American Journal of Public Health Research, 2019, Vol. 7, No. 2, 58-72
Available online at http://pubs.sciepub.com/ajphr/7/2/4
Published by Science and Education Publishing
DOI: 10.12691/ajphr-7-2-4

The Application of a Conceptual Framework and Model for Information, Education and Communication (IEC) to Reduce Antibiotic Misuse in Vu Ban District, Nam Dinh Province

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Received April 28, 2019; Revised May 11, 2019; Accepted May 18, 2019

Abstract This study aimed to improve the community health workers' awareness and practical ability of rational use of antibiotics to reduce antibiotic misuse among the Vietnamese population in Nam Dinh Province. The 'Modified Kolb's Model for Vietnam (MKMVN)' developed and piloted successfully in a rural district of Nam Dinh Province with significant improvements regarding antibiotic use and administration was repeatedly applied for another rural district within Nam Dinh Province as the training program taken place in each of 18 community health centers within the district. Assessment of the effectiveness of program was done through questionnaire and focus group discussion. The study showed positive changes in the health workers' knowledge and practical ability regarding the use and administration of antibiotics. The health workers' confidence for working and learning was evident in the focus groups held as part of the final evaluation. The overall mean score for correct responses to the questionnaire elevated significantly from 55.52 ± 9.32 points before the program to 97.19 ± 2.38 points after the completion of the program and remained comparatively high at 83.10 ± 8.28 points after three months. Considerable improvements were seen in solving patients' problems, providing appropriate treatment and administration of medicines and antibiotics in particular. By using the MKMVN as the educational intervention, this study showed evidently improvements in the participants' knowledge and practical ability regarding antibiotic use and administration. It also revealed that the model was accessible, acceptable and appropriate for the community health workers. It is recommended that the model can be applied on a larger scale and for other key health issues.

Keywords: *antibiotic, misuse, model*

Cite This Article: Ngo Huy Hoang, Joy Notter, and Joy Hall, "The Application of a Conceptual Framework and Model for Information, Education and Communication (IEC) to Reduce Antibiotic Misuse in Vu Ban District, Nam Dinh Province." *American Journal of Public Health Research*, vol. 7, no. 2 (2019): 58-72. doi: 10.12691/ajphr-7-2-4.

1. Introduction

This study is based within Vietnam. Officially the Socialist Republic of Vietnam, with Hanoi as the capital city, it is a country located in the center of the Southeast Asian Region. Although Vietnam (in land and resources) is a small country, it is the 3rd most populous country in South East Asia and the 13th most populous country in the world. According the 2009 Census the population of Vietnam is 85,789,573 [1]. Now regarded as an emerging economy, Vietnam still has many of the problems of other developing countries, not least of which is the misuse of antibiotics. Since antibiotics were discovered they have been acknowledged as one of the greatest scientific achievements, saving a countless number of lives from death by microbial infections. In Vietnam, it is evident that today non-infectious diseases have increased, while infectious illnesses have remained at high rates. Therefore, antibiotics are still integral drugs used to cure people with infections caused by pathogenic bacteria. However, the increasing resistance caused in part by misadministration, is compromising the health of the community. There have been several programs designed to reduce misuse, but these have all focused on the acute, or hospital settings [2]. Therefore, this framework seeks to address these problems within the rural setting where 70% of the population is still residing. It provides a model and program that engages with the community health workers, moving them from a passive acceptance of their limited competence, to actively seeking to learn, and to taking responsibility for their own knowledge and expertise. On a broader level it is hoped that it can readily be applied to other key health issues.

2. Objectives of the Study

The study aimed to improve the community health workers' awareness and practical ability of rational use of antibiotics to reduce antibiotic misuse among the Vietnamese population in Nam Dinh Province. Specifically, the study applied the conceptual framework in the education and training of public health workers to reduce antibiotic misuse among the population in Vu Ban district, Nam Dinh Province, Vietnam and assessed the effectiveness of the conceptual framework as a tool for improving knowledge and expertise in antibiotic administration in Nam Dinh Province.

3. Materials and Methods

A quasi-experimental design was used to assess the effectiveness of the model [3]. These designs support the control of as many threats to validity as possible in a situation in which at least one of three components (random sampling, control groups, and manipulation of the intervention) is lacking. Often undervalued this approach has much to offer if carefully used and interpreted. After consideration of several types of quasi-experimental designs in this study, the One-Group Pretest-Posttest Design [4] was seen as suitable for the small population of health workers at the community level. Figure 1 gives a diagrammatic representation of measurement for the intervention of this study.

Measurement of dependent variables	Manipulation of independent variables	Measurement of dependent variables
PRE TEST →	INTERVENTION →	POST-TEST
M1	RE-TRAINING / RE-EDUCATION M2	M3

Figure 1. Diagram of Measurement

Note: M2 was carried out on completion of the training
M3 was carried out 3 months later

The re-education and training program for health workers regarding antibiotic developed uses an interrupted Time Series for measurement of variables related to changes or differences in knowledge, and awareness of standards for prescribing antibiotics. These variables were measured prior to the education (baseline measures) again immediately on completion of the training and then after a three month interval.

Vietnam is divided into series of provinces which are also subdivided into districts then community providing health services within areas that correspond to the government administrative structure [5]. Healthcare services offered in the health communities are mainly provided by assistant doctors, nurses and others with lower levels of training. There is however, little research evidence available about the role and the situation of this group regarding antibiotic administration or of the factors that impact on their prescribing of antibiotics. In view of the aims of project, purposive sampling was seen as most appropriate, this non-random method of sampling aims to sample a group of people, or settings, with a particular characteristic and draws on the participants' experience of the phenomena under study to produce meaningful data [6]. For this study it included all health workers of all levels of education working full-time at all community health centers (hereinafter referred to as CHCs) in one district in Nam Dinh Province, Vietnam. The only exclusion was anyone who did not wish to participate or was unexpectedly absent at the time of survey.

Vu Ban District in Nam Dinh Province was chosen as it has features of geography, demography and a public health system that are representative of other community areas. The health structures in rural areas across Vietnam are dictated by government policy and are all developed and staffed in the same way, and it is anticipated that the findings from this study will be transferable to other rural areas in Northern Vietnam.

All community health workers from all levels of education working full-time in the selected district participated, this meant that with one focus group planned for each community health center there were 5-7 members for each session. This number fits well with recommended numbers for focus groups and therefore it was possible for everyone to participate.

The intervention of this study used the Modified Kolb's Model for Vietnam (MKMVN) that was developed and piloted within the PhD study program. With this experiential learning cycle the basic contents regarding to antibiotic use were introduced to the health workers.

This model was demonstrated its effectiveness in improving the awareness and practical abilities of health workers who are working at 11 community health centers in My Loc District, Nam Dinh Province, a typical rural district with features of geography, demography and a public health system that are representative of other community areas in Vietnam [7].

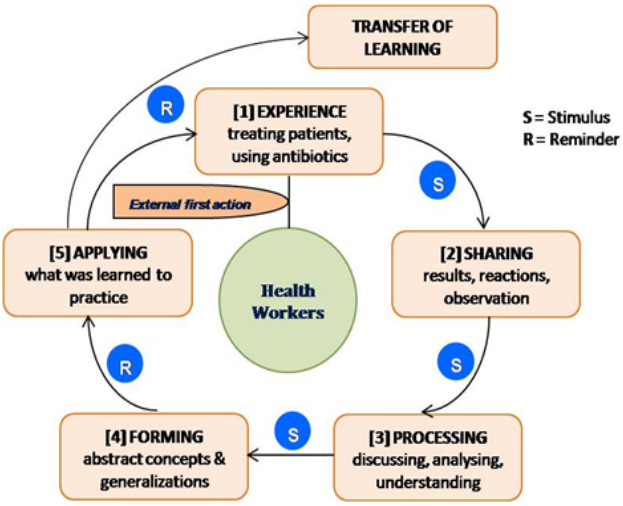

Figure 2. Modified Kolb's Model for Vietnam

The training program was delivered in each community health center. The schedule was planned as one working day for each center; however, any necessary administrative procedures were done in advance. This included obtaining approval from authorities, advanced work with the district center of health and the heads of community centers to reach an agreement and a confirmation of the timetable. The materials for training were also carefully planned and prepares, this included a training framework with illustrations in two formats, one for presentation during the session was stored in a laptop

(presented by the trainers), and the second was in the form of reference materials for the community health workers to keep.

Among varieties of data-collection, self-completion questionnaire shows advantages over the structured interview such as low expense, saving time, asking phrases in the same way for all respondents and no impact of personal reaction [8]. For this reason as a self-completion questionnaire was used for assessing the intervention. Another issue was taken into consideration was that the health workers who played as the respondents of the study and their working condition. As mentioned above under the Vietnamese education system and health system, health workers came from several original training/educations which were inconsistent, different from each other and as a general low qualification. Beside this self-completion questionnaire also has disadvantages such as the explanation what questions mean and help the respondents to understand what is required thus simple questions were used with any necessary clear instructions about how to complete the questions provided with each question [9].

The questionnaire used only closed questions as comparative quantification was needed and coding of open questions could have led to inaccuracies. Data from the questionnaire included demographic indicators including age, sex, and qualification, years qualified, training on medicine use, and awareness and practical abilities for antibiotic use as mentioned above. Using SPSS for windows software, descriptive analysis were used to analyze the data sets and much of the data were nominal and ordinal and therefore only non-parametric tests for significant difference could be used.

Overall assessment of the intervention needed to consider not only the changes revealed by using the questionnaire but also changes evident from watching and listening to the community staff working with regard to antibiotic use and administration. The differences between pre and post levels and the final assessment were analyzed using the same methods as in the pre-assessment measures.

In line with all studies in Vietnam, as described above, ethical approval has been gained from varying key individuals and organizations. However, this was at an organizational level. The main ethical issues were therefore that all participants knew what they were agreeing to do, and were confident that their identity would be protected. Participant information had been carefully prepared, and given to the participants on average one week before the actual questionnaire was administered. Nevertheless, before they completed the questionnaire, the researcher checked before that all those present had understood the information that they had been given and were still willing to participate. The questionnaires were numbered but contained no names, and there was no way the researcher could link the number with any individual. All questionnaires were securely stored by the researcher in a locked cabinet at Nam Dinh University of Nursing. Individual communities were identified by only numbers and no health service or university personnel had access to either the list of numbers, or the raw data, and the raw data will be stored for five years and then destroyed.

The ethical issues for qualitative data differ from those for quantitative data sets. The participants had indicated that they understood the purpose of the study but issues of identification were crucial. The focus groups were taped, and voices can be recognized, therefore before each session, the researcher reassured participants that no-one other than himself would listen to the tapes. The transcripts from the focus groups would not contain their names, and that none of the issues raised would be reported in a manner that identified a specific individual or community health center. The tapes and transcripts were numbered but, no health service or university personnel had access to either the list of numbers, or the tapes or transcripts. All data have been securely stored by the researcher in a locked cabinet at Nam Dinh University of Nursing, and the transcripts will be stored for five years and then destroyed.

4. Results and Discussion

At the beginning of the intervention there were 108 health workers, working at 18 community health centers (CHCs), participated to the project. Of 108 participants, 32 (29.6%) were men and 76 (70.4%) were women. The mean age ± SD was 40.67 ± 9.46 years, ranged from 22 to 60 years. The numbers of years in career were from the lowest of 1 year to the highest of 40 years and on average of 15.12 ± 8.90 years. Table 1 describes the education levels and job titles of CHC's health workers.

Table 1. Education and Job Titles of CHC's Health Workers

Edu. Level	Job Title	Gender		Total
		Men	Women	
University	Medical Doctor	14	2	16
	Nurse	2	2	4
	Midwife	0	2	2
College	Nurse	0	1	1
	Midwife	0	1	1
Secondary	Assistant Doctor	7	17	24
	Nurse	5	23	28
	Midwife	0	11	11
	Pharmacist	3	13	16
Elementary	Nurse	1	4	5
Total		**32**	**76**	**108**

Of the 18 CHCs, 16 centers where had a medical doctor and a secondary pharmacist per each center. Table 1 shows the education level and job title of health workers were different, community health workers with all job titles and levels of education are working together and mainly at secondary level in which the majority of them were nurses.

Before addressing the results of the program it is necessary to consider whether the participants' demography influences the answers to the planned questions or the questionnaire suited the participants. Table 2 gives a description of this.

At the beginning of the intervention there were no significant differences in overall score between groups at age band or in terms of seniority (p values of more than 0.05). The workers who qualified at university and

medical doctors gained higher scores than those of the workers at the other qualifications however, the numbers of health workers at college and elementary level were too small (only 2 and 5) it is not yet to confirm a significant difference in those of these two level.

Table 2. Mean Score by Health Workers' Demographic Categories

Category	Group	Number of Health Workers		Mean Score	p value
		n	%		
Age Band	22 – 29 years	17	15,7	56,59 ±10,16	p = 0,362
	30 – 39 years	26	24,1	55,65 ± 07,23	
	40 – 49 years	39	36,1	56,79 ± 09,01	
	50 – 60 years	26	24,1	52,77 ± 10,89	
Seniority	= 5 years	20	18,5	56,00 ± 09,79	p = 0,726
	6 – 10 years	23	21,3	54,52 ± 07,15	
	11 – 15 years	11	10,2	56,45 ± 08,93	
	16 – 20 years	24	22,2	56,79 ± 10,59	
	21 – 25 years	16	14,8	56,69 ± 09,92	
	>25 year	14	13,0	52,21 ± 09,76	
Edu. Level	University	22	20,4	62,14 ± 06,70	P_{UNI} <0,001
	College	02	01,9	51,00 ±09,89	
	Secondary	79	73,1	64,78 ± 08,69	
	Elementary	05	04,6	39,80 ± 04,38	
Job Title	Med. Doctor	16	14,8	61,69 ± 06,14	P_{MD} = 0,036
	Asst. Doctor	24	22,2	56,29 ± 07,89	
	Nurse	38	35,2	53,21 ± 09,86	
	Midwife	14	13,0	55,43 ± 11,85	
	Pharmacist	16	14,8	53,75 ± 08,12	

Before addressing the results of the program it was necessary to appraise whether the questionnaire suited the participants or questions planning to be used were easy or difficult for the participants to answer Table 3 was used to give a description of this.

Table 3. Variety of Scores by Education Level Before the Program

Score	Number of Participants				Total	
	University	College	Secondary	Elementary	n	%
31 – 49 points	1	1	21	5	28	(25,9)
50 – 59 points	7	1	34	0	42	(38,9)
60 – 69 points	11	0	22	0	33	(30,6)
70 – 76 points	3	0	2	0	5	(04,6)
Total	22	2	79	5	108	(100,0)

Obviously health workers regardless qualification levels possess actual knowledge as well as existing practical experience including those regarding the administration of medicines in general and antibiotics in particular. As seen in Table 4.3, before the intervention the score varied from 31 to 76, the scorebands of 50 – 59 and 60 – 69 were major. The range of score between levels of education showed no difference in statistics and figures in Table 3 also advocate the questionnaire used for participants of the study population in the extent was acceptable.

As mentioned in the section of study design, the questionnaire after being piloted and modified was used to evaluated changes in perception, understanding and practical ability of the participants at three different periods of time, these included measure 1 (M1), measure 2 (M2) and measure 3 (M3) refer to the time before, after, and three months later within the interventional program. At the time of third measurement, the assessment taken at three months after the program, as in many studies the loss of responders or participants until the end of study is unavoidable, and in this study 6 of 108 participants equal to about 5.5% (less than 10% of total participants) were absent because of personal reasons and excluded from the final data analyzing.

To get an overview of the result of the program the mean values of overall scores from three measurements were calculated and any association (using t-test and p-value < 0.05) between these values were considered as presented in Table 4.

Table 4. General Result by Overall Score

Score	Number of Participants	Min	Max	Mean + SD	p value (t-test)
M1	108	31	76	55.52 ± 9.32	
M2	108	86	100	97.19 ±2.38	p(2;1)< 0.001
M3	102	63	98	83.10 ± 8.28	p(3;1)< 0.001

The mean score elevated significantly after the completion of the program (97.19 ± 2.38 points, ranged from 86 to 100 points) and was still high after three months (83.10 ± 8.28 points, ranged from 63 to 98 points) in comparison with before the program (55.52 ± 9.32 points, ranged from 31 to 76 points), all p-values were less than 0.001. It is recognized that memory or retention of learning content decreased with elapsed time since learning. Naturally, learners can only remember 75% of what they learned by the end of a learning course, and retained less than 10% of learning after 30 days, this means more than 90% of what was learned was forgotten [10]. Interestingly in this program, the mean score after 90 days was still about 83 points. The mean score elevation after the completion (M2 – M1) was approximately 42 points. If considered this as 100% of knowledge then the elevation after three months (M3 – M1) was approximately 28 points. In comparison the two elevated levels (28 versus 42) the meaning was that after 90 days the health workers could retain more than 60% of what they learn from this program. Otherwise in this study helped the health workers to retain their knowledge far more so than expected. This indicates the effectiveness and sustainability of the program as well as the appropriateness of the applied model. In 2010, a similar program was conducted in My Loc, another rural district of Nam Dinh Province but the number of participants was smaller. The general result by overall score of the 2010 study was extracted in the below.

Score	Number of Participants	Min	Max	Mean + SD
M1	61	40	78	58.43±8.77
M2	61	96	100	99.25 ±1.00
M3	55	62	96	79.76 ± 9.02

There is a slight difference in the numbers of two studies due to a difference in the number of participants. However, these two studies generally gained the similar results in terms of overall score at serial times of assessment. This again indicates the effectiveness and

sustainability of the program and the appropriateness of the applied model.

Belief naturally influences strongly behavior and vice versa [11], here there was a belief in the necessity of antibiotics and decisions regarding antibiotic administration. Being often prescribed and taken, the health professionals had accepted that antibiotics were a cure for any minor illness. Consequently, there was a "blurred" belief in the necessity of antibiotic to treat almost all diseases and health problem. This led to unnecessary prescribing of antibiotics. Table 5 illustrates again their misconceptions regarding the necessity of antibiotics before the intervention and the changes obtained after the program through the time-serried measurements.

Table 5. Beliefs in the Necessity of Antibiotics

Belief	Measurement	Number of Participants	Yes		No	
			n	%	n	%
Most infections need antibiotics to treat	M1	108	95	88.0	13	12.0
	M2	108	1	0.9	107	99.1
	M3	102	57	52.8	45	41.7
Most ARIs need antibiotics to treat	M1	108	84	77.8	24	22.2
	M2	108	1	0.9	107	99.1
	M3	102	13	12.0	89	82.4
Many infections caused by virus and antibiotics do not kill	M1	108	33	30.6	75	69.4
	M2	108	4	3.7	104	96.3
	M3	102	6	5.6	96	88.9

The health workers' conceptions regarding the necessity for antibiotics varied considerably (M1). A majority of health workers (88%) and (77.8%) believed that most infections (an umbrella misconception) and most acute respiratory tract infections (ARIs) needed antibiotics. More than 30% of respondents did not recognize that antibiotics do not kill viruses. This is similar to those seen in the 2010 study conducted in another district and this also fits with the cross-sectional, internet-based questionnaire study of public beliefs on antibiotic and respiratory tract infections conducted by Cals, et al [12] where 47.8% of responders believed that antibiotics are effective in treating viral infections. However, the problem was far more obvious than that in this study, where the findings indicated that health workers of community centers actually possessed some knowledge and understanding of antibiotics but needed positive reinforcement to make changes and use knowledge appropriately. It is easy to recognize that the proportion of health workers said no with the first belief went down strongly from 99.1% after completing the program to 41.7% three months later; otherwise, many health workers came back the blurred belief that most infections need antibiotics to treat. This figure confirmed the difficulties referred to previously and the necessity of establishing positive reinforcement to the health workers and giving them frequent reminder by the educators of the program. Although the approach used was effective, it needed to be reinforced by further sessions to further increase the workers overall levels of knowledge, so helping them to understand the need for sustained improvement in prescribing.

Inevitably some cases will need antibiotic to treat, and for safe prescribing the principles of administration need to be followed, but in this study, in many circumstances these principles could not be fully complied with. The healthcare practitioners usually tried to follow the guidelines in which essential recommendations on administration of drugs in general and of antibiotics in particular are specified. However, as participants are educated to different levels and mainly to secondary level and they found them irrelevant and in some instances impossible to follow. The essential guidelines for administration of antibiotics provided by the Ministry of Health in recent years [13] need explanations that all staff can follow. In this study basic recommendations for antibiotic use aiming to restrict drug resistance were introduced giving specific categories: (a) one / more than one class, (b) narrow / broad- spectrum class should be started when treatment with antibiotics is necessary and (c) a course of antibiotic treatment depends on specific bacterial infection / a 5-day course for all conditions.

The correct awareness of all three categories were 51.8%, 95.3% and 87.2% of health workers in M1, M2 and M3, respectively. Clearly, before the program commenced, it was recognized that more than 50% of participants were aware of these recommendations but chose not to follow them. This can be explained in that there is always a big gap between awareness and a practical approach and are also other influencing factors. In the Vietnamese context this compares to recognition of the traffic law and obeying it when travelling, everyone knows it and someone obeys it. After completion of the program, the proportion of health workers with correct answers increased considerably to 95.3% and went down to 87.2% three months later. This again confirmed the necessity of providing positive reinforcement and giving frequent reminder to the health workers.

One of the purposes of the interventional program was to enhance participants' awareness of consequences of antibiotic misuse as a complete warning to health workers to consider carefully before any decision on using of antibiotics. These consequences were listed in closed questions. The results showed that before the program only about a half of health workers were aware of all the likely consequences. Immediately after the program all participants realized the consequences. Three months later the correct responses remained 45% higher (94.1% of health workers). The result to a large extent, showed the effectiveness of the program, but as some of health workers failed to be fully aware of certain consequences, it also indicated that including sessions regarding the consequences of antibiotic misuse is essential, and should be included in every programs regarding antibiotic administration.

As mentioned previously, in developing countries infectious conditions, respiratory infections and diarrheal diseases, are still the leading causes of deaths. However, although there are clear guidelines for diagnosis of these common illnesses, it appeared in this study, that illnesses seen in the community centers were not diagnosed based on the ICD. Common illnesses were just given a name of a disease by health workers. The health workers need to be clearly aware of the common diseases and conditions may or may not require systemic antibiotics to treat, Table 6 showed the result,

Table 6. Awareness of the Necessity of Antibiotics for Common Diseases

Agreed with the necessity of prescribing antibiotics	Percentage of the Health Workers		
	M1	M2	M3
Acute rhinitis	65.7	0.0	10.8
Acute common pharyngitis	79.6	0.0	27.5
Acute common laryngitis	81.5	0.9	18.6
Acute bronchitis	89.8	0.9	51.0
Red sore eyes	50.0	0.0	6.9
Acute common diarrhea	29.6	0.0	5.9
Functional disorders of colon	12.0	0.0	1.0
Urinary tract infections	89.8	100.0	98.0
Boils and carbuncles	71.3	100.0	90.2
Impetigo	49.1	100.0	85.3

In Vietnam, education and training curricula cover generally subjects that are not modular-based, thus linking factors and practice are not connected to factual information. In medical training and education programs, clinical subjects each comprise various separate components. Regarding any specific disease, most teaching elements address relatively adequately etiology, clinical manifestations and treatment, but these need to be related to actual cases for the role each one plays in practice to be fully understood. There is ample evidence from randomized controlled trials that most respiratory tract infections are viral in origin and self-limiting; thus antibiotics are rarely necessary [14,15]. Antibiotics are also not necessary or effective in diarrhea and functional disorders of colon [16] or may cause antibiotic associated diarrhea [17]. The official publications of Vietnam, also point out that for these conditions systemic antibiotics are not necessary or effective.

The first seven conditions listed in Table 6 should have received disagreement of giving antibiotics to treat. However, before the program these were attained a high incorrect agreement of giving antibiotics even functional disorders of colon and acute common diarrhea that received incorrect agreement from 12% and 29.6% of responses, respectively. From the figures in Table 6 it is fair to say that there was a poor understanding of antibiotic usage in the community practice. After completing the program there was a considerable change in health workers' awareness of the necessity of prescribing antibiotics accurately for these conditions and the result was maintained with significant proportions after three months, with the exception of acute bronchitis, a condition in which dyspnea is a prominent symptom that makes both health workers and clients fear the seriousness of the condition. This may explain the reason why this disease had the highest number of health workers believing it needs antibiotic treatment at the time of M1 and M3 (89.8% and 51%). In this case the educator has to discuss this condition separately with this group of health workers.

In the context of community health level, the lack of laboratory facilities is one of difficulties for health workers in determining an infection caused by viruses or bacteria. Otherwise, awareness of clinical signs and symptoms is important in decision of giving antibiotics or not to treat an infection. Manifestations such as fever, cough, runny nose, dyspnea, watery feces and other feelings of illness occur naturally in viral infections as well as minor illnesses unrelated to bacterial infections. These need nonspecific therapies e.g. relief of symptoms, rehydration, nutrition etc., instead of antibiotics, except in some rare cases with pus, blood excretion and production [18]. Educating health workers to understand the fact and be aware as to which one of these clinical manifestations is typical of a bacterial infection from then enables the health workers to decide if they do or do not give antibiotics for clients and patients with these clinical manifestations, in order to reduce unnecessary use of antibiotics.

Clinical manifestations commonly seen in the community health level were grouped into five categories: manifestations (ms) of systemic, respiratory, digestive, urinary and skin conditions. Before the intervention the number of health workers who were aware of all groups of manifestations was quite low, the correct answers of clinical manifestations were 17.6%, 31.5%, 48.1%, 39.8% and 59.3% referring to systemic, respiratory, digestive, urinary, and skin, respectively. Otherwise these manifestations could be thought bacterial in origin and antibiotics were automatically prescribed and used unnecessarily. Once the program was completed there were considerable improvements in the numbers of health workers perceiving correctly the clinical manifestations, from more than 93.5 to 100% of participants. After three months these numbers decreased but were still much higher than those before the intervention and stood at 65.7%, 83.3%, 90.2%, 78.4%, and 95.1% in the same order as mentioned above. These numbers indicate the extent of the success of the program and it's sustainability, particularly if it could form the basis of ongoing education and training courses which could then reinforce the information given, as the levels of decrease in M3 show the necessity of repetition and staff reminders.

It is difficult to make a comparison between the effectiveness of this program as against other such studies as the methods are different in their design and implementation. However a systematic review by Arnold & Straus [19] of thirty-nine interventional studies emphasized the overuse of antibiotics for viral infections and other conditions. With regards to the administration of antibiotics, results showed that multi-faceted interventions, especially interactive educational meetings, appeared to be more effective than didactic lectures. In this study the intervention followed the model on which the participants and the educator discussed, shared and achieved collective agreements in the appropriate area of the participants' workplace and thereby created these improvements.

In infections due to bacteria, addressing the pathogens and strains of bacteria in infectious diseases always appeared to be in corresponding medical lectures. Medical documents indicate evidently that some microbial strains are typical pathogens or frequently caused infection for a certain system of the human body. For example, Escherichia coli is the most common pathogen of bacterial infections on digestive and urinary tracts [20]. However this is an academic approach and this makes it difficult for the health workers in the community level in Vietnam. In this study pathogenic strains of Hemophilus influenza, Escherichia coli, and Staphylococcus aureus known to be common causes of bacterial infections of respiratory, digestive, urinary tracts and skin, respectively in Vietnam

[21] were addressed and the awareness of this issue by the health workers was evaluated.

More than 90% of the participants could match the pathogens to the body system immediate after the program. Three months after the completion of the intervention, the percentage of correct answers decreased compared with those immediate after the intervention but still higher considerably than those before the intervention. It is a fact that there are difficulties for not only low educated healthcare workers, but for many clinical practitioners, to name or recall the names of pathogenic strains and then to match them with commonly infected systems of the body. As a result, it becomes difficult for community health workers to retain those details. That they could answer correctly after the program, but did not retain the knowledge demonstrates the need for repeating education and training at intervals.

When antibiotics are necessary, the gold standard in treating infection is to tailor therapy to the organism grown from the site of infection (system of the body); this is based on bacterial culture detection and antibiotic sensitive map determination. Yet this is not a reality for certain clinical settings particularly at grassroots level in Vietnam; thus knowledge of the typical pathogens of the presumptive site of infection and of the local antibiotic resistance is essential [22]. Choosing one antibiotic drug from among several antibiotics available in the healthcare setting is critical. Official drug guidelines normally do give recommendations indicating which antibiotic should be chosen for a system/organ of the body and this should become the basic for clinical use of antibiotics [23]. Together with difficulties in detecting and connecting pathogenic bacteria as mentioned above, choosing a presumptive antibiotic (empirical treatment) for an infected system of the body becomes more important for grassroots healthcare workers. As seen in the 2008 survey) some classes of antibiotics were most commonly used in the community level and the situation continues today these in generic names are amoxicillin, cefalexin, penicillin and cotrimoxazol. And recently quinolones have shown effectiveness in the nationwide management of major typhoid and cholera epidemics in which ciprofloxacin is an extract [24]. These classes of antibiotics are both allocated to and commonly available in the community health centers within the study location.

Choosing a drug according to the organ or system of the body on which the chosen drug is active and effective is a prudent decision [25]. The percentages of correct answers were very low before the intervention regarding the five assessed antibiotics, amoxicillin, cefalexin, penicillin, cotrimoxazol and ciprofloxacin were only about 16.7%, 27.8%, 18.5%, 8.3% and 7.4%, respectively. These numbers are similar to those seen in the 2010 study.

The little number of health workers with correct answers appeared to show the lack of awareness involved in choosing right antibiotic for an infected system of the body. The lack of availability of laboratory tests and poor awareness of connecting common pathogens to the system were the causes of choosing inappropriate antibiotics. This gives an additional explanation to the reason why an antibiotic was prescribed to treat infections of any site of the body rather than a specific system. The inference is that the chosen antibiotics had less or no effectiveness against pathogenic bacteria. Improvement was clearly seen after completing the intervention and the participants retained a high proportion of correct answers after three months, from two to five times as many as those before the program with all antibiotics.

Even if the correct antibiotic is chosen for a bacterial infection, the next issue is the appropriate use of antibiotics in terms of correct dosages, right dosage intervals, and complete duration of the course. These are proven to produce effective treatment, help patient outcomes and help prevent the emergence and selection of antibiotic-resistance. From the focus group discussions of the study sample in the 2008 survey the inappropriate use of antibiotics was partly blamed on the non-compliance by patients/clients. On the one hand patients tend to stop taking the drug earlier than the expected duration of the course and can make mistakes with the dosage. On the other hand, unclear or inadequate instructions on taking drugs from health workers while prescribing and giving antibiotics are a reality. It was evident that aspects of irrational drug use arising from inadequateness on prescriptions and verbal instructions on communication with patients were widespread [26]. In this study essential instructions on taking antibiotics in particular and drugs in general that health workers should give clients included (a) how many capsules/tablets/sachet for each intake, (b) how many times a day the antibiotic should be taken, (c) the dosage intervals, (d) when the antibiotic should be taken, (e) how many days the antibiotic should be constantly taken, and (f) common unwanted effects, recognizing and dealing.

The number of health workers who had adequate awareness of the essential instructions was very low before the intervention (15.7%). This finding fits with studies in other developing countries, for example, a cross-sectional survey of 990 prescriptions from Goa, India indicated that 86.5% and 57.6% of these prescriptions had unclear instructions and unclear dosage for use, respectively, [27]. Within the community health centers in this study, there were several causes for this including lack of information, insufficient training and education with the underlying cause that the health workers themselves had not received adequate instructions of drug use from their original education courses or from further education and training. Consequently, inadequate writing related to use of drugs given to clients/patients, for instance *"Amoxicillin 500mg x 20 tablets for 5 days"* or insufficient communicating with clients/patients, for example *"4 capsules or 2 tablets a day, divided into 2 times*". This seems to be done easily and quickly as an inherited habit with no perception of what instructions should be delivered to the patients; the significance of their instructions or lack of concerning whether or not patients could understand and follow them.

The styles of giving clients instructions need to be changed. After completing the program (M2) there was a great improvement of the awareness of essential instructions by health workers (99.1% of participants) that will be communicated with clients/patients. Three months later this proportion dropped to 72.5% (M3) although it was about four times higher than in M1. This again indicates that giving clients or patients adequate instructions on drug use has not yet become a positive

habit for the study's health workers and needs time involving reinforcement and efforts from the educator.

The process that the health workers of the study have experienced is quite different from that of WHO. Surprisingly, *the three steps* playing by the health workers could be accepted as in comparison with as the steps of WHO's process: *define the disease* = step (1) define the patient's problem, *give the patient medications* = step (4) start the treatment, and *instruct the patient* = step (5) give information, instructions and warnings were done. The other steps of process either were ignored or have never been introduced to the health workers including (2), (3), and (6) in which the step (2) specify the therapeutic objective and the step (3) verify the suitable of treatment were decisive components of the rational use of drugs.

Only 14.8% of health workers could determine the process. This reflected the existing problem of medicine use in general and of antibiotic use in particular in the healthcare level of the study as well as other levels of healthcare system in which prescribing and giving patients drugs are not based on the rational process. Reviewing the literature indicates the fault was not deliberate, but the health workers themselves initial training and education concentrated more on theory than on practice. The pharmacological documents were probably 'drug-centered', focused on contra-indications and side effects of different drugs [28], not application in practice. But in clinical practice the reverse approach has to be taken, from the diagnosis to the treatment, from clinical manifestations to the drugs. Within study sample for the health workers whose qualifications were mainly secondary level, and whose original education consisted of separate subjects, the problem was inevitable, and further progress in clinical practice is needed. After completing the program 85.2% of participants could demonstrate the process and three months later the number of health workers who maintained the process was 46.1% of the total. About more than half of the health workers could not follow the introduced process and went back to their old habits of prescribing and using medicines. Educators and researchers acknowledge the difficulty of changing existing habits (in this context these are prescribing and using medicines) [29,30]. The result from this program showed the effort of the involved health workers together with the educator of the studied location. This also indicated, to the extent, the activeness, appropriateness and sustainability of the applied learning model on which the participants were learning by discussing, sharing and doing, rather than by listening to other people or reading about as they used to learn in their earlier education and training.

Once the process of rational treatment was acknowledged, making the process become alive, become a new habit and helping the health workers get used to the activity made a significant difference. This work acted to improve the ability of health workers in critical thinking to define the patient's problem in accordance with appropriate therapeutic objective(s), and then give the patient a suitable treatment. Within the program of this study, examples of real and common conditions seen in the participants' workplaces (CHCs) were drawn up and introduced as case studies. Tests were taken before the program, immediately after, and three months later, to evaluate the appropriateness of prescribing and using antibiotic following the process of rational treatment. Because the process mentioned above seemed to be new to the participants of the studied sample, requiring them to deal with the whole process in one case would make complex and difficulties. Otherwise certain steps of the process with slight modifications were introduced in separate examples.

Based on the example of a patient, the participants were required to define the patient's problem, specify the therapeutic objective, then verify the treatment that met the objective (example of patient 1 below),

Example of patient 1

A 48-year old man comes to your health center, complains of a dry cough and being itchy in his throat, which started two weeks earlier with a cold. He has stopped sneezing and having a runny nose but still has a cough, especially at night. He is a heavy smoker. Further history and physical examination reveal nothing special. One of your colleagues advises the patient to stop smoking, and considers the treatment for this patient.

A persistent dry cough after a cold is common and analyzed thoroughly. Medical evidence indicates this is caused by an irritation of respiratory tract and non-specific treatment is sufficient. This case is similar to those showed in evidence based medicine. Critical thinking on this case can describe the patient's problem as a dry cough which is persistent and simultaneous with an itchy feeling in the patient's throat. These symptoms matter to the patient. The patient's problem can be translated into a working diagnosis of persistent dry cough for two weeks after a cold. The most common cause is that the mucous membrane of the bronchial tubes is affected by the cold and therefore easily irritated. A secondary bacterial infection is possible but no existing evidence (e.g. no fever, no green or yellowish sputum, no physical signs through the medical examination). Continuous irritation of the mucous membrane is the most likely cause of the cough and vice versa the very persistent cough affects the mucous membrane as an irritation. Therefore the therapeutic objective is likely to stop the irritation by suppressing the cough concurrently with anti-allergy of respiratory tract to enable the membrane to recover and otherwise antibiotic is not necessary for this case. Changes before and after the program is shown in Table 7.

Table 7. Health Workers' Ability to Solve the Patient's Illness

Agreed with the necessity of prescribing antibiotics	Percentage of the Health Workers		
	M1	M2	M3
1. Acute rhinitis	65.7	0.0	10.8
2. Acute common pharyngitis	79.6	0.0	27.5
3. Acute common laryngitis	81.5	0.9	18.6
4. Acute bronchitis	89.8	0.9	51.0
5. Red sore eyes	50.0	0.0	6.9
6. Acute common diarrhea	29.6	0.0	5.9
7. Functional disorders of colon	12.0	0.0	1.0
8. Urinary tract infections	89.8	100.0	98.0
9. Boils and carbuncles	71.3	100.0	90.2
10. Impetigo	49.1	100.0	85.3

Before the program the numbers of health workers who could define correctly the patient's problem and the therapeutic objective were quite high (71.3% and 65.7% respectively), then rose and stayed higher following the intervention. Clearly, defining the patient's problem and specifying the therapeutic objective(s) of common illnesses are not so difficult for the health workers. However, the question is, why in reviewing literature in Vietnam, conditions of respiratory tract were most likely defined as respiratory infections or inflammations. The most likely answer is that the process of assessing rational treatment and it's components had not been introduced to the participants in their early training/education nor in the public health courses on which some of health workers attended before.

In this study, following the progress of the program on which aspects addressed from the beginning of the program, including the role of guidelines helped the participants to deal with the case mentioned above, defining the patient's problem and specifying the therapeutic objective. In contrast, the final step of verifying treatment to meet the therapeutic objective remained difficult for participants. In practical training/education, deciding a treatment that meets the therapeutic objective should be considered, but theoretically based education does not make the links with practice, leaving the qualified workers struggling. However, equally important is whether the rationale for the treatment that practitioners use to choose the treatment exists or is appropriate. If it does not exist or is inappropriate failure to decide correctly in future cases or new similar situations is likely to happen. The old habits for choosing a treatment returns, then antibiotics are easily given and used. It was evident in Table 7, the numbers of health workers who could verify the appropriate treatment were much smaller. Only one-fourths of the health workers could choose the appropriate treatment and only one of 108 health workers (0.9%) could give the rational interpretation on their chosen treatment. Behind these numbers the meaning is that antibiotics are likely to be chosen for this case in a real situation. This explains again the reason why antibiotics were given in treating most conditions of the respiratory tract.

After completing the intervention the ability of the studied health workers to use rational treatment increased greatly in both the appropriate treatment and the rational interpretation (93.5% and 57.4% of the health workers, respectively). Because this was during a short period, the decreasing level of antibiotic use could not be formally assessed. But the findings suggest that the proportion of persistent dry coughs commonly diagnosed as infections/inflammations of upper respiratory tract (e.g., pharyngitis; rhino sinusitis; or bronchitis…) treated with an antibiotic within the studied population is likely to decrease significantly. Rubin [31] used a multifaceted intervention to improve antimicrobial prescribing for upper respiratory tract infections which resulted in the percentage of patients who received antibiotics was in general 15.6% and in bronchitis 56% less than that compared with the baseline period. In this study, three months later the numbers of health worker staying with the rational treatment was still high for both choosing the appropriate treatment and giving the rational interpretation of the chosen treatment (67.6% and 10.8% of health workers, respectively) in comparison with those before the program but there was a strong decrease level of the percentage of health workers could give the rational treatment over time, especially could not give a rational interpretation to the chosen treatment, and a return, by some workers to their old prescribing (and using) habits. This again showed that changing existing habits of prescribing and using antibiotics is not easy and needs repeated reinforcement and a timely reminder.

When an antibiotic is necessary in circumstance when no micro-bacterial test is available, selecting an antibiotic appropriate to the infected organ/system of the body from among several antibiotics available in the community level is very important. This helps the effectiveness of antibiotics since then the limitation of antibiotic resistance. In the other example of patient (example of patient 2), the participants were asked to select an antibiotic from a limited number of antibiotics supposed available in their health center.

Example of patient 2

A 32-year old female comes to your health center, complains of appearance of a swelling which started three days ago, growing up with pain in her back. Further history and physical examination reveal nothing special, apart from a boil sized 3 x 3mm in her low back which is red, hard and heating but not gathering pus. One of your colleagues gives this patient Paracetamol, advises her to keep the boil undamaged until gathering pus, and to come back to lance her boil. Of course an antibiotic is considered to give this patient but there are only three antibiotics available in your center include Ciprofloxacin 500mg tablet, Penicillin V 1000mg tablet (equivalent 1,000,000UI) and Erythromycin 250mg tablet.

The requirement is not only selecting the antibiotic (this may be randomly correctly chosen or imitated old prescriptions) but also giving rational interpretation of the selected antibiotic.

The fact that there are a limited list of antibiotics available in the community level as showed in the 2008 survey meant limited choice of antibiotic. But it is evident that even with a limited list, selecting an antibiotic appropriate to a specific bacterial infection is not easy and needs to be prudent for the community health workers. In the context of lack information or no exposure of clear national guidelines healthcare workers commonly select an antibiotic by their own choice or preference, regardless of whether it was the most effective and they misunderstood the role of new drugs. This fits with other international studies, for example, according to a national 5-year follow-up study in Finland by Rautakorpi, et al [32] despite clear guidelines of no prescribing some antibiotics as first-line treatment for certain infections, non-compliance with the guidelines was continued with the majority incorrectly prescribing. Similarly, Kuehlein [33] conducted a study using observational and focus-group elements showed that although the German guideline recommended Trimethoprim as having good effect for the treatment of uncomplicated lower-urinary-tract infections in primary care, the participating general practitioners strongly rejected the guidelines and prescribed Ciprofloxacin instead of Trimethoprim. This

prescribing habit was mainly driven by their former hospital training and what was perceived as common therapy. In the above example of patient 2, Penicillin V should be chosen because the national guideline recommends this antibiotic appears to be effective for the treatment of skin bacterial infections at the community health level. A similar situation was seen before the intervention. Only 16.7% of health workers selected Penicillin with a rational interpretation of the reason why they selected this drug. If this is not changed it is likely that the participants will select another antibiotic instead of Penicillin. There were significant changes immediately and three months after the program (87% and 65.7% of health workers, respectively). Although this study was not a direct observation of changes in prescribing, the result of this study indicated to some extent the effectiveness of the program through the learning model, just showed that input at practice level strongly changed opinions in favor of Trimethoprim for treatment of uncomplicated lower-urinary-tract infections.

When an appropriate antibiotic is selected the importance is whether the selected antibiotic is adequately used. It is evident that even when inappropriate antibiotic is used but it can be used incorrectly. The incorrect use involves either unclear instructions on administration or non-compliance. Healthcare workers themselves are mainly responsible for the former i.e., instructing patients while prescribing and delivering drugs. Within the program of this study the first activity was focused on the health workers to support them in improving their ability to give patients clear, correct and adequate instructions. In the fact that most patients are taking the drugs at their home means instructions on administration of drugs becomes crucial work. In this study Amoxicillin, Cefalexin - the two most commonly used antibiotics and Ciprofloxacin increasingly being used as mentioned previously were introduced and the participants were asked to give adult patients essential instructions on general administration of these drugs.

The third example was focused on when one of three above antibiotics decided to be used for treatment a bacterial infection of an adult patient with no contraindication. Changes in giving instructions on the administration of these antibiotics before the intervention, immediate after and three months later were showed in Table 8.

Table 8. Correct Instructions on Antibiotic Administration

Measurements		Percentage of Giving Correct Instructions				
		Daydose	Dose Interval	When Taken	Duration	Total Correction
Amoxicilin	M1	6.5	32.4	0.9	25.0	0.9
	M2	99.1	98.1	93.5	100.0	90.7
	M3	56.9	60.2	70.9	82.5	36.2
Cefalexin	M1	1.9	27.8	1.9	23.1	0.9
	M2	96.3	96.3	92.6	91.1	88.9
	M3	28.4	49.5	68.9	68.9	22.5
Ciprofloxacion	M1	60.2	23.1	75.9	38.9	0.0
	M2	99.1	97.2	100.0	96.3	71.2
	M3	94.1	69.9	21.4	76.7	18.6

Before the intervention the percentage of health workers giving correct items of administration on all three drugs varied greatly, with the two most commonly used, Amoxicillin and Cefalexin having the lowest rates of correct items. Especially regarding the dailydose and the duration of treatment (6.5% and 25% for Amoxicillin; 1.9% and 23.1% for Cefalexin). Meanwhile these two items are the key factors to contain resistance if followed correctly. Total correction of the instruction was an alarming indicator, for Amoxicillin and Cefalexin, only one of the health workers gave correctly all four items of administration and none of them did for Ciprofloxacin. The reasons might be that the health workers did pay less their attention to what the guideline recommended because these were included in academic publications and they find these difficult to follow, so continue with their old habits of giving the patients simple instructions as mentioned previously. The problem is likely to be the same in other levels of health system and found that in Goa, from 990 prescriptions 213 of these prescriptions had no details of the duration of treatment. While analysing two hundred prescription slips collected from the patients in rural and urban India, Sharma and Khajuria [34] found that beside taking antimicrobials for viral conditions, inappropriate written instructions for use of drugs, inadequate dose as well as inadequate duration of drug taken were common. The problem also exists in developed countires, assessing the appropriatenees of antimicrobial therapy in Amphia hospital, the Netherlands, Willemsen [35] showed that only 9.4% of the correct antibiotics were used, and some were used incorrectly.

A great change was seen immediately after completing the intervention. The number of health workers giving correct instruction accounted for from more than 90% to 100% by items and from more than 70% to 90% by the total instruction. Three months later the proportion of health workers retained with correct instructions for these drugs was high compared with that before the intervention but there were variations among items of instructions. The proportion of giving totally correct went down considerably for all drugs after three months. The reason was that giving patients instructions of administration in details which could be difficult for the health workers to be familiar. Also they went back to their old habits of easy but insufficient communication with patients as mentioned above "*4 or 2 tablets a day, divided into 2 times*". This is unavoidable in progress of changing habit and reinforces the need for time to be given for continuing education [37].

This study was an educational program, basically using an experiential learning model, provided for community health workers of the studied location aiming to improve the target subjects' knowledge and practical ability regarding antibiotic use that showed effectively from the previous application in the 2010 study and repeated in this study. It is recognized that no one method of assessing and evaluating is enough as a whole or fully [36]. An educational program can create in some extent changes and in this project obvious changes were showed in the quantitative data analyzed above. However to assess the effectiveness of the conceptual framework as a tool for improving knowledge and expertise in antibiotic administration in the studied location it was necessary to know whether motivation for future learning was created by the program. For these reasons the voice of learners (herein the health workers of the study sample) needed to be listened to.

Eighteen focus groups were conducted, one in each of the eighteen health centers. To gain a real feedback on the program that may include positive and negative opinions given by the health workers, participants' identities and name of groups must remain confidential, therefore the findings from these focus groups cannot identify which center the participant was from as well anonymous quotes have been presented. All groups had a great advantage because in this phase a majority of health workers and the researcher were familiar with each other as well with group discussions those conducted in the initial survey. The participants were enthusiastic and willing to say their thoughts. It took around 30 minutes for each discussion and collective agreements were clearly seen in the transcripts. Analysis was done using the four steps as described in the method section and themes are presented in the below.

Addressing to what the participants think about the purpose of the program that they attended most of the health workers acknowledged that it satisfied them and their work. This was evident that knowledge and learning focused on antibiotic use had sunk into oblivion, and the participants' express was

"Having experienced this program it turned out that we are doing our routine work with no caution of adequateness or appropriateness of medicine use."

And

"The contents that the program provided meet with our work at community health level and help to improve our ability to use of antibiotics."

Most participants confirmed that antibiotics have been overused and misused and the need to be enhanced frequently health workers' knowledge of not only antibiotic administration but other medicines and acknowledged this type of program that focused on antibiotic administration was the first one to them

"Overuse and misuse of antibiotics and also several medicines are existing. This learning met things we need, this would have been delivered to grassroots level earlier and not only antibiotics but other health issues... are really needed."

An educational program may be academic and unfocused on specific needs and if so it leads to less effectiveness after completion. When discussing on this, an acknowledgement emerged from all health centers that the program they had experienced suited their work in general and their responsibility in particular. Their expression was unanimous as the followings quotes indicate

"Use of medication in general or use of antibiotics in particular is a routine of our work, the knowledge that the program brings to us is not new but essential to be applied for treatment patients get better."

And

"The contents of this program are practical for our health centers not only for the situation of antibiotic use, but for the practice of medication in general."

The above express of participants demonstrates that the model satisfied the need of community health workers and this by itself made the obvious changes in the health workers' knowledge and practical ability regarding antibiotic administration.

Addressing to the appropriateness of the model, the participants clearly appreciated that it had been delivered in their own workplace, rather than in the traditional large groups in a central location. And again the health workers all agreed that the learning they attended was active and fits with their condition like those seen in the 2010 program

"It was pleased for us… how to say exactly… feeling easy to participate and our learning took place naturally and actively, with no enforcement."

And

"This learning program is very suitable and useful for us - community health workers, firstly to improve our process of patients' exam in here then use antibiotics as well as medicines get safer and more appropriate."

And

"When antibiotic use at the community level becomes more better it will reduce the burden at higher levels."

There are several job titles and different educational levels as showed in the demographic section however whether the program needs for most participants. This aspect was represented as the follow

"I am myself a nurse and some people here and many people in other centers also are nurses, in principle we have no right to decide the treatment or prescribe, but in fact in our shifts or night duties or while doctors absence from centers we have to do and we see this is really helpful."

In fact, there are medical doctors working at these health centers (16 of 18 centers, each has a medical doctor as mentioned in the demographic section) and one argued that reflection to what included in the program depended on person's original education. However, he by himself acknowledged that after many years of giving patients antibiotics the program now played as a recall that make him (and maybe some others who may have the same thinking) had to think again

"On the program for medical doctors we learned all and even deeply, but we have to prescribe antibiotics, just in some cases ,to ensure and to please patients… however, after completing this program we have to rethink… and need to change. Honestly, this program is practical for all of us, easy to acquire and apply for our work."

In contrast, an overwhelming agreement was that what included in the program was close to the situation of community health centers

"The program we experiences are really practical, situational, at school we were all learning about antibiotics and other medicines but general and complex, furthermore we are living and working here, we see these learning contents are very suitable."

No program can be completely suitable for all participants. However in the context of this study underlying these arguments there was an overwhelming support for the type and content of the program. This was asserted by most health workers participated to discussions

"We kept doing our work; we have never heard how it should be done or what should be done."

And

"Some of us in here and other centers were also sent to some training courses on other health topics held by

higher level but honestly, could retain not much and left less impression in our work."

The appropriateness of the model and program was confirmed by almost participants this was expressed by a feeling of safety and confidence, recognized through all discussions and was said

"Learning occurs right in our center makes us feel easy, we all know each other so we feel pleased and especially we can ask if something is not clear, this type of learning is more effective than sitting to learn in other place."

And

"Direct learning, direct discussing like this is truly effective, within us of our center it is easy to talk and listen to each other, get much knowledge and more careful."

Also

"Direct talking to each other like this we can reply on each other, each one gets direct information and reflect immediately on, this is really useful and better than gathering in a classroom."

In fact, some health workers attended other past programs; they also confirmed that they preferred difference in venue for the program. One of the opinions on this was said

"I came to attend some training courses in several times. One thing I can say that it is difficult to pay attention so less acquirement and honestly, in sometimes people were sitting there just a formality."

It is clear that each way of conducting and organizing has both advantages and disadvantages. In the context of the community health workers of the studied location, an on-site educational program like this program appeared to satisfy the participants' desire and was convenient for them.

Looking back to the quantitative data it is clear that patients/clients were given antibiotics with little perception of being rationality and adequateness. Although overall, all joined improvements, and accepted the appropriateness of the program's content it would be worth considering whether peer based, and hence separate educational program should be considered in the future.

It is obviously, some health workers during their service, attended some of training courses and/or learning activities and had got impact on their practice. In contrast, the program of this study was specifically aimed to change practice. Three months after completing the program the feedback on it appeared to be maintaining an effect on the health workers' perception, attitude and working. The impact on the health workers' perception regarding antibiotic use were expressed as

"We already learned medicines and antibiotics as well as, but time has elapsed knowledge will be naturally forgotten, this learning emphasized on antibiotics and provided us prudent use of antibiotics that can be applied for our work."

It is not easy for people to admit their mistakes, herein for health workers to admit their mistakes in professional work particularly those regarding the use of medicines. However, having experience of this program the participants appeared to be brave enough to say

"Having experience this program we do recognize that many conditions do not need antibiotic to treat, and keep using antibiotics for these illness this makes antibiotics to be familiar to bacteria then become less or no effect."

And

"In fact, have to stop giving antibiotics easily for every conditions and use them rationally and appropriately, and when it is necessary to use of an antibiotic we will consider to administer it appropriately with the infection and the patient."

There was a clearer change in the perception of health workers emerged from all groups of discussions that

"When the locals come to us with conditions such as non-infections, common cold and infections caused by viruses without complication we just apply symptomatic treatment and other medicines and in addition we will explain that antibiotics are not necessary for their condition."

Change in the health workers' attitude is strongly confirmed that

"What we learned from this program are very basic but not too complex or academic to remember therefore we can apply whenever we work with patients."

And

"Truly, there are many sources of information about medicines but however, patients listen and believe health workers the most so it is our self not others we can apply what we learned from the program to explain, instruct and persuade patients adequately and clearly on symptomatic treatments if antibiotic is not necessary."

In the quantitative analysis changes in the practical ability of participants were shown clearly. However, the program included a rational process of treatment thus the opinions those participants raised from all discussions about their action in working with patients were considered, otherwise the way they carry out their medical examinations and treatment was said to be

"It was an usual before we did patients' exam and give treatment but after this program we apply the steps of the process of rational treatment and see that this is very useful and rational to give the patient a suitable treatment matches with treatment objectives and get an effective outcome."

More precisely this was said that

"After this program we spend more time on giving patients adequate instructions on administration of antibiotic as well as medicine and more detailed explanations."

In addition to confidence for working, the participants were also explained it was important that they evaluated both the format of the study day and the contents. They needed to say honestly what they thought otherwise a program could be developed that would not meet their needs. They were assured that their comments would be respected, that no information would be reported to outside the group management and that they would not be identifiable in any report. Also, as with the first interviews, they could choose not to participate.

This was a very different approach, with its emphasis on small group learning, and sharing knowledge and expertise

"The way of learning in this program is practical, within small group learning it is easier for problems to be opened and exchanged properly, and then all staffs get

specific lessons and experiences on antibiotic administration. This was absent in previous time."

The issue of retention is crucial, as this participant pointed out with learning by rote or a purely lecture system the learner is outside the situation. Information is passively given and there is no engagement between the individual and the subject. In health care situations such as the community, this is dangerous, on paper the worker has attended an appropriate course, but without involvement and internalization the knowledge is not retained.

Another aim of this program was to introduce participants to the concept of continuing professional education (CDM) and continuing medical education (CME). These educational approaches which are well known and accepted in many developed countries are new for Vietnam. The approach used to deliver the courses, based on the characteristics of adult learning and experiential learning also seemed to be new to the community workers who described it as a model where learning was based on sharing, and that each person has to contribute

"Having participated this program we realized that this is an useful way in which knowledge is delivered practically, communicating from this person to other one and vice versa give more effectiveness, and the most importance is we get right things and new knowledge from concrete experiences of ourselves."

Interestingly, a comparison this program with the health workers basic education raised from many participants that

"We learned many lessons in medical schools and they were quite theoretical but our working is different, it is a reality and not easy to apply theory to practice because it doesn't fit with any mold. This program gives us a practical way."

And

"This program gave us an useful way of learning, with this way of learning we can do our self-learning and learning from each other from now."

The results of this program were more positive than had been expected. It had been hoped that participants would see the benefits of the course offered, but that they had been so quick to accept the principles behind the approach, was a bonus. It had been thought that once they saw the benefits they would find it helpful, but all the groups were adamant that they saw this as a way of ongoing education and training

"With the way of learning of this program we have an opportunity to exchange to each other in our center, about a certain patient or any patient and so on then learning experience from successful cases even from failure, from then everyone can apply [knowledge] to similar cases. It can be said discussing and sharing are very helpful."

The program has also given community health worker a belief in themselves of what they learned those they had not had previously

"We believe that you do not need to persuade us, in the next time we will apply what we learned from this program to similar cases, it means we will work this way for patients."

This commitment to independent learning is in direct contradiction to the passivity shown in the initial focus groups, where there was no suggestion of self-directed learning, but instead an acceptance that they did not have the knowledge they need. It was seen as important to explore whether this was just an immediate reaction to the changed approach to learning, or whether the workers felt able to sustain it if no further similar courses were available in the near future. It was confirmed that

"If you don't come back, I think everybody in here are still active not only in acquiring information of drug use but also in continuing our learning followed up this program."

Although the focus of the course had been on antibiotic administration, as part of this an emphasis was placed on the role of the professional, and the responsibility the role brings with it. The participants had readily accepted this and with it came a commitment to carry on using the format from the program to provide a basis to continue their learning

"Having experienced this training course we recognized that we need to be assertive in gaining knowledge, in professional terms, it gives us a foundation to build on to solve problems for the next time, it means we have a framework to follow."

This is a major change, and whilst it was hoped that participants would begin to think about future learning, their response was more positive than expected. It is accepted that they will need support to maintain their motivation and enthusiasm, and one of the best ways to do this is through encouraging them to support each other

"In here the grassroots level we have a little access to many sources, however through this program we can do our learning based on direct dialogue, discussions, sharing and getting support and help for each other, from these activities we are able to upgrade our awareness."

The reflective element of the model had helped them to review the way they worked, and they were clear that prior to this course their work had been formulaic. They tended to use the same antibiotics without thinking about them and without thinking deeply about individual cases. The participants now saw the importance of considering evidences before giving the locals antibiotics

"From this program we learned a way of working that is any decision on treatment patients and use of medicines must be based scientific evidences to avoid mistakes and follow a rational process."

It is clear that not only was the program accepted by the health workers, but seen by themselves as a new, active way to learn and to work with each other. Although there were differences in the voice or verbalization compared with those seen in the 2010 study) it is recognized in some what a similarity in the meaning of themes from this stud. This again confirms the effectiveness and stability of the program and model.

Combination the results seen in the quantitative data set with what were said in discussions. It showed clearly there was a good impact on the health workers of the study sample. However to retain this impact it needs reinforcement.

To contain antibiotic resistance and to improve judicious use of antibiotics multifaceted strategies are necessary [38]. The opinions above fit with large scale national and international strategies and need more powerful resources than are currently available. However the health workers with their responsibility in their health centers where the first contacts taken place can play a

crucial role as a channel of communication to pass on knowledge and information to clients/patients.

5. Conclusion and Recommendation

The program worked well within the study location. It received the approval of both leaders of the local health system and the health workers at the community level. There are a little difference in the manpower structure and the educated level of the health workers within the study location at the time of the intervention in comparison with the studied district in 2010 these differences were 16 of 18 centers have a medical doctor and there were nurses and midwives at bachelor and college levels. However, the health workers were still mainly educated at the secondary level for professional (79 of 108 health workers equal to 73% of the total). Assessments taken immediately before conducting the learning model indicated that misunderstandings, misperceptions and inappropriate practice regarding antibiotic use were still in existence among the community health workers.

This interventional program based on experiential learning with some modifications made to fit the model to the Vietnamese context did lead to considerable improvement regarding knowledge about antibiotic use among the health workers in the community. A follow-up assessment revealed that these improvements were not only seen immediately after the learning model but also seen in three months after completion the intervention when the second post course assessment was carried out.
The evaluation from the repeat questionnaires indicated positive changes in both the perception and the practical ability of the health workers regarding antibiotic use. The overall mean scores immediate after the intervention and three months later were about 97 and 83 points respectively compared with about 55 points before the learning program (p values of 0.001). Changes in correct perception and rational use of antibiotic were varied in different indicators but overall clearly showed an improvement. In addition, as a result of participating in the program the health workers have learned a different and more appropriate method for professionals to use when examining patients and prescribing appropriate treatment.

Analysis of the group discussions revealed that it appeared that this learning model met the health workers' expectation, was seen as appropriate and made a strong impact on the health workers. The model was acknowledged by the health workers as an effective and practical way of working and learning and gave them self-confidence for their ongoing development. However, the quantitative results seen in the measurements after three months and emerged from discussions showed a need for further support regarding knowledge and skills in medicine use and in working with patients/clients.

Combination of the quantitative and qualitative sets of data proved that this learning model achieved the expected purposes in the appropriateness, the improvements in knowledge and practical ability regarding antibiotic use among the community health workers of the study, and the ability to transfer to the other community health centers of local healthcare system.

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