IMPACTS OF TRAINING OF VILLAGE HEALTH VOLUNTEERS IN REDUCTION OF MORBIDITY FROM ACUTE RESPIRATORY INFECTIONS IN CHILDHOOD IN SOUTHERN THAILAND

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Abstract. In 1990, the Ministry of Public Health of Thailand started a five-year education program on management of cases with acute respiratory infection (ARI). The objective of this study was to test whether such a program could reduce the average number of sick days of the target children.

30 villages in the study district were randomly allocated into 15 study and 15 control villages. A 2-day training workshop for village health volunteers from the study villages was conducted. The cohort of children age below 5 years in the two areas were followed-up for 19 week in the peak season of the disease.

Among the 664 and 649 target children with 67,083 and 67,984 child-days observed in the study and the control villages, 71 and 41 children, respectively, were free from any episode. The preventive odds ratio of treatment adjusted for age and village effects = 0.88, 95% (CI 0.4-1.95). The median of the average sick periods in the individuals were 27 and 34 days, respectively. After adjusting for age, episodes/month and locality, the ratio of average sick days between children in the study and control villages was 0.89 (95% CI 0.76-1.05) or 11% shorter duration without statistical significance. The adjusted odds ratios of visiting the health center, private clinics, the community hospital and provincial hospital were 0.95 (95% CI 0.69-1.25), 1.43 (95% CI 0.98-2.11), 2.01 (95% CI 1.06-3.82) and 4.71 (95% CI 1.50-14.8), respectively.

The training program thus had rather little impact on morbidity of the disease but tended to promote utillization of higher level of health services by the affected children.

INTRODUCTION

Acute respiratory infection (ARI) is one of the most important health problems of children (Leowski, 1986). In Thailand, health statistics show that ARI is the most common cause of death among children (Ministry of Public Health, 1995). In the early 1990s, Thailand spent approximately 4 million US dollars in 5 years, educating pediatricians, doctors in district hospitals, health workers in health centers and village health volunteers with the aim of improving case detection and case management. The current study aimed to assess the impact of the training program on change of health care utilization and change of average sick days among the affected children. There have been a number of intervention studies looking at the impact on mortality of target children in developing countries (Mtango and Neuvians, 1986; Datta *et al*, 1987; Pandey *et al*, 1991; Bang *et al*, 1990). The mortality rates in Thailand are relatively low and morbidity was used to evaluate the program instead.

MATERIALS AND METHODS

Study area, population and study design

The study was conducted from January to May 1991 in Nong Chik District, Pattani Province. The community has a low socioeconomic status. The total population is approximately 50,000. The district is administratively divided into 12 Tumbons (or subdistricts) comprising altogether 67 villages. The expected number of 0-5 year old population was between 4,000 and 5,000. There is one 10-bed hospital with one doctor and 13 health centers, each with two or more health workers (a midwife and a sanitarian). The 200-bed provincial hospital is 15 km from the community. Buses from all villages to these hospitals were available at least once a day.

Thirty villages from the district were randomly chosen for this study. Fifteen of these were randomly allocated as the study area where the education package was provided. The other 15 served as control villages.

Education program

The curriculum and media for training were developed and distributed by the Ministry of Public Health in Bangkok. The contents were modified from those recommended by WHO, to suit the local situation. The learning objectives for the village health volunteers were to be able to detect serious ARI (defined as a respiratory rate of higher than 50 per minute, or with a convulsion, or refusal to eat and drink), to give initial care by sponging and to advise referral of cases to a health center where antibiotics (either ampicillin or cotrimoxazole) would be given and referal to the hospital is made if necessary.

The health workers who had been trained by pediatricians at the regional hospital collectively conducted a 2-day training workshop for the study villages. Approximately 10 health volunteers from each of the study villages participated in the workshop. The methods of training included a video program, lecture, demonstration and simulation. The medium of teaching was a combination of Thai and local Malay dialect.

Data collection

Baseline data regarding ARI in the random samples of both populations were collected prior to the intervention. Two weeks after the training workshop, all the children under 5 years old in the 30 villages were visited by a team of home visitors once a week for a maximum of 19 weeks. The following variables were obtained at each visit: an event of ARI (whether the child had cough, runny nose), severity of the attack (presence of fever, refusing food and drink, retraction of intercostal space) and health care utilization in the past week.

In adition to the field visit, data from the surveillance system for communicable diseases, which was based on clinical diagnosis at the hospital and health centers, were used to identify children who were diagnosed as having pneumonitis.

Data analysis

Statistical analysis included descriptive statistics of the baseline information and non-parametric statistics for crude comparison of episodes per month and average duration of illness of the affected individuals between the two groups. For multivariate analysis to compare the incidence rates, which were heavily skewed, logistic regression (Breslow and Day, 1980) with the dichotomous outcome of zero versus any episode per month was used. The duration of illness of affected cases was transformed to a logarithmic scale in order to approximate a normal distribution. Multiple linear regression was used to test the effect of training on duration of illness with adjustment for other confounders. Since children in the same village might have a common infective agent, and thus the probability of getting infection and the duration of illness might be correlated within the same village, the generalized estimating equation method (Zeger and Liang, 1986) was carried out using the SPIDA package (Gebski *et al*, 1992) to adjust for this correlation wherever possible. Finally, logistic regression was used to test the effect of training on health care usage.

RESULTS

Baseline data

Baseline characteristics of subjects in villages with trained and untrained volunteers are shown in Table 1. Both groups of villages were well balanced in size of target population, sex distribution and person-time of observation. Children in the treatment group had a relatively higher proportion in the under-one-year age group and a lower proportion in the one-to-two-year age group. The difference was however not statistically significant. Children in the control group tended to be sicker. The prevalence of runny nose was statistically higher in the control villages. Other baseline characteristics including socioeconomic status, occupation and education of parents (not shown) were not statistically significantly different between the two groups.

Altogether, there were 21,683 child-weeks of visits. The average observation period was 17 weeks. Four hundred and fifty children were absent at some stage during the observation as their parents temporarily took them out of the villages. They contributed 2,431 weeks or an amount of missing information of 11.2 percent of the total expected person-time. Thus the missing period of obsevation was not a great problem. The average duration of observation per individual was slightly longer in the treatment group.

Table 1
Baseline characteristics of participating subjects.

	Volunteers trained	Volunteers not trained	p-value
No. of villages	15	15	–
No. of subjects in each village			
Range	30-66	21-68	–
mean/SD	44.3/10.0	43.3/10.8	0.9*
Total subjects	664	649	–
male / female	364/300	328/321	0.12**
Age (mean /SD)	2.0/1.4	2.2/1.4	0.80*
Age group in year, No. (%)			0.194**
<1	177(26.7)	143(22.0)	
1 to 1.9	131(19.7)	156(24.0)	
2 to 2.9	144(21.7)	145(22.3)	
3 to 3.9	177 (17.6)	119 (18.3)	
4 to 4.9	95(14.3)	86(13.3)	
Total days of observation			
Total days observed	67,083	67,948	–
Mean days observed	101.0	104.2	–
Finding in 1st visit %			
cough	15.1	18.6	0.08**
runny nose	24.2	29.7	0.025**
runny ear	0.08	0.08	0.97**

* p-value by chi-squared test
** p-value by *t*-test

Frequency of episodes and duration of sickness

Of the 1,313 children observed, 10 percent were free from any episode of ARI. The median number of episodes per month was 0.030 in the treatment group and 0.033 in the control group (Wilcoxson Rank Sum test, z=2.11 p = 0.035). However, from Table 2, using binary generalized estimating equation, after adjusting for age group and controlling for correlation within the same village, the difference in probabillity of getting a respiratory infection was not statistically significant. The only statistically significant predictor was age above 4 years in which the probability of getting respiratory infection was the lowest. The estimated common correlation within the same village was 0.07, indicating that the probability of getting infection among individuals in the same village is quite independent from each other.

Duration of illness of the affected children

The maximum and the median of days of illness among the affected children were 118 and 32.4 days in the control group and 119 and 38.6 days in the treatment group. From crude comparison, the difference of the median was statistically significant (Wilcoxson Rank Sum test, z=-3.786, p < 0.001). The result of linear generalized estimating equations to test the hypothesis of association between training and duration of illness is shown in Table 3. The estimate of common correlation within the

Table 2
Factors affecting probability of getting at least one infection, analysed by generalized estimating equations of logistic regression (adjusted for correlation of outcome within the village).

	Odds ratio	95% CI	p-value
Treatment/control	0.884	0.40-1.95	0.759
Age group (year)			
1 to 1.9	0.957	0.58-1.58	0.863
2 to 2.9	1.091	0.61-1.93	0.765
3 to 3.9	0.777	0.48-1.23	0.286
4 to 4.9	0.353	0.19-0.63	0.001

Estimate of common correlation within the same village = 0.068

same village was modest (0.103). The estimated reduction of duration of illness resulting from volunteer training was 11 % (ratio=0.892), with a 95 % confidence limit of 24 % reduction to 5 % increase. When children of 4 years or older were used as a reference group, children in the second year of life had the longest duration, followed by infants under 1 year old. The remaining groups had duration of ARI not statistically different from the reference group. The duration of illness was also influenced by two other morbidity indicators. For each additional episode in a month, the average duration of illness was prolonged by 14% children with ear secretion at the first visit had 36 % longer duration of illness than those without ear secretion.

Severity

One hundred and forty (21 %) children in the treatment group and 160 (24 %) in the control group had at least one episode of fever during the visits. Logistic regression analysis indicated that training of volunteers did not significantly reduce the likelihood of having fever (odds ratio = 0.45%, 95% CI 1.25-2.23). Ten children in the treatment group, in

Table 3
Factors affecting duration of illness as analysed by linear generalized estimating equations of multiple linear regression (adjusted for correlation of outcome within the village).

	Ratio	95% CI	p-value
Volunteer training*	0.892	0.759-1.048	0.165
Age group (year)**			
<1	1.113	1.031-1.201	0.006
1 to 1.9	1.223	1.106-1.352	0.000
2 to 2.9	1.083	0.993-1.181	0.073
3 to 3.9	1.002	0.910-1.104	0.965
episodes/month	1.145	1.105-1.186	0.000
presence of ear secretion in the first visit	1.362	0.997-1.862	0.042

Estimate of common correlation within the same village = 0.103

* Training versus no training

** Using children 4 years or older as a reference group contrast to three in the control group, were reported to refuse drinking. Retraction of intercostal space was reported in 3 children in the treatment group and 2 in the control group. From the surveillance system, four children from the treatment villages and four from the control group were in the name list of patients diagnosed with pneumonitis. There was no death in the study period. The number of children with severe ARI was too small to use for statistical comparison.

Health care usage

The probability of visiting a health center, private clinics, comunity hospital and provincial hospital adjusted for age group, episodes per month, duration of sickness and subdistrict are shown in Table 4. Private clinics were most commonly used, followed by provincial hospital and health centers. The community hospital was the least commonly used. Odds ratios for utilizing the service of the treatment group increased with level of facility of care. Thus, training of health volunteers might promote more utilization of a higher level of curative facility rather than promoting use of the health center.

DISCUSSION

Appropriate management of cases is considered to be one of the control strategies for ARI since primary prevention of infection by many viral and bacterial agents is still diffficult. In rural areas of developing countries, education of primary health care personnel is the most important method to improve early case management. It might initially be considered unethical not to give any education to the control group. However, because of limitation of budget and because the program was in its starting phase, comparison of outcome of interest between trained and untrained populations in such a study is feasible and appropriate. In fact, the untrained group in this study was subsequently trained after the study had finished.

We considered that comparison between one treatment village and another control village is not sufficient. While cross-influence from education can be minimized, it is difficult to argue that the two villages could actually be the same and the unit of comparison could be the individual subjects in the community. Moreover, duration of illness may be strongly determind by infective agents which are contagious, causing high correlation of outcome among the subjects in the same village. Randomized controlled trials using the village as unit for randomized allocation need more resources but can minimize the problem of comparability of villages and agents.

Generalized linear equations used in the analysis eliminated the problems of correlation within the same village and gave more conservative but more valid estimates and confidence intervals. However, it was not possible to aply the same method for logistic regresion in the analysis of health care usage because of the low rate of the outcome variables.

Training of health volunteers had rather little effect on duration of illness compared to the effects of number of episodes per month and the presence of ear secretion. These two factors thus interrelate with duration of illness. The children who tended to have higher frequency of episodes, greater prob-

Table 4

Pattern of utilization of modern health care during the child's sickness, calculated at the base-line level of other covariates (age group, duration of sickness, episodes per month and subdistrict).

	Rate of usage among the control group	Odds ratio of the treatment group	95% CI
Health center	7.6/1,000	0.93	0.69-1.25
Private clinic	13/1,000	1.43	0.98-2.11
Community hospital	0.9/1,000	2.01	1.06-3.82
Provincial hospital	8.6/1,000	4.71	1.50-14.8

ability of otitis media, when affected with common cold would have longer duration of illness.

In comparison of duration of sickness, utilization of health care was not included in the model as both are outcomes of interest. Thus non-significant decrease of duration of illness among the treatment group might partly be due to higher health care utilization among them. By contrast, duration of sickness was adjusted for in the analysis of health care usage because the former was an independent determinant of the latter. In other words, the longer the child was sick, the higher the probability that he/she would utilize the health care system.

The base-line rates of visiting private clinics and the provincial hospital were higher than those of visiting the health center and community hospital, indicating by-pass of the referral system. The community hospital was most importantly by-passed. Whether this was because it is located too close to the city where there are more doctors, or because of low acceptance of the clients, was not investigated. Although the increase in utilization of this level of care in the villages receiving the training program was statistically significant, the rate of usage was still the lowest.

It is therefore concluded from this study that the training program had little effect on duration of the illness compared to susceptibility of the child. The referral system for treatment of this disease substantially by-passed the community hospital and this problem was only slightly improved by the training program.

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