and reduced number of sex partners (8/89 versus 9/50, $P = 0.12$).

DISCUSSION

Our study is the first quantitative investigation of the HIV vulnerability and prevalence among the general population of ethnic minorities residing in a high migration area in northern Laos. It suggests that HIV is still of low prevalence in northern Laos;¹ however, our findings reveal an alarming lack of knowledge about HIV combined with frequent and often unprotected non-cohabitant sex. Knowledge about HIV was even poorer than reported previously from the north.¹² This challenges the effectiveness of previous HIV awareness programmes accompanying road construction and the approaches towards minorities.⁵ We found better HIV knowledge among beneficiaries but not safer sexual behaviour; despite knowledge, often misinformation or misconceptions influence the way people behave.¹³ Previous VCT did not induce safer sexual behaviour in this study population. VCT has potential for HIV prevention but is known to be less effective in low-prevalence populations.^{14–16}

Younger age at first sex (17 versus 19.5 years) and a 10-times higher premarital female sex rate compared with countrywide findings¹² reveal further risk factors for HIV transmission in our study population. We found premarital sex more common among men and Hmong ethnicity. Higher premarital sex rates were also reported from male adolescents of the same province⁷ and from men in the capital¹⁷ and might partly be due

Table 1 Sociodemographic characteristics of interviewed villagers (n = 470)

Variables	Categories	Number (%)
Total		470
Female		260 (55.3)
Mean age (in years, 95% CI)		28.8 (27.9–29.6)
Marital status	Single	103 (21.9)
	Cohabiting	8 (1.7)
	Married	349 (74.3)
	Separated	1 (0.2)
	Divorced	3 (0.6)
	Widow	6 (1.3)
Education	No schooling	
	Illiterate	140 (29.8)
	Literate without schooling	84 (17.9)
	Schooling	
	Primary school	137 (29.1)
	Junior secondary school	90 (19.1)
	Senior secondary school	18 (3.8)
College/university	1 (0.2)	
Occupation	Farmer	425 (90.4)
	Student/pupil	37 (7.9)
	Government officer	6 (1.3)
	Merchant/vendor/other	2 (0.4)
	Religion	Animist
	Buddhist	125 (26.6)
	Christian/other	2 (0.4)
Ethnicity	Khmu	151 (32.1)
	Phounoi	117 (24.9)
	Hmong	72 (15.3)
	Lanten	47 (10.0)
	Lao Bit	35 (7.4)
	Ho	19 (4.0)
	Sida	13 (2.8)
	Thai Lue	6 (1.3)
	Phou Sang	4 (0.9)
	Other	6 (1.3)
Settlement	Within previous two years	81 (17.2)
Location	2 km away from new road	93 (19.8)

CI = confidence intervals

to different gender roles and a higher cultural acceptance for men to have sexual activities.⁷ Men are more economically independent and often work outside the village. Unmarried women are traditionally responsible for the housework, stay with their parents at home and are expected not to have premarital sexual experiences in the ethnic Lao culture. However, this may vary in various ethnic groups with some often allowing or even encouraging premarital sexual relations, including Khmu groups.¹⁸ Khmu ethnicity also has large numbers of young women engaging in commercial sex in Laos including in LNP.^{5,19–21} High cultural acceptance for premarital sex was also found among various hill tribes, including Hmong, in two studies from bordering Thailand.^{22,23} Comparing nine hill tribes the Hmong ranged among the highest in their acceptance of unmarried sex.²³ Extramarital sex rates were higher among Hmong men compared with two other groups.²² Ethnic specific customs and beliefs are known to impair sexual abstinence¹¹ and need to be considered for further prevention programmes.

Condom use in men was 56%; this is in contrast to 94% reported by SW in LNP.²¹ Presumably men’s sexual partners have differed from regular SW. Multipartner sexual relations were reported to be common in Laos⁶ and unsafe behaviour is often highest among non-professional/occasional SW.²⁴

Condom use among women was alarmingly low and needs further attention. Considering that contraceptive use among married women was even higher than in urban areas^{12,25}

Table 2 Factors associated with sex of never-married villagers aged 15–24 years old (n = 102) in univariate analysis

Variables	‘Yes’ number (%)	‘No’ number (%)	Crude OR (95% CI)	P value
Numbers	31 (30.4)	71 (69.6)		
Genders*				
Female	12 (39)	44 (62)	1	
Male	19 (61)	27 (38)	2.58 (1.1–6.1)	0.03
Age groups^{*,†}				
15–19 years	17 (55)	60 (84.5)	1	1
20–24 years	14 (45)	11 (15.5)	4.49 (1.7–11.7)	0.001
Education				
Schooling	22 (71)	58 (82)	1	
No schooling	9 (29)	13 (18)	1.83 (0.68–4.9)	0.23
Religion*				
Buddhist	6 (19)	25 (35)	1	
Animist	25 (81)	46 (65)	2.26 (0.8–6.3)	0.11
Ethnicity (reference Phunoi)*				0.013
Phunoi	5 (16)	25 (35)	1	
Khmu	9 (29)	30 (42)	1.5 (0.4–5.1)	
Hmong	6 (19)	4 (6)	7.50 (1.5–36.7)	
Other	11 (35)	12 (17)	2.70 (1.0–7.1)	
Settlement*				
Within last 2 years	3 (10)	16 (23)	1	
More than 2 years	28 (90)	55 (77)	2.72 (0.7–10.1)	0.13
Location				
Directly on the new road	24 (77)	61 (86)	1	
2 km away from the new road	7 (23)	10 (14)	1.78 (0.6–5.2)	0.29
Previous information about HIV*				
No	11 (37)	36 (51)	1	
Yes	19 (63)	35 (49)	1.78 (0.7–4.3)	0.20
Knowledge of sexual transmission of HIV*				
No	6 (20)	34 (48)	1	
Yes	24 (80)	37 (52)	3.68 (1.3–10.1)	0.009
VCT group two years ago				
No	14 (47)	36 (51)	1	
Yes	16 (53)	35 (49)	1.18 (0.5–2.8)	0.71

OR = odds ratio; CI = confidence intervals; VCT = voluntary counselling and testing

*Variables included in the multivariate analysis

†Age was stratified in five-year groups comparing the higher to the youngest age group

knowledge about HIV in our population lags strikingly behind. This reflects that HIV education has not yet been integrated enough in the local family planning services in LNP. Poor access to condoms might be another important barrier to condom utilization in our study population since SW in the same province had reported much higher condom use despite similar poor knowledge.²¹ However, condom availability and cultural acceptability among ethnic minorities was not investigated in our study. Our finding of decreasing condom use with age has also been reported from developed countries²⁶ but would need special attention in ethnic groups practicing traditional sexual initiation rituals involving older/middle-aged partners, as seen in Akha society.^{18,27,28}

The current national strategy puts main focus for HIV prevention on most-at-risk populations. HIV risk for certain rural and ethnic populations with low HIV awareness and knowledge is still estimated to be low and generally not cost-effective for special interventions.⁶ This follows the common perspective that low knowledge and evident risk practices does not necessarily translates into infection in low prevalence settings. However, sudden contact with higher prevalence subpopulations by new road construction can change the whole picture

Table 3 Factors associated with sex of never-married villagers aged 15–24 years old ($n = 102$) in multivariate logistic regression analysis

Variables	'Yes' number (%)	'No' number (%)	Adjusted OR (95% CI)	P value
Numbers	31 (30.4)	71 (69.6)		
Age groups (years)*				
15–19	17 (55)	60 (84.5)		1
20–24	14 (45)	11 (15.5)	5.02 (1.8–14.2)	0.002
Ethnicity (reference Phunoi)				0.013
Phunoi	5 (16)	25 (35)	1	
Khmu	9 (29)	30 (42)	1.58 (0.4–5.7)	
Hmong	6 (19)	4 (6)	7.27 (1.3–39.5)	
Other	11 (35)	12 (17)	5.64 (1.5–21.8)	

OR = odds ratio; CI = confidence intervals

*Age was stratified in five-year groups comparing the higher to the youngest age group

as experiences from other countries have shown. Increased mobility allows broadened sexual networks between ethnic groups and cross-border migrants. High vulnerability of ethnic groups has been documented in neighbouring Thailand²³ and China.²⁹ HIV spread in Yunnan from ethnic minorities to the majority Han population, facilitated by increased migration on new roads connecting high with low HIV prevalence areas,^{4,29} Laos faces similar challenges. An expanding sexual economy along R3 in LNP already has been described, which especially involves poorly educated ethnic minority women²⁰ and is characterized by snowballing recruitment networks reaching even remote villages.^{5,19}

Our results urge to increased educational campaigns targeting ethnic groups affected by new socioeconomic and infrastructural development in their cultural and socioeconomic context.^{5,20,25,30} Further research needs to investigate ethnic-specific beliefs and customs influencing sexual risk behaviour in order to elaborate culturally appropriate approaches for HIV and sexually transmitted infections prevention. Prevention programmes need to extend beyond road construction time.

Study limitations

Our study has the typical limitations of a cross-sectional study and survey with self-reported sexual behaviour³¹ including potential statistical errors from multiplicity analyses. Selection of the study population was not random, which limits the generalizability of our findings. However, differences between rural villages in times before the newly constructed road were mainly determined by ethnicity and access to services. Inequality in infrastructural access has diminished with the new road and accompanying developmental aid. Considering generalizability of data, the selected villagers, therefore, are expected to be more representative for their ethnicity as the main determinant. However, our study included only three of the 15 most common ethnic groups along the road in statistically sufficient numbers. In reference to existing population data⁵ we could include about 63.4% of all Phunoi, 23.5% of all Hmong and 2.3% of all Khmu villagers living at R3. Unmet needs in health and sanitation as one of the selection criteria might have caused over-representation of poverty and poorer understanding of HIV transmission but it was an objective of the study to explore this issue in remote villagers. On the

Table 4 Factors associated with no condom use at last non-cohabitant sex ($n = 139$) in univariate analysis

Variables	'Yes' number (%)	'No' number (%)	Crude OR (95% CI)	P value
Number	86	53		
Gender*				
Male	38 (44)	48 (91)	1	
Female	48 (56)	5 (9)	12.1 (4.4–33.4)	<0.001
Age groups (years)*,†				0.004
15–19	7 (8)	10 (19)	1	
20–24	17 (20)	19 (36)	1.28 (0.4–4.1)	
25–29	14 (16)	9 (17)	2.22 (0.6–8.0)	
30–34	10 (12)	5 (9)	2.86 (0.7–12.1)	
35–39	17 (20)	7 (13)	3.47 (0.9–12.8)	
40–44	10 (12)	3 (6)	4.76 (0.9–23.9)	
45–49	11 (13)	0 (0)	undefined	
Marital status*				
Unmarried	11 (13)	19 (36)	1	
Married	75 (87)	34 (64)	3.81 (1.6–8.9)	0.001
Education*				
Schooling	47 (55)	36 (68)	1	
No schooling	39 (45)	17 (32)	0.57 (0.3–1.7)	0.12
Religion				
Buddhist	15 (17)	11 (21)	1	
Animist	71 (83)	41 (79)	1.27 (0.5–3.0)	0.59
Ethnicity (reference Phunoi)*				0.030
Phunoi	12 (14)	12 (23)	1	
Khmu	42 (49)	14 (26)	3.00 (1.1–8.2)	
Hmong	10 (12)	13 (25)	0.77 (0.2–2.4)	
Other	22 (6)	14 (8)	0.96 (0.4–2.1)	
Settlement				
Within last two years	9 (10)	8 (15)	1	
Longer than two years	77 (90)	45 (85)	1.52 (0.6–4.2)	0.42
Location				
Directly on the new road	70 (81)	46 (87)	1	
2 km away from the new road	16 (19)	7 (13)	1.50 (0.6–3.9)	0.41
Previous information about HIV*				
No	44 (51)	18 (34)	1	
Yes	42 (49)	35 (66)	0.49 (0.2–1.0)	0.048
Knowledge of sexual transmission of HIV*				
No	41 (48)	14 (26)	1	
Yes	45 (52)	39 (74)	0.39 (0.2–0.8)	0.01
VCT two years ago				
No	29 (34)	21 (40)	1	
Yes	57 (66)	32 (60)	1.29 (0.6–2.6)	0.48

OR = odds ratio; VCT = voluntary counselling and testing

*Variables included in the multivariate analysis

†Age was stratified in five-year groups comparing the higher to the youngest age group

other hand, VCT, two years prior to the survey might have led to over-estimation of HIV knowledge. The high population growth due to new settlers within just two years has probably increased heterogeneity in the sample but reflects the socio-economic attraction from the new road with rapid changes and increased migration.⁵ Low education and language problems might have impaired correct understanding of questions. Sexual behaviour surveys among populations with little exposure to data collection face a risk of under-reporting or incorrect answers. We did not ask about injecting drug use (IDU); IDU in Laos seems to be more common among typical high-risk groups in urban areas but data are lacking.¹ HIV prevalence might be under-estimated for 2008 since more than one-third of villagers of reproductive age refused VCT at that time. However, considering the almost complete VCT

Table 5 Factors associated with no condom use at last non-cohabitant sex (n = 139) in multivariate logistic regression analysis

Variables	'Yes' number (%)	'No' number (%)	Adjusted OR (95% CI)	P value
Numbers	86	53		
Gender				
Male	38 (44)	48 (91)	1	
Female	48 (56)	5 (9)	17.7 (5.8–55)	<0.001
Age groups (years)*				0.001
15–19	7 (8)	10 (19)	1	
20–24	17 (20)	19 (36)	1.15 (0.3–4.9)	
25–29	14 (16)	9 (17)	3.59 (0.8–17)	
30–34	10 (12)	5 (9)	3.19 (0.6–18)	
35–39	17 (20)	7 (13)	5.78 (1.2–28)	
40–44	10 (12)	3 (6)	8.74 (1.4–56)	
45–49	11 (13)	0 (0)	∞	

OR = odds ratio
*Age was stratified in five-year groups comparing the higher to the youngest age group

coverage in 2006, the close timing of the road opening and VCT in 2008, and that none of the meanwhile 16 new HIV positives in LNP were from the four study villages, it is very unlikely that relevant numbers of HIV-positive villagers were missed in 2008. Characteristics for refusal appear to be similar but those few villagers who were absent might represent a more mobile subgroup with possibly higher risk profiles.

CONCLUSIONS

Ethnic minorities living alongside a new trans-Asian highway in Laos had alarmingly low HIV knowledge associated with risky sexual behaviours, revealing high HIV vulnerability. Further preventive efforts are needed, taking into account ethnic-specific customs and gender differences to prevent the spread of HIV to these vulnerable groups.

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