HEALTH SEEKING BEHAVIOR ASSESSMENTS FOR RESPIRATORY ILLNESS IN THE LAO PEOPLE'S DEMOCRATIC REPUBLIC (LAOS)

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SUMMARY

Respiratory illness (RI) remains a public health problem in Laos, but little is known about its burden and people's health seeking behavior. Among 1,751 households (9,114 people) studied, 3.5% (317/9,114) had RI (fever, cough, and sore-throat) 30 days before the survey [6.3% in rural and 2.3% in peri-urban areas (P<0.001)]. Of all sick persons, 77% sought treatment [94% in peri-urban and 48% in rural areas (P<0.001)] and 31.5% of them self-medicated [55.5% in peri-urban and 29% in rural areas (P<0.001)]. Sick people in peri-urban areas preferred to chose private clinics and pharmacies as their first treatment option while in rural areas they frequently consulted with village health volunteers and visited the health centre as their first choice. Distance, costs of care, and service availability are the most important determinants of seeking care. The differences in the RI burden and health seeking behavior between the two areas of Laos are probably due to the difference in health service availability and socio-economic status

Keywords: Respiratory illness, health seeking behaviour, Laos

1. Introduction

Respiratory illness is a leading cause of death and disease burden worldwide (Bryce, 2005) and about 95% of the deaths occurred in developing countries (Wardlaw *et al*., 2006). In the Lao PDR (Laos), it is an important cause of morbidity and mortality, particularly among children, but very little is known about its burden. The latest national health survey in 2000 demonstrated that about 1% of under-five children had acute respiratory infection in the past two weeks before the survey (NSC, 2001). The respiratory illness surveillance system had not existed in Laos until recently but this is

only facility-based, with disease reports originating from hospitals and health centers. Therefore, the capacity of this surveillance system to reflect actual disease burden in the community may be limited.

Because health seeking behaviors and health care utilization practices vary widely from community to community, health utilization assessments can assist in identifying the extent to which facility-based data reflects actual burden of disease in the community. In addition, understanding community patterns of health seeking behavior and who in the community are the first points-of-care for villagers within the context of respiratory illness and reporting would improve public health practice in the community. The survey was conducted to provide better direction for Lao public health program and policy planners to improve public health practice, surveillance systems, and prevention strategies and generate important information to help evaluate ongoing Lao Government health activities.

2. Methods

2.1. Study sites

The study was conducted in peri-urban (Vientiane Capital and Vientiane Province) and rural (Sayabouly and Sekong Provinces) areas. These localities were chosen because they cover the range of peri-urban and rural areas which are sites for the development and piloting of village-based mechanisms to promote human and animal avian influenza surveillance and response, and had previous avian influenza or influenza-like outbreaks. Vientiane Capital and Vientiane Province are located in central Laos with 9 and 13 districts, respectively comprising of both urban and peri-urban areas and one peri-urban district from each was studied. Sayabouly Province is located in northern Laos on the Lao-Thai border with 10 districts which comprise of largely rural areas, with some being very remote and poor. Sekong Province is located in southern Laos on the Vietnam border with four districts comprising of rural areas and multiple ethnic minority groups (NSC, 2006). One rural district from each of these provinces was selected for the study.

2.2. Sampling procedure and survey

The provinces and districts were purposively sampled as mentioned above while the villages were randomly selected from the village list of each district. Three villages were randomly selected from each district and all households in the village were studied.

All members of the households were eligible for the survey. An individual was considered a member of a household if he/she had slept within that compound for at least six of the preceding twelve months. Household members who died within 30 days before the survey were also included as they might have had an episode of respiratory illness.

Following a verbal consent, the recognized head of the household and older caregivers (at least 15 years of age) served as proxies for non-adult household members and for adult household members not present or not able to answer the questionnaire were interviewed. A designed structured questionnaire comprising of socio-demographic information, household members' respiratory illness and health seeking behavior, and the household and animal care practice was used to collect information.

Sixteen focus group discussions (FGDs) were conducted (eight in each urban and rural area). The participants in the qualitative study were recruited from those who took part in the questionnaire interviews. Eligible participants were selected purposively based on their experiences of having at least one of their family members had ARI symptoms at least during last month and their willingness to participate. There were seven to eleven participants per FGD with varying occupations, ages and educational backgrounds. Each FGD lasted approximately 1-1.5 hours and was tape-recorded. Translators were used to conduct FGDs in the rural areas with some ethnic minority women. The tapes and notes of the FGDs were transcribed in Lao and then translated into English.

Definition of respiratory illness

The definition for respiratory illness was derived from the WHO case definition for influenza (WHO) and defined as new fever with sore throat and/or a cough in the absence of other diagnoses during the 30 days before the survey.

2.3. Sample size determination

Assuming that 2.2% of all individuals would have had an episode of RI within 30 days preceding the assessment (Clague *et al*., 2006) with an alpha of 0.05 and estimated precision of 1%, the sample size of 865 households was needed. But the calculated sample size was adjusted for a design effect of 2.0 to account for correlations within clusters; therefore a total of 1,751 households should be included.

2.4. Data analysis

Quantitative data were analyzed using Stata v9 (StataCorp, College Station, TX, USA). Comparisons between two groups were made using *Chi-square, Fisher's Exact, Student-t, and Mann-Whitney U* tests as appropriate. Logistic regression analysis was performed to identify determinants of seeking different types of health care.

Qualitative data were analyzed using a participatory process in parallel with software-based analysis using MAXQED. Transcripts were read and reread and open codes developed to capture emerging themes in the data. Then the key themes and concepts from the English transcripts were identified. The themes were systematically catalogued across all focus groups. The description of how the themes were described and explained by the FGD participants was then made. Finally, the themes were

compared across major subgroups of participants.

3. Results

Of all 1,872 households and 9,703 villagers in the target study sites, 1,751 (93.5%) and 9,114 (94%), respectively were included in the study. The reasons for non-recruitment were that the household members were not in the villages during the survey or moved away.

3.1. Socio-economic-demographic characteristics of study households and population

Of all study population 50% were males, 72% were from peri-urban area, and 66% were Lao Leum (lowland Lao people). The median (IQR) age of all study villagers was 23 (11-39) years and 34% of them were children ≤ 15 years. The median (IQR) highest schooling years in the households was 10 (5-11) and 62% were classified as poor. The overall mean (95%CI) number of bed-rooms in the households was 2.2 (2.1-2.3) and 98% of all households used a wood/charcoal stove for cooking. The mean (95%CI) number of household members who smoked inside the houses was 1.5 (1.4-1.6).

3.2. Respiratory illness burden and disease severity

The proportions of persons and households with respiratory illnesses within 30 days before interview were 3.5% (317/9,114) and 15% (264/1,751), respectively. Of 317 ill persons (53% males), 156 (49%) were from peri-urban areas. The overall median (IQR) age of ill people was 17 (5 – 40) years with 49% of them were children ≤ 15 years and 14% were under five children. Among those who were reported to be ill, 219 (69%); 77 (24%); and 21 (7%) were classified as mild, moderate, and severe, respectively and 8 (3.5%) were admitted to hospital with a median (IQR) length of stay in hospital of 4.0 (2.5-4.5) days. The overall median (IQR) duration of the illness was 4 (3-7) days. Fever, cough, sore-throat, runny nose, headache, muscle ache, difficult or fast breathing, chill, wheezing, and nausea or vomiting were present in 100%, 90%, 83%, 70%, 65%, 58%, 42%, 30%, 21%, and 18.5%, respectively.

The disease severity was not significantly different between children and adults (P=0.35). Except for muscle pain, which was significantly more frequent in adults (66%) compared to in children (49%) (P=0.005), other symptoms and signs were similar between the groups. The median (IQR) days of illness was also statistically longer in adults than in children [5 (3-7) vs 4 (3-7), P=0.02].

Of 229 adults with respiratory illness, 143 (62%) were absent from their daily work during their illness and 65% of their family members were also absent from their daily activities to look after them.

3.3. Factors associated with respiratory disease burden

The proportion of the households using charcoal/firewood stoves for cooking was significantly higher among those with RI persons (77%) compared to 62% in the households without RI persons (*P<0.001*). The frequency of the households situated in very smoky environments was also statistically higher in the households with RI patients than those without [43% vs. 25% (*P<0.001*)]. The percentages of the households with sick and dead animals, and with animals slaughtered within 30 days before the interview were significantly higher in the households with RI patients than those without [14% vs. 7% (*P<0.001*), 13% vs. 7% (*P<0.001*), and 74% vs. 65% (*P=0.001*), respectively].

In a univariate analysis, the villagers who lived in peri-urban areas, Lao Leum ethnic group, literacy of the family heads, and higher socioeconomic status were significantly associated with seeking care for respiratory illness (*P<0.001* for all). However, in a multi-variate analysis, only the peri-urban residents were independently correlated with seeking care for RI illness (*P<0.001*). Villagers' sex, age, and disease severity were not significantly associated with RI seeking care.

3.4. Treatment seeking behavior and preference

Of all villagers with respiratory illness, 225 (71%) sought treatment. Among those who did not seek treatment, 38% thought their illnesses were just mild and would be self-limited, and 33% of them said they were not able to afford the treatment and transportation costs. More than half (59%) of the villagers who did not seek care said they just rested at home, while 31.5% of them self-medicated at home.

The first treatment places/health providers chosen by these people were private clinics (29%), health centers (19.5%), pharmacies (15%), village health volunteers (15%), district hospitals (5%), central hospitals (4%), provincial hospitals (3.5%), and mobile clinics (1.3%). A small proportion (1.4%) of these people went to see traditional or spiritual healer as the first choice for their illnesses.

The most frequent reasons for selecting these places/health providers as the first choice were that it was close to their house (70%); they had good experience at those facilities/health providers (36%); it was cheap (29%); it provided the appropriate service for their illness (25%); offers a good quality of care (19%), and does not require much waiting time at the facility (19%).

The median (IQR) traveling time, regardless of any transportation mode, from their homes to health facilities was 5 (4.5-20) minutes. The most common modes of transport used by ill people to get to the health facilities were walking (44.8%) and motorcycle (43.9%). Eighty-two percent (260/317) of the people who sought treatment were prescribed with medication and able to afford the treatment while 16% of them

could not afford the medicines prescribed by the health providers. The median (IQR) cost of care during their illnesses was LAK 20,000 (10,000-60,000).

Comparison of treatment seeking between peri-urban and rural areas

Less sick people sought care in rural (48%) compared to peri-urban (94%) areas (*P*<0.001) as they tended to rest at home more often than those in the urban-areas (63% vs. 22%, *P*=0.04). There were no statistically significant differences in the reasons for not seeking for care between the sick people who lived in rural and peri-urban areas.

Sick people who lived in peri-urban areas commonly chose private clinics (44.9%) or pharmacies (22.5%) as the first places of care while those who lived in rural areas frequently chose to consult with the village health volunteer (42.3%) and visit the health centre (41.1%) as their first choice (*P*<0.001).

The reasons for choosing a particular facility as the first point of treatment were as quality of care (26% vs. 6%, *P*<0.001), having good previous experience at the facilities (43.5% vs. 5%, *P*=0.018), familiarity with heath care providers (16% vs. 5%, *P*=0.018), and short waiting times required in the facilities (28% vs. 1%, *P*<0.001) were significantly higher in the peri-urban than in the rural areas. More sick people in rural areas walked to the health facility than those in the peri-urban areas (94% vs. 17%, *P*<0.001), but more villagers in the peri-urban area used a motorcycle as their mode of transport when compared with those who lived rural areas (68% vs. 2.4%, *P*<0.001). After seeking care, all patients (100%) in peri-urban areas received medication while only 95% of the patients in rural area did (*P*=0.017).

The proportion of sick persons who could not afford treatment was also statistically higher in rural (37%) compared to peri-urban areas (4%) (*P*<0.001) and the median (IQR) cost of medication (LAK) paid by the patients was significantly higher in the peri-urban [30,000 (15,000-80,000)] than in the rural areas [10,000 (5,000-30,000)] (*P*<0.001). The percentage of sick persons who smoked was significantly higher in the rural compared to the peri-urban areas (50% vs. 6%, *P*<0.001).

Qualitative data

Sixteen focus group discussions (FGDs) were conducted (eight in each urban and rural area). The median (range) age (years) of the participants was 36.5 (19 - 60) and 33 (18 - 46) for women in the urban and rural areas, respectively; and 37 (18 - 60) and 30 (18 - 58) for men in the urban and rural areas, respectively. Most of the participants were rice farmers and housewives both in peri-urban and rural areas.

The order of seeking care and different factors in influencing sick persons as they progress along a continuum of care was mapped (Figure 5). In general, all participants first attempted to self-treat any illness at home. Some experiences of self-treatment such as drinking hot water, taking a sponge bath, self-medication; especially

with medical herbs, were documented. More rural participants cited self-treatment than the peri-urban participants. The reasons for self-treatment were convenience, low cost and the perception the disease was mild. As participants from FGDs mentioned as following:

"If there is someone in the household got sick. If they got sick and there were not severe, they went to buy medicine by themselves. If the illness is severe, they asked someone to buy medicines for them." (Female, age 18-30 year old; Xayabouli\Xaya)

The decision to move from one provider to another (or from self-treatment to seeking some form of treatment) was commonly influenced by illness severity and treatment failure such as no improvement in the patient's condition, and a lack of medicines. Rural areas are considered by FGD participants as being characterized by constrained access, in terms of infrastructure and distance, together with higher direct and indirect costs for seeking care. Because of these barriers, they state they will seek formal health care (e.g. health centre, hospitals) only when very ill, unlike their counterparts in urban areas who seek informal care (e.g. pharmacy) even in cases of very mild illness. Given the higher costs and constrained access, participants in rural areas, care-seekers tended to revert to whatever providers are available to treat illness. These participants often used village health volunteers, but also turned to illegal physicians (unregistered providers of medicine and health advice), spirit healers, traveling traders, or self-treatment with herbal medicines in equal numbers. Other than specific cultural beliefs about spirit healers held by a small number of participants, informal health options available in rural areas are *not preferred*, but are used as the only option available because all other options are too expensive and too far away. When people in remote, rural areas say they have "sought treatment" the reality of the type and quality of treatment is quite different from that of those in peri-urban or less remote settings. The availability of service providers in rural areas was also much more constrained. VHVs and health centers would sometimes not have the medicines needed for illness; further, the equipment and acceptability of care at each place was considered subpar by some participants.

Cost, distance, and service availability were the primary factors, acting as barriers to participants in rural areas accessing formal health services; while cost, service availability and trust were the important factors to accessing different options of health care providers and not as barriers. Rural participants were less likely to be able to seek any kind of formal health care for illness. Clearly those in urban areas have many more options to choose from, and thus have more ways of comparing different options and choosing where to seek care. They are very likely to receive some form of treatment than those in rural areas. While the central hospital is considered very expensive, most people in VTE municipality would still seek care there if they had a severe illness. Further, when cost is relatively the same for two or more options, those in urban areas

look to quality and the range of services offered to decide which to choose. There are more options and alternatives to care in the urban areas, so if one option (central hospital) is too expensive, there are many other options to choose from – i.e. private clinics, provincial hospitals, and district hospital (especially if they have insurance card). As participants from focus group discussions mentioned:

"Going to a district hospital is more complicated with many steps. I do not like to go there. Seeing doctors at the private clinic is better because it is the same doctor as in the district hospital while cost is 25,000 LAK." (Female, 18-30 years, VTE capital)

4. Discussion

To the best of our knowledge, this is the first study on the burden of and the health care seeking behavior for respiratory illness conducted in Laos. The overall proportion of the persons with respiratory illness within 30 days before the survey was 3.5%, half of them were children ≤ 15 years, and 14% were the children under five. This figure was considered to be considerably high and might be much higher than this if the survey had been carried during the winter. The Lao national health survey in the year 2000 revealed that ~ 1% of the children under-five had acute respiratory infection in the past two weeks before the survey (National Health Survey, 2000). The overall frequency of the people with respiratory illness in the present study was higher than the prevalence of influenza in rural Thailand (2.2%) in the 30 days preceding the assessment (Clague *et al.*, 2006). A study in rural Uganda demonstrated that of the 323 Uganda children aged < 2 years, 37% had upper respiratory tract infection within 2 weeks before the survey which was much higher than that found in our study (Mbonye, 2003). The prevalence of acute respiratory infection in the 2 weeks before the study among Saudi Arabia children aged < 2 years was 24% (Saeed and Bani, 2000). However, it is very difficult to compare the prevalence of respiratory illness between one to another study since the definition of the disease used may differ and the study settings are also different.

The proportion of persons with respiratory illnesses in the present survey was significantly higher in the rural than in the peri-urban areas, probably due to the poorer socioeconomic; environmental; and hygienic conditions in the rural areas. The higher prevalence of respiratory illnesses observed among the rural, disadvantage groups such as poor (compared to non poor), ethnic minorities of poor socioeconomic status (compared to better socio-economic condition), and children under five years old (compared to adults) reiterates the relationship between poverty and morbidity which are documented in previous literature (Bloom *et al.*, 2004; Sen 2003; Wagstaff 2002; Lahelma and Arber, 1994).

In this study, the frequency of the persons with respiratory illness who sought treatment was ~ 71% which was also considered to be high. The Lao national health

survey in 2000 demonstrated that the proportion of the people who suffered from any illnesses in the two weeks preceding the survey and sought care was only 47% (NSC, 2001). Whether sick people seek care depends on many factors such as disease severity, distance from home to health care facilities, availability of care service, and affordability. Severity of the disease could not explain the high percentage of seeking care in the present study because only 6% of sick persons were classified as having severe disease and the proportion of the ill people who sought for care was very similar among those who had mild, moderate, and severe disease (73.5%, 65%, and 67%, respectively). The high rate of seeking care of the people in the present study might be due to the care service availability in their own villages with a very short distance from their homes. However, the care service available in the villages was only very basic health care provided with low cost of service (e.g. ~ 2 US$ for mild and ~ 8 US$ for severe cases). In the national health survey in 2000, the reasons for not seeking care by the villagers were mild illness, lack of transport, long distance, and cost (NSC, 2001). In our study, the reason for not seeking care due to inability to afford treatment and transportation costs was about 1/3 while another 1/3 thought that their illnesses were mild. The reasons for not seeking care of sick persons in our study are totally different from those mentioned in a study in the Dominican Republic where the most frequent reasons cited by the respondents for not utilizing health services were distrust of the clinic staff, shortage of medicines, and dispersion of the rural population (Ugalde, 1984).

The frequency of sick persons who sought for treatment in our study was quite similar to that (65-66%) found in Sri Lanka and Nigerian children who had symptoms suggestive of malaria, acute respiratory infections, diarrhea, and measles and sought for care (Amarasiri de Silva *et al*., 2001; Adegboyega *et al*., 2005). Three quarter of children under five with acute lower respiratory tract infections in rural Bangladesh sought treatment (Zaman *et al*., 1997). In the Dominican Republic, approximately 60% of the children had respiratory infection in the two weeks preceding the survey sought care from health care providers (Thind and Andersen, 2003). In rural Uganda, only 35% of the mothers seeking care for their children with upper respiratory infection and children were taken to health units only when they developed life-threatening symptoms (Mbonye, 2003). This was due to the high costs of care, long distances to health units, poor attitude of health workers, lack of drugs at health units, and limited involvement of fathers in care of the children.

Our explorative study results indicated the important role of self-treatment for respiratory illnesses, particularly in the rural areas where the accessibility and availability of health facilities, and affordability are limited. The reasons for self-treatment in the present study were convenience (close distance between home and health facility), low cost (affordability), and the diseases were mild (severity). The options of self-treatment as the first choice were usually influenced by the perception of

severity. The FGDs participants in both peri-urban and rural areas in the current study reported to choose self-medication and self-treatment as first line treatment in cases of mild respiratory illnesses. The previous studies also found that self-treatment was quite common when the severity of illness was perceived to be low (Stoller & Forster, 1992, Stevenson *et al.*, 2003; Tuan *et al.*, 2005). In Laos, approximately 1/3 to 1/2 of the people were self-medicated when they became sick (Vinar, 1994; NIOPH, 1999; NSC, 2001) – the findings that were consistent with that of our present survey quantitative and qualitative data. In Guatemala, about 2/3 of the children with diarrhea and respiratory illnesses were self-treated by their guardians or relatives and only 1/3 of illnesses were treated by health providers such pharmacists, doctors, and personnel at health posts and centers (Heuveline and Goldman, 2000).

A study in the Dominican Republic demonstrated that the choice of health service utilization among children aged less than five years with respiratory illness was determined by location (proximity) and cost (Thind and Andersen, 2003). Our quantitative data demonstrated the difference in the health care seeking behavior between peri-urban and rural areas. If there was no improvement following self-treatment, sick people who lived in peri-urban areas preferred to choose private clinic and pharmacy as their first treatment option while those in rural areas frequently consulted with the village health volunteer and visited the health centre as their first choice. This difference may be explained by the difference in the availability and proximity of those health care facilities between peri-urban and rural areas. In peri-urban areas, private clinics and pharmacies are more readily available and nearby when compared to rural areas. In contrast, nearly no private clinics or pharmacies are available in the rural areas, except for the health center and village health volunteer. It is obvious that Lao villagers prefer to use the closest health care facilities because it is convenient for them and they do not have to pay for travel cost to go to facilities further away. The data from the national health survey in 2000 also showed that more people in the peri-urban and urban areas went to a pharmacy when they were ill compared to those in rural areas, but private clinics were not mentioned as a place where sick persons visited (NSC, 2001). A study in western Nepal revealed that almost half of the childhood illness episodes were treated by pharmacists and in 15% of episodes, medicines were purchased from the pharmacies without consultation (Sreeramareddy *et al.*, 2006) because many patients cannot afford to perform the tests, doctors recommended and therefore they consulted the nearest pharmacist.

The reasons for choosing those places/health providers as the first choice were similar between peri-urban and rural areas (proximity, familiarity, and cost) but the difference was that sick persons in peri-urban areas tended to think about quality of care more than those in rural areas. Although client-perceived quality of services and confidence in the health provider affect the health service utilization (Duong, Binns &

Lee, 2004), the people in rural Laos usually do not have many choices of health care facilities in their localities. In rural and remote areas of Laos, apart from health centers and village health volunteers, the alternative and closest places are the district or provincial hospital, which are usually far away from the people's villages and sometimes it takes ~ 2-3 days by walking from their homes to such facilities as clearly shown in our current survey. Therefore, in rural and remote areas of Laos, not only is there a limited choices of local health care facilities, but the modern or high quality of services is also a big challenge for the rural villagers to access.

Previous studies suggested that illness severity is an important determinant of treatment seeking behavior (Rosenstock and Becker, 1998; Yoder and Hornik, 1996). In western Nepal, the mothers were more likely to seek care for their sick children when they perceived the illness as "serious" (Sreeramareddy *et al*., 2006) and in Bangladesh, the mothers' decision to seek medical care for the children having acute respiratory infection also depended on their understanding of the disease severity (Rashid *et al*., 2001). In our study, the decision to move from one health provider to another (or from self-treatment to seeking some form of treatment) was also influenced by illness severity and treatment failure such as no improvement and lack of medicines. The sick persons did not usually go back to the same health care provider or facility where they first went, but to other places. In peri-urban areas, people would seek further care in the central hospitals where better quality of service and modern technology are available, for example, where there are more experienced doctors and blood tests available. In rural areas, people would like to seek further treatment in the district or provincial hospital, but this is constrained by distance and cost. Therefore, many of them just waited until illegal healers came to sell drugs in their villages, some of them would alternatively see spiritual healers, and even some reported that they just waited for death in the case of serious illness.

In the present study, a smoky environment was significantly correlated with respiratory illness – this finding is consistent with that found in many previous studies (Pérez-Padilla *et al*., 1999; Peters *et al*., 1999; Riojas-Rodríguez *et al*., 2001; Rivas *et al*., 2008). This association was supported by the higher prevalence of respiratory illness in the rural areas where the frequency of households with charcoal/firewood stove in the houses was also very high. In rural Laos, particularly among ethnic groups, most of the houses have this type of stove in the centre of the houses and a fire is usually made for the whole day and used for cooking, providing warmth (during the winter), and preventing insects flying into the house including mosquito. This can cause the environment in the house very smoky and hence may contribute to the high prevalence of respiratory illness.

The predictors of care seeking behavior for childhood having any illnesses (not only respiratory infection) in western Nepal were total family income, number of

symptoms, mothers' education, and perceived severity of illness (Sreeramareddy *et al*., 2006). In our present survey, in a univariate analysis, the villagers who lived in peri-urban area, Lao leum ethnic group, literacy of the family heads, and wealthier status were significantly associated with seeking care for respiratory illness. However, in a multi-variate analysis only the peri-urban residents were independently correlated with seeking care for RI illness. Indeed, the people living in peri-urban areas have a significant better economy and education; therefore they tend to seek for care much more than those in rural areas – the reasons that were consistent with the findings in Sreeramareddy *et al*., in western Nepal.

This study was conducted shortly after a big avian influenza outbreak in Laos. Therefore, one of the objectives of the survey was also to assess the household animal-to-animal and animal-to-human interface in the target villages in order to understand to which extent this interface may contribute to human respiratory illness in the country. Interestingly, the proportion of the households who reported that their livestock had been sick and dead within the 30 days before the interview was considerably high. In contrast, the number of the households with sick animals that had separated their sick animals from others and declared their animal deaths was still quite low. The study demonstrated that the dead animals were incorrectly disposed of by the villagers, and some of them even butchered and ate the carcasses. These findings suggested a significant high risk of the household animal-to-animal and animal-to-human interface in the study locations, and therefore, the practical and appropriate measures to alleviate these risks are urgently required in order to prevent further disaster from the avian influenza epidemic in the country.

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