

DETERMINANTS OF MONTHLY REPORTING BY VILLAGE HEALTH VOLUNTEERS IN A POOR RURAL DISTRICT OF LAO PDR

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Abstract. Village health volunteers (VHV) are community members trained as lay health workers. They are engaged in a variety of health care programs in which they are often required to make regular reports to their supervisors, including community-based surveillance data. The objective of this study was to identify factors influencing monthly reporting activities among VHV in a remote area of Lao PDR. Data were collected through structured interviews with VHV in November 2008. Logistic regression analysis was conducted to assess associations between completion of monthly reporting and socio-demographic and economic factors and VHV-related factors, such as training, experience, type of main job, and satisfaction with incentives. Of the 137 VHVs from 97 villages interviewed, 39.4% stated they submitted their monthly report at least once over the past three months. Most frequently mentioned reasons for not reporting were "no money to visit health center", "no time to visit health center", and the "health center is located too far". Logistic regression analysis showed failure to report was associated with longer distances between the VHV village and the responsible health center, lower levels of education, fewer training sessions attended by the VHV, and the type of main job of the VHV. Although most VHVs owned vehicles and were given financial support for travel, difficulty traveling to the responsible health center remains the leading cause for failure to report.

Keywords: community health aides, voluntary workers, disease notification, data collection, Lao PDR

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INTRODUCTION

Improvement in the health situation of rural communities in developing countries has been sporadic due to the biased allocation of health care services to cities. The provision of basic health

services to rural communities is essential for achieving health-related Millennium Development Goals (Chen *et al*, 2004; Houweling *et al*, 2007). To address the lack of health manpower in remote rural areas, community members are trained and used as lay health workers in a variety of health care delivery programs, such as provision of first aid, treatment of simple and common illnesses, and the promotion of immunization, breastfeeding, environmental sanitation, and clean water (Corluka *et al*, 2009; Lewin *et al*, 2010). Regular and accurate reporting is essential for community-based surveillance programs, which are often led by lay health workers, the involvement of whom allows health officials to capture disease trends and to detect and promptly respond to unusual conditions in communities (Oum *et al*, 2005; Kyei-Faried *et al*, 2006).

In many countries, community-based surveillance systems have been implemented for vital events and a range of infectious diseases, including dracunculiasis, malaria, smallpox, and poliomyelitis (Cutts *et al*, 1993; Cairncross *et al*, 1996; WHO SEARO, 2003; WHO, 2004; Oum *et al*, 2005). Since facility-based surveillance systems have limitations in reaching people who do not have access to public health facilities or who choose not to use them (Oum *et al*, 2005), the WHO recommends community-based surveillance systems as a useful strategy for controlling emerging diseases, such as SARS and avian influenza (WHO, 2005a).

From the lay health worker's perspective, working for the public health sector is considered a good opportunity to foster satisfaction from helping others, have self improvement, and develop social skills (Thomas *et al*, 2007). In low income countries, lay health workers also reported

a lack of monetary incentive as a major factor lowering their motivation (Kironde and Klaasen, 2002; WHO, 2005b).

Lay health workers in Lao PDR are called village health volunteers (VHV). The main activities the Lao health authorities expect of VHV is to include helping health workers with outreach activities, providing health education for communities, providing basic treatment using a first aid kit (only in remote villages), referring patients to health care facilities, facilitating prenatal care clinics at healthcare facilities, and conducting community-based surveillance for vital events and malaria (only in malaria endemic villages). Health authorities expect VHV to make monthly reports of surveillance activities, disruption of medical items they use, program outcomes and the difficulties they encounter, to responsible health facilities (either a health center or a district health office).

One problem VHV have is lack or delay in monthly reporting (Jorgensen *et al*, 2010). A number of countries have reported the same problem; a lower reporting rate was observed during plowing and cultivating months in Ethiopia (Ghebreyesus *et al*, 2000). In Nigeria, reporting frequency was associated with the region in which the lay worker lived, their occupation, and the distance between his/her village and the reporting location (Brieger and Kendall, 1996). However, the above studies are not applicable here because they were qualitative in nature and were conducted without consideration of potential confounding socio-demographic and economic factors. Few studies have reported the activities of lay health workers in Asian countries. The objective of this study was to identify the determinants of monthly reporting among VHVs in a rural district of Lao PDR.

MATERIALS AND METHODS

Study site and population

This study was conducted in Xepone District, Savannakhet Province, central Lao PDR. Xepone District is located 500 km from the capital, Vientiane, and borders Vietnam. Recently, the government identified Xepone as one of the 47 poorest districts in the country, out of a total of 134 districts, in terms of insufficient household income and access to education and health services, water and roads (International Monetary Fund, 2004). In 2008, the total population of Xepone District was approximately 45,000; 75% of the population was comprised of ethnic minorities. Government health-care facilities in the district consist of one district hospital and ten health centers. Common illnesses reported from these healthcare facilities are malaria, diarrhea, and respiratory infections.

The VHV program has been carried out in Xepone District since the 1990s. In each village, a couple of VHV are selected from the community by village executives, and trained health officials. Their expected activities depend on the characteristics of the village. For example, in a village where malaria is endemic, VHV are trained for a week and equipped with rapid diagnostic test kits and anti-malaria medicines to provide prompt diagnosis and treatment of villagers. In a village where access to a health center is difficult, VHV are equipped with a first aid kit. In cases where multiple VHV live in a vil-

lage, they are expected to help each other and share each others work.

According to the national health information system, VHV are supposed to complete monthly reports by the 25th of each month; the data reach the ministry via health centers, and district and provincial health offices by the 20th of the following month (Fig 1). If no event occurs, the VHV is supposed to make a zero report. As a communication tool, fixed phones are available at 9 out of 11 such responsible facilities.

Village health volunteers are not employed by the government, nor paid on a regular basis. Their incentives include exemption from medical expenses, including consultation and medicine charges, and an irregular allowance paid by a vertical program when a VHV attends training or helps conduct an outreach activity. In Xepone the Lao-Belgian Health Cooperation Project, which aimed to reform the organization of health care, was

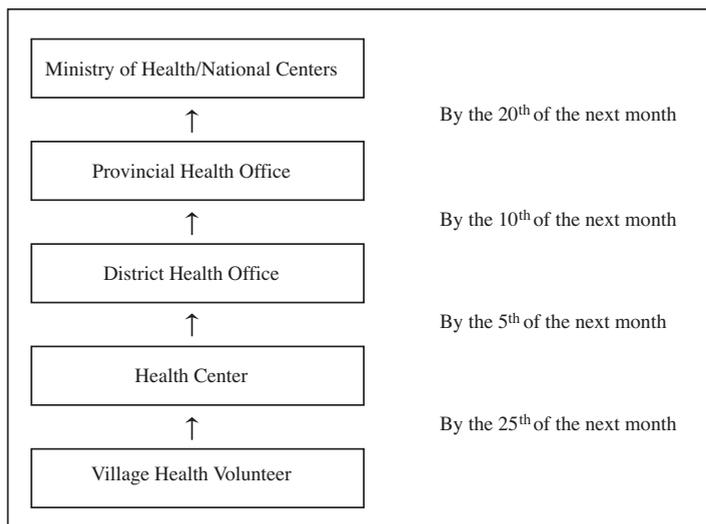


Fig 1-National monthly reporting system. Village health volunteers and health facilities are supposed to complete monthly reports to the upper-level health facilities by the indicated dates.

in place from March 2005 to December 2008. During that period, VHV received regular financial support (25,000KIP; nearly USD 3.5) for transportation every three months.

Of the 158 villages in the district, 131 villages are located within the catchment areas of the ten health centers. For this study, VHV, who resided in these 131 villages, were eligible and included in the study.

Data collection

Data were collected through structured interviews with VHV in November 2008. Trained interviewers visited the target villages, and invited the VHV of each village to an interview. Through this process we collected data of the frequency of monthly reporting during the prior three months (August to October), socio-demographic and economic characteristics, history of training, experiences as a VHV, the main job of a VHV, and satisfaction with the incentives of the VHV job. Data about distances between villages where VHV reside and the responsible health centers were collected from the Xepon District Health Office.

Data analysis

We conducted bivariate and multivariate analyses to assess factors associated with VHV completion of monthly reporting during the past three months. For analysis, responses regarding reporting were divided into "reported" (always or some months) and "not reported" (never). Although some VHV are responsible for reporting on more than one program, VHV who reported on at least one program were included in the "reported" category. Independent variables were age group (<30, 30-39, or ≥40), educational attainment (<3 years in primary school, 3-5 years in primary school, or ≥6 years

in primary and secondary school combined); household possession of a vehicle (no vehicle, bicycle only, motorbike with or without bicycle); the distance between the VHV village and the responsible health center (<5 km, 5-9 km, or ≥10 km); length of time being a VHV (<3 years, 3-5 years, or ≥6 years), number of training sessions attended (<3, 3-5, or ≥6), main type of job as a VHV (malaria, vital event surveillance, or other), and satisfaction with incentives (dissatisfied, neutral, or satisfied).

The chi-square test was used for bivariate analysis. For multivariate analysis, odds ratios (OR) and 95% confidence intervals (CI) of the outcome for each independent variable were estimated using logistic regression analysis. Trend association was assessed by assigning ordinal scores (1, 2, or 3) to increasing levels of independent variables. Variables adjusted for the multivariate model were age, educational attainment, and household possession of a vehicle. Statistical analysis was performed using SPSS 17.0 (SPSS, Chicago, IL). A *p*-value <0.05 was accepted as statistically significant.

Ethical clearance

This study was approved by the National Ethics Committee for Health Research, Ministry of Health, Lao PDR (No. 172/NECHR). Written and verbal consent was obtained from participating VHV.

RESULTS

Characteristics of VHV

Data were collected from 97 of the 131 target villages (Fig 2). In the remaining villages, interviewers could not conduct interviews either because the VHV was absent during the survey or because interviewers had difficulty in reaching the

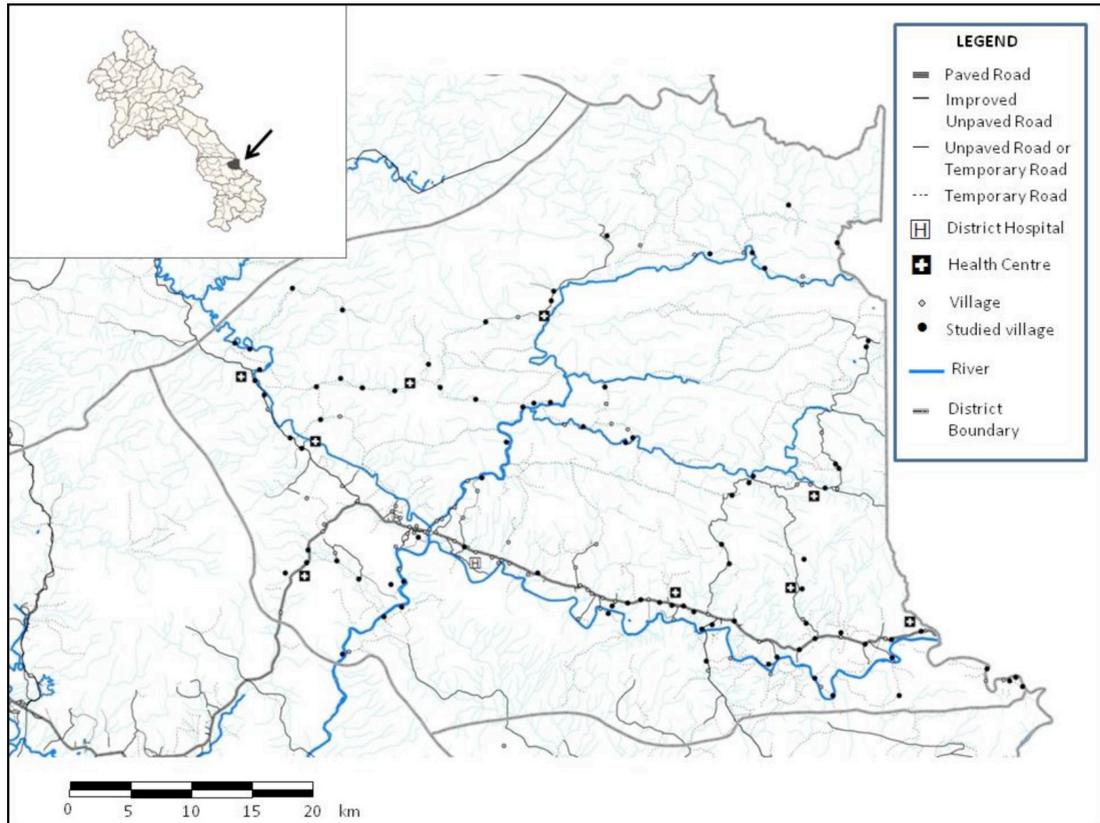


Fig 2—Map of the Xeponé District showing study villages. Black circles indicate the 97 villages where data were collected from the village health volunteers. Grey circles indicate the remaining villages in the district. Small map inserted the upper left shows Lao PDR; Xeponé district is highlighted in black.

villages. Of the 140 VHV interviewed, three new VHV, who attained their position within three months prior to the interview, were excluded from the study. Table 1 shows the characteristics of the 137 VHV. Almost all were males (92.7%). The median age was 32 years, with a range of 18 to 60 years. In most cases (78.8%), educational attainment was primary school level. Nearly all (97.1%) were farmers. The percentages of VHV who owned a bicycle, motorbike, or car/tractor were 22.6, 48.9, and 23.4%, respectively. The median length of time working as a VHV was 3

years, with a range of 0-15 years. The most commonly reported training session the VHV attended was “malaria prevention/case management” (78.8%), followed by “the use of the first aid kit” (54.0%) and “diarrhea management” (48.2%).

Reporting activities

Of 137 VHV, only 17 (12.4%) stated they reported to the responsible health center “every month” during the past three months; 37 (27.0%) reported they made reports “some months” late and 83 (60.6%) indicated “never” sending

Table 1
Characteristics of VHV (N=137).

Characteristics	N (%)
Sex (male)	127 (92.7)
Age (years)	32 (18-60) ^a
Educational attainment	
No formal education (0 years)	9 (6.6)
Primary (1-5 years)	108 (78.8)
Secondary (6-11 years)	17 (12.4)
Other	3 (2.2)
Occupation	
Farmer	133 (97.1)
Other	4 (2.9)
Possession of vehicles and assets	
Bicycle	31 (22.6)
Motorbike	67 (48.9)
Car or tractor	32 (23.4)
Mobile phone	29 (21.2)
Electricity supply (available)	44 (32.1)
Mobile phone signal (available)	68 (49.6)
VHV experience (years)	3 (0-15) ^a
Training received	
Malaria prevention/case management	108 (78.8)
First aid kit	74 (54.0)
Diarrhea management	66 (48.2)
Common cold management	47 (34.3)
Supporting activities for immunization	37 (27.0)
Respiratory infection management	32 (23.4)
Mother and child health	31 (22.6)
Other	43 (31.4)
Main VHV job	
Supporting activities for immunization	101 (73.7)
Vital event surveillance	58 (42.3)
Providing basic treatment using first aid kit	53 (38.7)
Health education	43 (31.4)
Malaria surveillance and case management	35 (25.5)
Other	4 (2.9)
Information about village where VHV works	
Mean number of households (SD)	46.9 (33.8)
Mean population (SD)	272.4 (219.5)

^aMedian (range); ^bMean (standard deviation)

reports (Table 2). Among those who made a monthly report at least once, 81.5% reported about "vital events", and nearly a quarter reported about a

"number of malaria cases" or "the use of the first aid kit". The majority (87.0%) reported by visiting their responsible health center.

Table 2
Reporting activities of VHV.

Details of reporting activities	<i>n</i> (%)
Frequency of reporting during the past 3 months (<i>n</i> =137)	
Every month	17 (12.4)
Some months	37 (27.0)
Never	83 (60.6)
Topics reported (<i>n</i> =54)	
Vital events	44 (81.5)
Number of malaria cases	14 (25.9)
First aid kit	14 (25.9)
Other	5 (9.3)
Means for reporting (<i>n</i> =54)	
Visit	47 (87.0)
Letter	4 (7.4)
Other	3 (5.6)

Table 3
The most important reasons for not reporting that were mentioned by VHV who did not report every month in the past three months (*N*=120).

Reasons	<i>n</i> (%)
No money to visit the responsible health center for reporting	31 (25.8)
No time to visit the responsible health center for reporting	24 (20.0)
The responsible health center is located too far away	14 (11.7)
No means of transportation	13 (10.8)
No time to prepare report form	10 (8.3)
It is not my responsibility	8 (6.7)
Other	20 (16.7)

Reasons for not reporting

Table 3 shows the most important reasons stated by VHW for not reporting. Most commonly mentioned reason was "no money to visit the responsible health center for reporting" (25.8%), followed by "no time to visit the responsible health center for reporting" (20.0%), and "the responsible health center is too far away" (11.7%).

Factors associated with monthly reporting

Table 4 shows bivariate associations

between independent variables and VHV's completion of monthly reporting during the past three months. The completion of monthly reporting was associated with educational attainment ($p=0.029$), distance between village and health center ($p=0.038$), number of training sessions attended ($p=0.014$), and main type of job for VHV ($p<0.001$).

With the multivariate analysis, these associations remained statistically significant (Table 5). Village health volunteers

Table 4
Bivariate analysis for associations of variables with VHV monthly reporting during the past three months.

Variables	VHVs total (n=137)	VHVs who reported at least once	p-value ^a
Age (years)			0.88
<30	51	19	
30-39	45	19	
≥40	41	16	
Educational attainment (years)			0.029
<3	48	12	
3-5	69	31	
≥6	20	11	
Possession of a vehicle			0.82
No	60	24	
Bicycle only	10	3	
Motorbike	67	27	
Distance between village and health center (km)			0.038
<5	39	19	
5-9	39	19	
≥10	59	16	
VHV experience (years)			0.24
<3	47	14	
3-7	62	27	
≥8	28	13	
Number of training sessions attended			0.014
<3	61	16	
3-5	45	21	
≥6	31	17	
Main job of VHV			<0.001
Malaria and/or vital event surveillance	79	42	
Other	58	12	
Satisfaction with incentives			0.79
Dissatisfied	14	5	
Neutral	29	13	
Satisfied	94	36	

^aChi-square test

living 10 km or further from the health center were less likely to make monthly reports than those living within 5 km (adjusted OR 0.37; 95% CI 0.15-0.89). Those with 3-5 years of primary school education (adjusted OR 2.83; 95% CI 1.21-6.65) or more than 5 years of total education

(adjusted OR 4.30; 95% CI 1.34-13.82) were more likely to make monthly reports than those with less than 3 years of education. Those who had attended 3-5 (adjusted OR 2.53; 95% CI 1.08-5.93) or more than 5 training sessions (adjusted OR 2.84; 95% CI 1.09-7.43) were more likely to

Table 5
Multivariate analysis for associations of variables with VHV monthly reporting during the past three months.

Variables	Adjusted odds ratio ^a	95% confidence interval	<i>p</i> for trend
Age (years)			
<30	1.00	-	0.75
30-39	1.21	0.51-2.88	
≥40	0.88	0.36-2.16	
Educational attainment (years)			
<3	1.00	-	0.008
3-5	2.83	1.21- 6.65	
≥6	4.30	1.34-13.82	
Possession of a vehicle			
No	1.00	-	
Bicycle only	0.45	0.10-2.06	
Motorbike	0.73	0.34-1.59	
Distance between village and health center (km)			
<5	1.00	-	0.021
5-9	0.87	0.34-2.24	
≥10	0.37	0.15-0.89	
VHV experience (years)			
<3	1.00	-	0.15
3-7	1.92	0.81-4.53	
≥8	2.09	0.72-6.11	
Number of training sessions attended			
<3	1.00	-	0.001
3-5	2.53	1.08- 5.93	
≥6	2.84	1.09- 7.43	
Main job of VHV			
Malaria and/or vital event surveillance	3.93	1.72-8.94	
Other	1.00	-	
Satisfaction with incentives			
Dissatisfied	1.00	-	
Neutral	1.76	0.43-7.22	
Satisfied	1.41	0.41-4.84	

^aAdjusted for age, educational attainment, and possession of vehicles

make monthly reports than those who attended fewer than 3 sessions. Additionally, a VHV whose main job was malaria/vital event surveillance was more likely to make a monthly report than those involved in another job (adjusted OR 3.93; 95% CI 1.72-8.94).

DISCUSSION

In this study of VHV from 97 villages in Lao PDR, more than 60% of the subjects stated they did not make any monthly reports during the past three months. Failure to report was associated

with longer distances between the VHV village and the responsible health center. It was also associated with a lower level of education and having attended fewer training sessions.

Our results show if the village of the VHV was located ≥ 10 km from the health center, they were less likely to comply with monthly reporting than those living < 5 km from a health center. Some VHV programs have addressed such distance constraints by offering vehicles and/or monetary support for transportation (Zachariah *et al*, 2006). However, such a strategy may not necessarily work in a hilly, mountainous region where road conditions are poor, particularly during the rainy season. Our results indicate, that although more than half of VHV owned a motorbike and were provided with financial support for travel, we found no association between vehicle ownership and reporting. Thus, it is important to seek other strategies for improving reporting.

We found a VHV with < 3 years of primary education was less likely to comply with monthly reporting than a VHV with more education. Poor literacy might make a VHV reluctant to complete a reporting form. The importance of the ability for lay health workers to read, write, and do simple mathematical calculations is established (UNICEF, 2005); however, in rural, tribal communities in Lao PDR, it can be difficult to find community people who meet the educational criteria and are willing to work as volunteers. One community-based surveillance system project in rural Cambodia overcame this literacy limitation using a tally sheet for recording and reporting (Oum *et al*, 2005). Another problem in Lao PDR is reporting forms varied among programs, making it difficult for a VHV to complete them.

Simplifying and standardizing reporting forms could potentially improve reporting by a VHV with lower education.

The number of training sessions attended by a VHV was associated with completion of monthly reporting. Our findings are similar to a study from Nepal (Thomas *et al*, 2007) where VHV expressed a desire to learn as a main motivation for volunteering. VHV training sessions should address the importance of reporting. A meeting at the place of reporting is a good opportunity to provide not only training, but regular, supportive supervision, which has been shown to be essential for sustaining motivation of lay health workers (WHO, 2005b).

In this study, analyzing the association between sex differences and the completion of monthly reporting was impossible because almost all VHV in the study were males. This male domination was also seen in other parts of Lao PDR (Mayxay *et al*, 2007). Female lay health workers are more common than male lay health workers in most South and Southeast Asian countries (WHO SEARO, 2007). Further study is needed to assess the pros and cons of predominantly male VHV in Lao PDR.

Thirty-nine point four percent of the VHV reported monthly at least once during the past 3 months, 53.2% VHV chiefly engaged in malaria and vital event surveillance reported monthly during the past 3 months, this is low compared to previous studies. In Ethiopia approximately 60% of voluntary malaria village workers completed weekly reports (Ghebreyesus *et al*, 2000). In India 91.6% of community women involved in community-surveillance completed weekly reports (Deepa *et al*, 2008). However, caution is needed when comparing our study findings with

these results: in the Ethiopian study, volunteers who did not submit reports were replaced by others. In the Indian study, the duration of the project was only four months.

Two reasons may explain the low reporting frequency observed in this study. First, this study was conducted at the beginning of the dry season, but the study asked about the previous 3 months, which was during the rainy season. In Lao PDR, the road conditions are poor and farmers are busier during the rainy season. Our results may underestimate reporting frequency during the dry season. Second, there is a possibility that in cases where multiple VHV reside in a village, one made the monthly reports on behalf of the others. This could result in underestimation of the actual reporting frequency. We also cannot rule out overestimating the reporting frequency. During the study period, the VHV received financial support for transportation from the Lao-Belgian Health Cooperation Project, which could lead to improved monthly reporting.

In regard to the consequences of poor monthly reporting, two things should be considered. First, regarding malaria surveillance, the VHV is requested to report the number of suspected and confirmed cases of malaria along with demographic information and reported data, which are summarized at the district level. Poor reporting by VHV may lead to underestimation of malaria incidence in the district, leading to inadequate funding for intervention programs at the national level. Second, event surveillance plays an important role in helping health staff identify pregnant women and promote adequate antenatal care services. Poor reporting may result in under utilization of antenatal care services by pregnant women in Lao PDR (Phathamavong *et al*, 2010).

As seen in Table 3, most of the reasons for not reporting were related to difficulties in traveling between the VHV villages and the responsible health facility. This is consistent with the result of logistic regression analysis that showed a longer distance was associated with lower frequency of reporting. During the study, 25,000 Kip was provided to each VHV for transportation; lack of money for travel was most frequently noted as a reason for not reporting. There is a need to assess how much it costs for a VHV to report monthly. The results of such an assessment could be used to adjust the compensation to VHV whose travel costs exceed the usual amount.

One possible option to overcome constraints related to travel to a responsible health center is to introduce oral reporting through mobile phones. This is a strategy that has seen increasing use in health interventions in developing countries (Lester and Karanja, 2008; Tomlinson *et al*, 2009). Nearly half the VHV reported a mobile phone signal was available in their villages, and signal coverage has increased rapidly in Lao PDR (Table 1). However, oral reporting by telephone cannot completely replace the current reporting system, because VHV must submit a written form and attend a meeting when visiting the responsible health center. Mobile phone reporting may be used as a complementary approach to the existing system in order to enhance reporting frequency, particularly during the rainy season.

In this study there were two major limitations. First, was the potential for recall bias, as we employed a self-reporting system. We were unable to validate these self-reports because most health centers did not record which VHV handed in their reports and the forms submitted

were often poorly kept. Second, since we employed a cross-sectional design for the survey, it is impossible to determine cause-effect relationships.

In conclusion, although most VHVs owned vehicles and were given financial support for travel, difficulty in traveling to the responsible health facility was reported as the main reason for not reporting. Lack of reporting was also independently associated with lower educational attainment and attendance at fewer training sessions. This study suggests overcoming travel constraints and providing trainings is necessary to enhance the reporting activities of VHV.

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REFERENCES

- Brieger WR, Kendall C. The Yoruba farm market as a communication channel in guinea worm disease surveillance. *Soc Sci Med* 1996; 42: 233-43.
- Cairncross S, Braide EI, Bugri SZ. Community participation in the eradication of guinea worm disease. *Acta Trop* 1996; 61: 121-36.
- Chen L, Evans T, Anand S, *et al.* Human resources for health: overcoming the crisis. *Lancet* 2004; 364: 1984-90.
- Corluka A, Walker DG, Lewin S, Glenton C, Scheel IB. Are vaccination programmes delivered by lay health workers cost-effective? A systematic review. *Hum Resour Health* 2009; 7: 81.
- Cutts FT, Waldman RJ, Zoffman HM. Surveillance for the Expanded Programme on Immunization. *Bull World Health Organ* 1993; 71: 633-9.
- Deepa TM, Venkata Rao E, Patil RR, Samuel R. Operational feasibility of establishing community reporting systems. *Natl Med J India* 2008; 21: 166-70.
- Ghebreyesus TA, Witten KH, Getachew A, *et al.* The community-based malaria control programme in Tigray, northern Ethiopia: A review of programme set-up, activities, outcomes and impact. *Parassitologia* 2000; 42: 255-90.
- Houweling TA, Ronsmans C, Campbell OM, Kunst AE. Huge poor-rich inequalities in maternity care: an international comparative study of maternity and child care in developing countries. *Bull World Health Organ* 2007; 85: 745-54.
- International Monetary Fund (IMF). Lao People's Democratic Republic: Poverty Reduction Strategy Paper December 2004, IMF Country Report No. 04/393. Washington DC: IMF, 2004. [Cited 2010 Jul 10]. Available from URL: <http://www.imf.org/external/pubs/ft/scr/2004/cr04393.pdf>
- Jorgensen P, Nambanya S, Gopinath D, *et al.* High heterogeneity in *Plasmodium falciparum* risk illustrates the need for detailed mapping to guide resource allocation: a new malaria risk map of the Lao People's Democratic Republic. *Malar J* 2010; 9: 59.
- Kironde S, Klaasen S. What motivates lay volunteers in high burden but resource-limited tuberculosis control programmes? Perceptions from the Northern Cape province, South Africa. *Int J Tuberc Lung Dis* 2002; 6: 104-10.
- Kyei-Faried S, Appiah-Denkyira E, Brenya D, Akuamo-Boateng A, Visser L. The role of community-based surveillance in health outcomes measurement. *Ghana Med J* 2006; 40: 26-30.

- Lester R, Karanja S. Mobile phones: exceptional tools for HIV/AIDS, health, and crisis management. *Lancet Infect Dis* 2008; 8: 738-9.
- Lewin S, Munabi-Babigumira S, Glenton C, *et al.* Lay health workers in primary and community health care for maternal and child health and the management of infectious diseases. *Cochrane Database Syst Rev* 2010; 3: CD004015.
- Mayxay M, Pongvongsa T, Phompida S, Phetsouvanh R, White NJ, Newton PN. Diagnosis and management of malaria by rural community health providers in the Lao People's Democratic Republic (Laos). *Trop Med Int Health* 2007; 12: 540-6.
- Oum S, Chandramohan D, Cairncross S. Community-based surveillance: a pilot study from rural Cambodia. *Trop Med Int Health* 2005; 10: 689-97.
- Phathamavong O, Ali M, Souksavat S, Chounramany K, Kuroiwa C. Antenatal care among ethnic populations in Louang Namtha Province, Lao PDR. *Southeast Asian J Trop Med Public Health* 2010; 41: 705-16.
- Thomas C, Newell JN, Baral SC, Byanjankar L. The contribution of volunteers to a successful community-orientated tuberculosis treatment centre in an urban setting in Nepal: a qualitative assessment of volunteers' roles and motivations. *J Health Organ Manag* 2007; 21: 554-72.
- Tomlinson M, Solomon W, Singh Y, *et al.* The use of mobile phones as a data collection tool: a report from a household survey in South Africa. *BMC Med Inform Decis Mak* 2009; 9: 51.
- UNICEF. What works for children in South Asia: community health workers. Kathmandu: United Nations Children's Fund Regional Office for South Asia, 2005.
- World Health Organization (WHO). Acute flaccid paralysis surveillance: a global platform for detecting and responding to priority infectious diseases. *Wkly Epidemiol Rec* 2004; 79: 425-32.
- World Health Organization (WHO). Asia and Pacific strategies for emerging diseases. Geneva: WHO, 2005a.
- World Health Organization (WHO). Evaluation of the dracunculiasis surveillance system in 4 districts in Ghana. *Wkly Epidemiol Rec* 2005b; 80: 270-6.
- World Health Organization Regional Office for South-East Asia (WHO SEARO). Regional strategy for integrated disease surveillance. Report of an intercountry consultation, Yangon, Myanmar, 21-24 August 2002. New Delhi: WHO SEARO, 2003.
- World Health Organization Regional Office for the South-East Asia (WHO SEARO). Role of village health volunteers in avian influenza surveillance in Thailand. New Delhi: WHO SEARO, 2007.
- Zachariah R, Teck R, Buhendwa L, *et al.* How can the community contribute in the fight against HIV/AIDS and tuberculosis? An example from a rural district in Malawi. *Trans R Soc Trop Med Hyg* 2006; 100: 167-75.