

RESEARCH ARTICLE

Primary Study on Providing a Basic System for Uterine Cervical Screening in a Developing Country: Analysis of Acceptability of Self-sampling in Lao PDR

Tomomi Yoshida^{1*}, Yoshimi Nishijima¹, Kiyomi Hando², Soulideth Vilayvong³, Petsamone Arounlangsy³, Toshio Fukuda¹

Abstract

Background: Most developing countries have been unable to implement well-organized health care systems, especially comprehensive Pap smear screening-based programs. One of the reasons for this is regional differences in medical services, and a low-cost portable cervical screening system is necessary. To improve regional discrepancies in cervical screening systems, we investigated the usefulness and acceptability of cervical self-sampling by liquid-based cytology (LBC) for 290 volunteers in the Lao PDR. **Materials and Methods:** Following health education with comprehensive documents, cervical self-sampling kits by LBC were distributed in three provincial, district, and village areas to a total of 290 volunteers, who were asked to take cytology samples by themselves. Subsequently, the acceptability of self-sampling was evaluated using a questionnaire. **Results:** The documents were well understood in all three regions. Regarding the acceptability of self-sampling, the selections for subsequent screening were 62% self-sampling, 36% gynecologist-sampling, 1% either method, and 1% other methods. The acceptability rates were higher in the district and the village than in the province. For the relationship between acceptability and pregnancy, the self-sampling selection rate was higher in the pregnancy-experienced group (75%) than in the pregnancy-inexperienced group (60%). For the relationship between selection of self-sampling and experience of screening, the self-sampling selection rate was higher in the screening-inexperienced group (62%) than in the screening-experienced group (52%). **Conclusions:** Our data show that this new way forward, involving a combination of self-sampling and LBC, is highly acceptable regardless of age, educational background, and residence in rural areas in a developing country.

Keywords: Cervical cytology - self-sampling - acceptability - regional difference - developing country

Asian Pacific J Cancer Prev, 14 (5), 3029-3035

Introduction

Cervical cancer is the third most common cancer worldwide, and over 88% of cases occur in developing countries (IARC, 2008). Cervical cancer, which is preventable and treatable, is the number one cancer killer of women in developing countries. Since the introduction of Papanicolaou (Pap) smear screening, cervical cancer prevention efforts worldwide have focused on screening women at risk of the disease using Pap smears and treating precancerous lesions in developed countries. As a result, Pap smear screening has significantly reduced the mortality rates of cervical cancer (Christopherson et al., 1976; Kim et al., 1978; Ries et al., 1999). Pap smear screening is a multipart process that can lead to early detection of cervical cancer and its precursors. In resource-rich settings, women are usually able to make repeated

visits to seek screening, diagnosis, and treatment in clinics, and the quality of the smears and their interpretation must be adequate.

However, most developing countries have been unable to implement comprehensive Pap smear screening-based programs (Fahs et al., 1996). It has been estimated that only about 5% of women in developing countries have been screened for cervical dysplasia in the past 5 years (WHO, 1986). Several sociodemographic and behavioral factors have consistently been reported to be associated with Pap smear screening. Women who are older, poor, uneducated, or uninsured are less likely to have received recent or any Pap smears (Chavez et al., 1997; Lantz et al., 1997; Stearns et al., 2000; Breen et al. 2001; Casey et al., 2001). Moreover, residence in rural areas may impose additional barriers to cervical cancer control, including lack of medical care infrastructure with fewer primary care

¹Department of Laboratory Sciences, Graduate School of Health Sciences, Gunma University, Gunma, Japan, ²The Non-Government Organization, International Support and Partnership for Health (ISAPH), Thakhek, ³Department of Pathology, Faculty of Medicine, University of Health Sciences Lao PDR, Vientiane, Lao PDR *For correspondence: toyosida@health.gunma-u.ac.jp

physicians, specialists, or hospitals, as well as problems with transportation (Moscovice, 1989; Sawyer et al., 1990; Harris et al., 1993; Guidry et al., 1997; Hawkins et al., 1997; Yabroff et al., 2001). Health care system infrastructure resources, provider availability, and patient characteristics vary geographically in ways that can impact Pap smear screening and disease stage at diagnosis, as well as use of recommended treatments and cervical cancer survival. Goldie et al. (2005) showed that if a woman is screened only once in her lifetime between the ages of 30 and 40 years, it would reduce her lifetime risk of cervical cancer by 25-36% (Goldie et al., 2005).

Lao People's Democratic Republic (Lao PDR) is a country in south-east Asia, which is surrounded by China, Vietnam, Cambodia, Thailand, and Myanmar. It is 236,800 km² in size, its population of 6.25 million people live in 17 provinces, with most people (67%) still living in rural areas, its adult literacy rate is 73%, and its life expectancy is 69.9 years (United Nations Development Programme, 2013). Compared with its bordering countries, Lao PDR has a low population density. The majority of people living in rural areas depend on agriculture. Lao PDR is one of the poorest countries in the world. As a true mosaic of ethnic groups, Lao PDR has many different ethnic groups with different languages, religions, and traditions. The three main groups are determined by the altitudes of where they live: i) the Lao of the plains, or "Lao Loum", living below an altitude of 400 m above sea level; ii) the Lao of the mountains, or "Lao Thoung", living between 400 and 900 m; and iii) the Lao of the high mountains, or "Lao Soung", living above 900 m. For the grassroots health care system, there are 757 local Health Centers within 141 districts of the 17 provinces/cities (Lua et al., 2011). These Health Centers have a useful database showing that the five most common cancers causing mortality per 100,000 people were liver cancer, followed by colorectal, lung, uterine cervix, and stomach cancers in females in 2007-2008 (Lua et al., 2011). In Lao PDR, very few epidemiological studies have been performed on mortality, especially that caused by cancer (Moore et al., 2008).

This study focused on the acceptability of cervical cytology by self-sampling, based on an analytical questionnaire survey for combination of a self-sampling device and liquid-based cytology in Lao PDR. Items to be elucidated included demographic data for regional differences, occupation, history of health examination, and knowledge of cervical cancer and screening programs for the acceptability of the self-sampling method.

Materials and Methods

The target subjects were three groups consisting of women who a) worked in Khammouane Provincial Hospital, b) worked in Xebangfay District Health Office, and c) lived in Tung village in Sibounhouane subdistrict (see Figure 1). This study was conducted in cooperation with the University of Health Sciences in Lao PDR, Khammouane Provincial Health Office and Hospital, Xebangfay District Health Office, and the targeted Tung village with the cooperation of the village people. The targeted number of women was about 300 village,

provincial, and district people including medical staff.

This study was implemented for about 1–2 days in each field and consisted of three steps. The first step was a lecture on health education by a Lao medical doctor to health sciences university staff about cervical cancer, human papillomavirus (HPV), and usefulness of Pap smear screening. The second step was the distribution of a self-sampling kit, including a small poster about health education, an explanatory booklet for self-sampling (Figure 2), a self-sampling device (Rovers Viba-brush; Rovers Medical Devices, Oss, The Netherlands), and a cell-fixative solution vial (Muto Cyto Collect; Muto Pure Chemicals Co. Ltd., Tokyo, Japan) (Figure 3), followed by an explanation of how to complete self-sampling with an



Figure 1. Map of Lao PDR

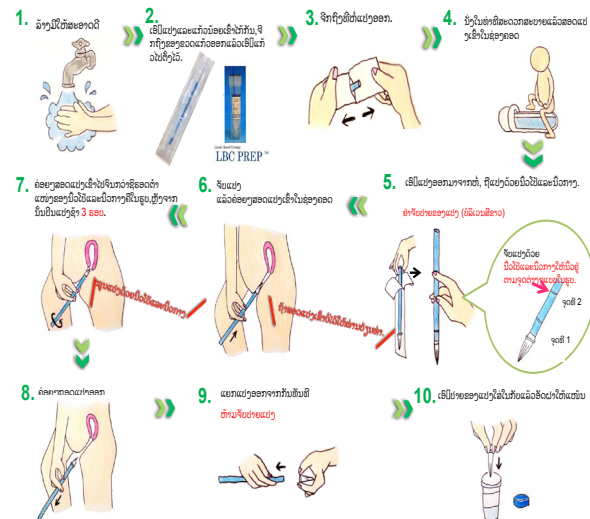


Figure 2. Manual of Self-sampling Method in Lao Language

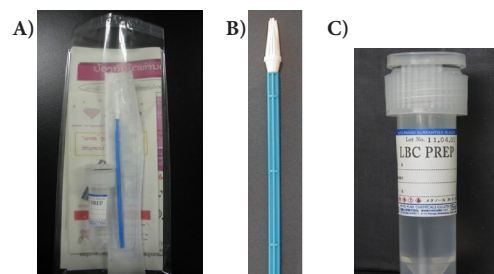


Figure 3. A) Self-sampling Kit, B) Brush and, C) Fixative Vial

easy and safe method for implementation. The third step involved self-sampling by the women at home or in a toilet, and completion of a questionnaire. The questionnaire items were as follows: i) basic module: district, name, age; ii) woman module: ethnicity, educational background, occupation, marital status, pregnancy status, smoking, knowledge of cervical cancer and screening programs, experience of cervical cancer screening programs; iii) impression of self-sampling module: understanding of explanatory booklet, acceptability of self-sampling method.

All documents, leaflets, posters, and questionnaires were written in the Lao language and volunteers were interviewed orally in areas of low literacy with cooperation of university staff. This study was approved by the Institutional Review Board of the University of Health Sciences in Lao PDR, prior to implementation.

Results

Basic module data

Two hundred and ninety volunteers were analyzed, comprising 171 women (mean age: 41.6 years) in Khammouane Provincial Hospital, 68 women (mean age: 36.8 years) in Xebangfay District Health Office, and 51 women (mean age: 40.8 years) in Tung village in Sibounhouane subdistrict (Table 1).

Woman module data

Regarding ethnicity among the 290 volunteers, Lao Loum comprised 98% (285/290) and Lao Thoug comprised 2% (5/290) (Table 1). For marital statuses, the married rate was 93% (270/290) and the unmarried rate was 7% (20/290) (Table 1). In pregnancy, women with experience of pregnancy comprised 91% (265/290) and those without experience of pregnancy comprised 8% (24/290) (Table 1). For these three items, there were no differences between Khammouane province, Xebangfay district, and Tung village. Regarding smoking history, smokers were 1% (1/290), non-smokers were 92% (267/290), and past smokers were 7% (21/290) (Table 1). For educational backgrounds, 9% (27/290) graduated from university, 53% (155/290) from college, 14% (40/290) from high school, 10% (29/290) from secondary school, and 11% (32/290) from primary school, while 2% (5/290) had never attended school. The corresponding

educational backgrounds by area, with a final section of 'not determined', were 15% (25/171), 67% (116/171), 10% (17/171), 5% (8/171), 2% (3/171), 0% (0/171), and 1% (2/171) in Khammouane province, 3% (2/68), 51% (35/68), 24% (16/68), 10% (7/68), 12% (8/68), 0% (0/68), and 0% (0/68) in Xebangfay district, and 0% (0/51), 8% (4/51), 14% (7/51), 27% (14/51), 41% (21/51), 10% (5/51), and 0% (0/51) in Tung village, respectively (Figure 4). The more highly educated people were concentrated in Khammouane province. Regarding occupations, medical professionals including medical doctors, doctor assistants, and other medical professionals were 48% (138/290), employees including teachers and merchants were 27% (79/290), farmers were 19% (55/290), unemployed people including housewives were 6% (17%), and one person did not answer. The corresponding occupations by area were 71% (121/171), 23% (39/171), 1% (2/171), 5% (9/171), and 0% (0/171) in Khammouane province, 25% (17/68), 51% (35/68), 18% (12/68), 6% (4/68), and 0% (0/68) in Xebangfay district, and 0% (0/51), 10% (5/51), 80% (41/51), 8% (4/51), and 2% (1/51) in Tung village, respectively (Figure 5). For history of hospital visits and health checks, women with experience of visiting hospital were 72% (209/290), women without experience

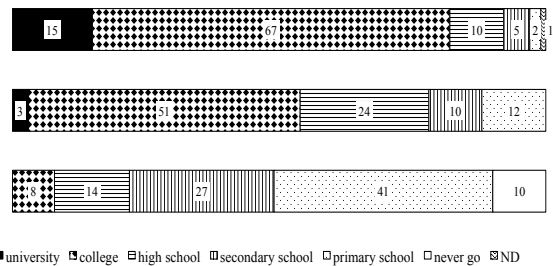


Figure 4. Educational Background by Area



Figure 5. Occupation by Area

Table 1. Woman Module Data

		Province (%)	District (%)	Village (%)	Total (%)
Ethnicity	Lao Loum(incl. Pouthai)	169/171 (99)	66/68 (98)	50/51 98	285/290 (98)
	Lao Thoug	2/171 (1)	2/68 (2)	1/51 2	5/290 (2)
Age		21-58 (41.6)	19-50 (36.7)	18-80 40.8	18-80 (39.7)
Marital status	Married	161/171 (94)	62/68 (91)	47/51 92	270/290 (93)
	Unmarried	10/171 (6)	9/68 (9)	4/51 8	20/290 (7)
Pregnancy	Experienced	159/171 (93)	59/68 (87)	47/51 92	265/290 (91)
	Inexperienced	11/171 (11)	9/68 (9)	4/51 8	24/290 (8)
	ND	1/171 (1)	0/68 (0)	0/51 0	1/290 (1)
Smoking	Yes	0/171 (0)	1/68 (1)	0/51 0	1/290 (0.5)
	Former	0/171 (0)	1/68 (1)	20/51 39	21/290 (7)
	Never	171/171(100)	65/68 (97)	31/51 61	267/290 (92)
	ND	0/171 (0)	1/68 (1)	0/51 0	1/290 (0.5)

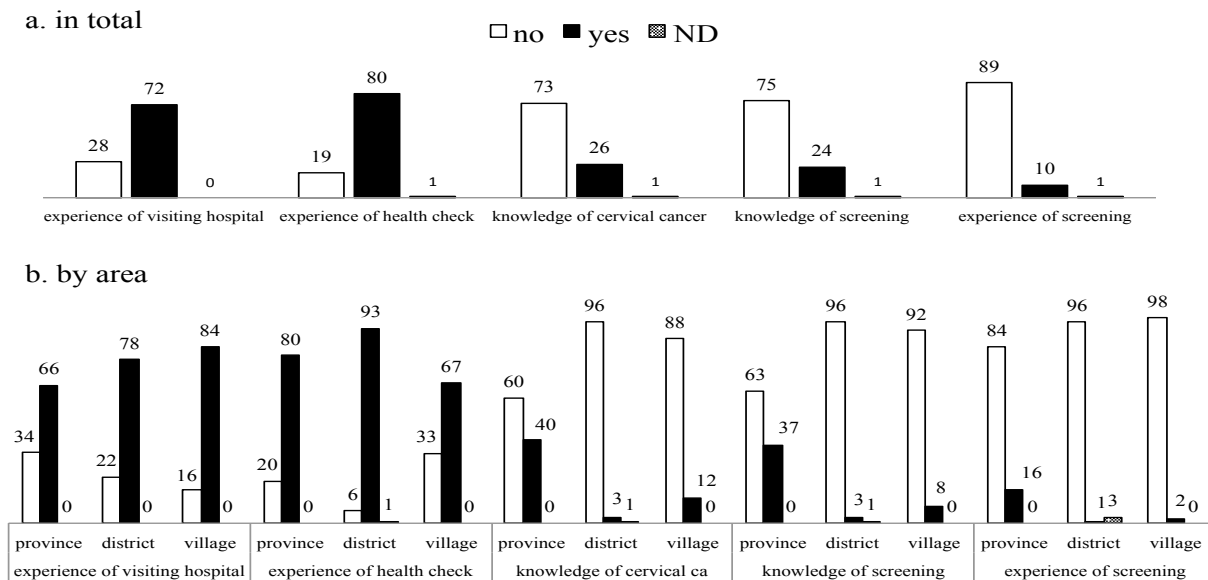


Figure 6. Knowledge and Experience

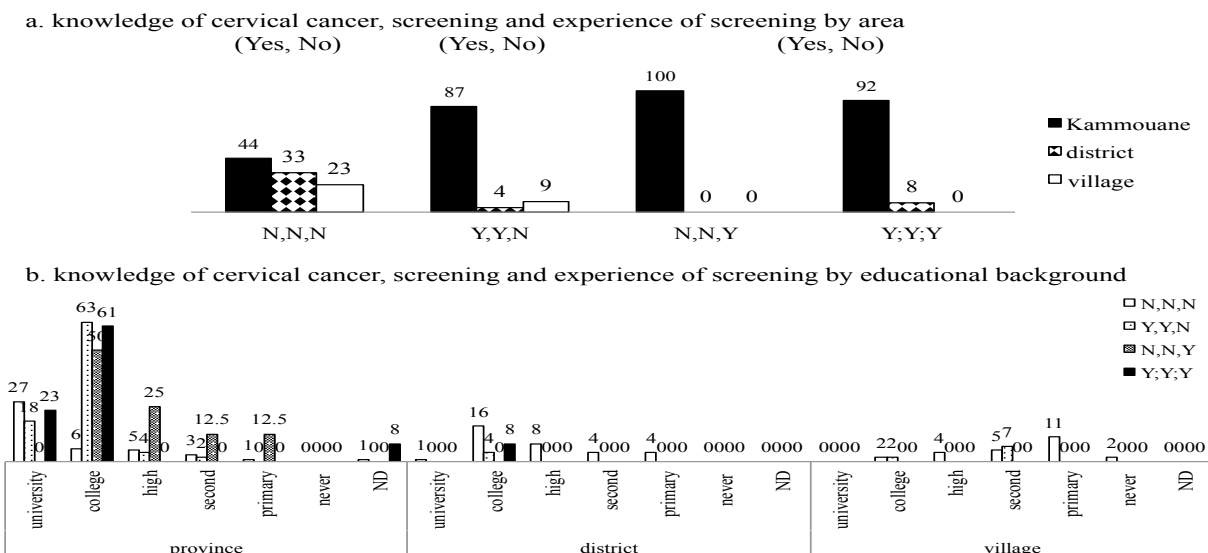


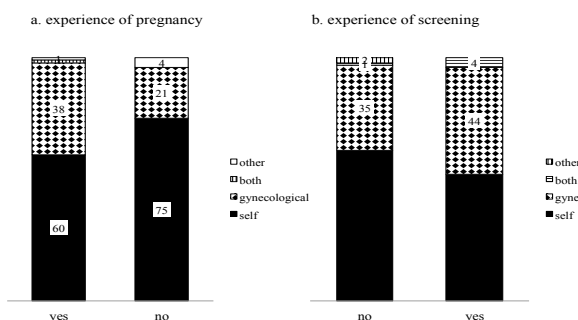
Figure 7. The Combination of Answer in Knowledge and Experience

of visiting hospital were 28% (81/290), women with experience of health checks were 80% (233/290), and women without experience of health checks were 19% (56/290) (Figure 6a). According to each area, the history of visiting hospital involved an experienced group of 66% (113/171) and an inexperienced group of 34% (58/171) in Khammouane province, an experienced group of 78% (53/68) and an inexperienced group of 22% (15/68) in Xebangfay district, and an experienced group of 84% (43/51) and an inexperienced group of 16% (8/51) in Tung village (see Figure 6b). These rates showed only small differences between the three areas. In knowledge of cervical cancer and screening programs, women with knowledge of cervical cancer comprised 26% (76/290) and women with lack of knowledge comprised 73% (213/290). For knowledge of screening programs, women with knowledge comprised 24% (89/290) and women without knowledge comprised 75% (220/290). Moreover, for experience of cervical cancer screening programs, the experienced group was only 10% (28/290) and the

inexperienced group was 89% (280/290) (Figure 6a). The detailed regional data are shown in Figure 6b. For the relationships between knowledge and experiences by area, the three questionnaires were based on knowledge of cervical cancer and screening programs, and experience of cervical cancer screening programs. We defined our focus on their answers for combinations of Yes (Y) and No (N) into four groups of “YYY”, “NNN”, “NNY”, and “YYN”. For residences, the YYY group comprised 92% (12/13) in the province, 8% (1/13) in the district, and none in the village, while the NNN group comprised 44% (86/195) in the province, 33% (84/195) in the district, and 23% (45/195) in the village. The NNY group comprised 100% (8/8) in the province and the YYN group comprised 87% (40/46) in the province, 4% (2/46) in the district, and 9% (4/46) in the village (Figure 7a). Regarding the relationships of knowledge, experiences, and educational backgrounds in the province, the experienced group with knowledge was 23% (3/13) in graduates from university and 61% (8/13) in graduates from college. The

Table 2. Impression of Self-sampling

		Province (%)	District (%)	Village (%)	Total (%)
Understanding of explanatory booklet for self-sampling	Yes	165/171 (96)	62/68 (91)	51/51 (100)	278/290 (96)
	No	5/171 (3)	4/68 (6)	0/51 (0)	9/290 (3)
	Other	1/171 (1)	2/68 (3)	0/51 (0)	3/290 (1)
Selection for next screening method	Self-sampling	92/171 (54)	48/68 (71)	38/51 (75)	178/290 (62)
	Gynecologist-sampling	76/171 (44.5)	18/68 (26)	11/51 (21)	105/290 (36)
	Either	2/171 (1)	0/68 (0)	1/51 (2)	3/290 (1)
	Other	1/171 (0.5)	2/68 (3)	0/51 (0)	3/290 (1)
	ND	0/171 (0)	0/68 (0)	1/51 (2)	1/290 (0)

**Figure 8. Relationship between Acceptability and Past Pregnancy, Screening**

experienced group without knowledge was 50% (4/8) in graduates from college, 25% (2/8) in graduates from high school, 12.5% (1/8) in graduates from secondary school, and 12.5% (1/8) in graduates from primary school in the district, the experienced group with knowledge was 8% (1/13) in graduates from college, and the group with knowledge but without experience was 4% (2/45) in graduates from college. In the village, there was a group with knowledge but without experience comprising 2% (1/45) in college graduates and 7% (3/45) in secondary school graduates (Figure 7b).

Impression of self-sampling module

For understanding of the explanatory booklet for self-sampling, the group with understanding was 96% (278/290) and the group without understanding was 3% (9/290). There was no difference by each area, and interestingly all volunteers in Tung village were able to understand the explanatory booklet (Table 2). Regarding the acceptability of the self-sampling method, selection of self-sampling was 62% (178/290), selection of gynecologist-sampling was 36% (105/290), selection of either method was 1% (3/290), and selection of other methods was 1% (3/290). By each area, the acceptability rates were higher in the district and the village than in the province (Table 2).

For the relationship of acceptability and pregnancy, the self-sampling acceptability rate was higher in the pregnancy-experienced group (75%, 18/24) than in the pregnancy-inexperienced group (60%, 156/262). These data showed that pregnancy-inexperienced women tended to prefer self-sampling (Figure 8a). In the relationship of acceptability and experiences in screening, the acceptability rate was higher in the screening-inexperienced group (62%, 163/262) than in the screening-experienced group (52%, 14/27). The screening-experienced women were all pregnancy-experienced (Figure 8b).

Discussion

Despite the fact that cancer of the cervix is preventable, it is the most common cause of cancer death among women in developing countries. Although screening efforts based on Pap smears have been introduced in several developing countries, many have achieved only limited success, because Pap smear screening is a multipart process that can lead to early detection of cervical cancer and its precursors. To be effective, women must receive regular Pap smear screening, and the quality of the smears and their interpretation must be adequate. In most countries, the development of systems to ensure access to high-quality cytologic services is a challenge, and efforts to improve the quality of Pap smears and screening approaches are currently ongoing (Swaddiwudhipong et al., 1995; Lazcano-Ponce et al., 1999; Hart et al., 2003). In Lao PDR, one of the South-East Asian countries, cervical cancer is the fourth most common cancer causing mortality in females, but no data are publically available (Moore et al., 2008; Lua et al., 2011). Therefore, the aim of our study was to assess the utility of a self-sampling device with liquid-based cytology based on regional differences in acceptability of the developed strategy in Lao PDR.

The target subjects were three groups of women who lived in Khammouane province, Xebangfay district, and Tung village in Sibounhouane subdistrict. Khammouane province is distant from the capital city of Vientiane, requiring about 5 hours of driving by car. Xebangfay district is more than 40 km distant from Khammouane prefecture, and Tung village is a further 40 km distant from the district. The ethnic groups, ages, marital statuses, pregnancy experiences, and smoking histories showed no differences between the three areas.

In the educational backgrounds, there were differences by living area, as people who graduated from university comprised only 9% (27/290) in total, with 15% in Khammouane province and 3% in Xebangfay district. In addition, people who graduated from college comprised 53% (155/290) in total, with 67% in Khammouane province, 51% in Xebangfay district, and 8% in Tung village. Meanwhile, the village people who graduated from primary school comprised 41%, and 10% had never attended school. There were also differences in occupations, with people who worked as medical professionals including medical doctors, doctor assistants, nurses, and technicians in the medical field at 71% in Khammouane province and 25% in Xebangfay district. On the other hand, 80% of the village people were farmers.

For history of hospital visits and health checks, 80% of

people had experienced health checks in total, comprising by area, 80% in the province, 93% in the district, and 67% in the village. There were no differences by area. Some non-profit organizations have been conducting health projects involving maternal and child health, reproductive health through health education, and increases in knowledge level and basis of well-being, which can contribute to improvement of the health statuses of people in rural areas. These activities aim to improve the health statuses of village people by monitoring physical checkups through health education and mobile clinics. These aspects provide the opportunity to undergo physical checks in rural areas at equal levels to provincial areas.

Regarding knowledge of cervical cancer and Pap smear screening, just 26% had knowledge of cervical cancer and just 24% had knowledge of screening, while only 10% of women had experienced screening programs in total. There are some reports that regional differences in the availability of primary care providers and specialists may affect patient education about risk factors, recommendations for screening, and access to treatment, while transportation problems, such as longer distance of mass transit, may also create barriers to care for rural women (Sawyer et al., 1990; Harris et al., 1993; Ramsbottom-Lucier et al., 1996; Guidry et al., 1997). Our data showed the YYY group comprised 92% living in the province, 8% in the district, and 0% in the village, whereas the experienced group without knowledge (NNY) comprised 100% living in the province. These data revealed that living areas are closely correlated for people with and without experience of screening programs.

Moreover, for the relationships of knowledge, experiences, and educational backgrounds, the experienced group with knowledge contained more people who graduated from college in the province, while the experienced group without knowledge showed a broad distribution of educational backgrounds. In addition, there were few people who had no experience despite having knowledge in the district and the village. These data showed that women in the province have many opportunities for screening programs regardless of knowledge about cancer or screening, whereas through the intervention of some activity groups such as non-profit organizations, women in rural areas get the chance to obtain some knowledge, but have no chance to experience screening programs.

For understanding of the explanatory booklet for self-sampling, 96% achieved understanding in total, while by area, all the volunteers were able to understand the booklet in the village. Although the literacy rate was low, the village people understood the method for self-sampling. This is because our explanatory booklet or poster uses many illustrated figures for elaboration and the Lao language is easily understandable by people with wide ranges of ages and educational backgrounds.

The acceptability of the self-sampling method was 62% in total. In the village, the rate of acceptability was highest (75%), followed by the district (71%) and the province (54%). Some studies in areas with high cervical cancer mortality have compared the rates of sexually transmitted diseases (STDs) in rural versus

urban populations, and reported contradictory findings. Moreover, Wiesenfeld et al. (2001) showed that use of self-collected swabs from the distal vagina for STD testing was easily implemented in a high-school setting, where it was widely accepted by the students. In the present study, the combination of self-sampling and liquid-based cytology, a new slide preparation method that is useful for infections like *Candida*, *Leptothrix*, and HPV, allowed the detection of koilocytic atypia, as observed in many previous reports (Aral et al., 1991; Wiesenfeld et al., 2001). Nabandith et al. (2012) tried to examine the cervical PAP smear test using self-sampling instrument at Settathirath hospital in Vientiane, they showed 3.1% with abnormal epithelial case out of 200 healthy volunteers with medical knowledge with conventional self-sampling instrument and PAP smear (Nabandith et al., 2012). Our study implemented newly developed apparatus with liquid based cytology. This newly developed manual liquid-based cytology system may be suitable for cervical cytology screening in developing countries, together with the ease of transportation, preservation, and performance of additional studies on the same sample, such as HPV testing (Papillo et al., 1998; Serwani et al., 2007; Settakorn et al., 2008; Nandini et al., 2012). In addition, we found that the group without experience of pregnancy and no experience of pelvic examination by clinicians preferred the self-sampling method. Some reports have shown similar results for adolescents and young adult women, namely that most women preferred self-sampling (Hsieh et al., 2003; Richardson et al., 2003; Sanchaisuriya et al., 2004; Suwannarurk et al., 2010).

Our study also demonstrated that a new way forward is possible, since the combination of self-sampling and liquid-based cytology showed high acceptability regardless of age, educational background, and residence in rural areas in a developing country. These innovative new strategies bring those people closer to protecting women from cervical cancer in broad areas in developing countries.

Acknowledgements

The present study supported in part by the 43rd grant from the Mitsubishi Foundation.

References

- Aral SO, Soskoline V, Joesoef RM, O'Reilly KR (1991). Sex partner recruitment as risk factor for STD: clustering of risky modes. *Sex Transm Dis*, **18**, 10-7.
- Breen N, Wagener DK, Brown ML, Davis WW, Ballard-Barbash R (2001). Progress in cancer screening over a decade: results of cancer screening from the 1987, 1992 and 1998 National Health Interview Surveys. *J Natl Cancer Inst*, **93**, 1704-13.
- Casey MM, Call KT, Klingner JM (2001). Are rural residents less likely to obtain recommended preventive healthcare services? *Am J Prev Med*, **21**, 182-8.
- Chavez LR, Hubbell FA, Mishra SI, Valdez RB (1997). The influence of fatalism on self-reported use of Papanicolaou smear. *Am J Prev Med*, **13**, 418-24.
- Christopherson WM, Lundin FE, Mendez WM, Parker JE (1976). Cervical cancer control: a study of morbidity and mortality

- trends over a twenty-one-year period. *Cancer*, **38**, 1357-66.
- Fahs MC, Plichta SB, Mandelblatt JS (1996). Cost-effective policies for cervical cancer screening: an international review. *Pharmacoeconomics*, **3**, 211-30.
- Goldie SJ, Gaffkin L, Goldhaber-Fiebert JD, et al (2005). Cost effectiveness of cervical-cancer screening in five developing countries. *N Engl J Med*, **353**, 2158-68.
- GLOBOCAN Cancer Fact sheet: Cervical Cancer Incidence and Mortality Worldwide in 2008. "Interagency for Research on Cancer" (2008). <http://globocan.iarc.fr/factsheets/cancers/cervix.asp>.
- Guidry JJ, Aday LA, Zhang D, Winn RJ (1997). Transportation as a barrier to cancer treatment. *Cancer Pract*, **5**, 361-6.
- Harris R, Leininger L (1993). Preventive care in rural primary care practice. *Cancer*, **72**, 1113-8.
- Hart LG, Salsberg E, Phillips DM, Lishner DM (2003). Rural health care providers in the United States. *J Rural Hlth*, **18**, 211-32.
- Hawkins R, Curtiss C (1997). Cancer resources for providers in the rural community. *Cancer Pract*, **5**, 383-6.
- Hsieh YH, Howell MR, Gaydos JC, et al (2003). Preference among female Army recruits for use of self-administered vaginal swabs or urine to screen for Chlamydia trachomatis genital infections. *Sex Transm Dis*, **30**, 769-73.
- United Nations Development Programme (2013). Human Development Report; Explanatory note on 2013 HDR composite indices: Lao People's Democratic Republic (2013). <http://hdrstats.undp.org/en/countries/profiles/la.html>
- Kim K, Riger RD, Patric JR, et al (1978). The changing trends of uterine cancer and cytology: a study of morbidity and mortality trends over a twenty year period. *Cancer*, **42**, 2439-49.
- Lantz PM, Weigers ME, House JS (1997). Education and income differentials in breast and cervical cancer screening. Policy implications for rural women. *Med Care*, **35**, 219-36.
- Lazcano-Ponce EC, Moss S, Alonso de Ruiz P, Salmeron CJ, Hernandez AM (1999). Cervical cancer screening in developing countries: why is it ineffective? The case of Mexico. *Arch Med Res*, **30**, 240-50.
- Lua NT, Chinh ND, Hue NT, et al (2011). Survey-based cancer mortality in the Lao PDR, 2007-08. *Asian Pac J Cancer Prev*, **12**, 2495-8.
- Moore MA, Attasara P, Khuhaprema T, et al (2008). Cancer epidemiology in mainland South-East Asia - past, present and future. *Asian Pac J Cancer Prev*, **9**, 67-80.
- Moscovice IS (1989). Rural hospitals: a literature synthesis and health services research agenda. *Hlth Serv Res*, **23**, 892-930.
- Nabandith N, Pholsena V, Mounthisone P, et al (2012). First trial of cervical cytology in healthy women of urban Laos using by self-sampling instrument. *Asian Pac J Cancer Prev*, **13**, 4665-7.
- Nandini NM, Nandish SM, Pallavi P, et al (2012). Manual liquid based cytology in primary screening for cervical cancer--a cost effective proposition for scarce resource settings. *Asian Pac J Cancer Prev*, **13**, 3645-51.
- Papillo JL, Zarcka MA, St John TL (1998). Evaluation of the ThinPrep Pap test in clinical practice: a seven-month, 16,314-case experience in northern Vermont. *Acta Cytol*, **42**, 203-8.
- Ramsbottom-Lucier M, Emmett K, Rich EC, Wilson JF (1996). Hills, ridges, mountains, and roads: geographical factors and access to care in rural Kentucky. *J Rural Hlth*, **12**, 386-94.
- Richardson E, Sellors JW, Mackinnon S, et al (2003). Prevalence of Chlamydia trachomatis infections and specimen collection preference among women, using self-collected vaginal swabs in community setting. *Sex Transm Dis*, **30**, 880-5.
- Ries LAG, Kosary CL, Hankey BF, Edwards BK (1999). Cancer Statistic Review, 1973-1996. National Cancer Institute, Bethesda.
- Sanchaisuriya P, Pengsaa P, Sriamporn S, et al (2004). Experience with a self-administered device for cervical cancer screening by Thai women with different educational backgrounds. *Asian Pac J Cancer Prev*, **5**, 144-50.
- Sawyer JA, Earp J, Fletcher RH, Daye FF, Wynn TM (1990). Pap tests of rural black women. *J Gen Intern Med*, **5**, 115-9.
- Settakorn J, Rangdaeng S, Preechapornkul N, et al (2008). Interobserver reproducibility with LiquiPrep™ liquid-based cervical cytology screening in a developing country. *Asian Pac J Cancer Prev*, **9**, 92-6.
- Sherwani RK, Khan T, Aktar K, et al (2007). Conventional pap smear and liquid based cytology for cervical cancer screening - a comparative study. *J Cytol*, **24**, 167-72.
- Stearns SC, Slifkin RT, Edin HM (2000). Access to care for rural Medicare beneficiaries. *J Rural Hlth*, **16**, 31-42.
- Suwanarurk K, Bhamarapratana K, Kheolamai P, et al (2010). Can self vaginal douching for high risk HPV screening replace or assist efficacy of cervical cancer screening? *Asian Pac J Cancer Prev*, **11**, 1397-401.
- Swaddiwudhipong W, Chaovakiraripong C, Nguntra P, et al (1995). Effect of mobile unit on changes in knowledge and use of cervical cancer screening among rural Thai women. *Int J Epidemiol*, **24**, 493-8.
- Wiesenfeld HC, Lowry DL, Heine RP, et al (2001). Self-collection of vaginal swabs for the detection of Chlamydia, gonorrhea, and trichomoniasis: opportunity to encourage sexually transmitted disease testing among adolescents. *Sex Transm Dis*, **28**, 321-5.
- World Health Organization (1986). Control of cancer of the cervix uteri. A WHO meeting. *Bull World Hlth Organ*, **64**, 607-18.
- Yabroff KR, Lawrence WF, King JC, et al (2005). Geographic disparities in cervical cancer mortality: what are the roles of risk factor prevalence, screening and use of recommended treatment? *J Rural Hlth*, **21**, 149-57.