Community Health Worker Competency in Managing Acute Respiratory Infections of Childhood in Bolivia[1]

PAUL S. ZEITZ,[2] LEE H. HARRISON,[2] MIRIAM LÓPEZ,[3] & GUIDO CORNALE[4]

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A competency-based training and evaluation method was developed to improve and assess the management of acute respiratory infections (ARI) in young children by community health workers (CHWs) in Bolivia. This method was used to evaluate three groups of Bolivian CHWs, provide them with a one-day refresher course in ARI management, and assess the effects of the course. The results showed the CHWs capable of acquiring the skills needed to effectively manage ARI cases in accordance with the World Health Organization's ARI case management strategy. It was found important, however, that their training emphasize how to count the respirations of children with tachypnea and how to identify chest indrawing. In general, the competency-based methods appeared to be effective in training and evaluating CHWs in the area of ARI case management; it is expected that these methods will prove useful in other community-based health interventions.

Acute respiratory infections (ARI) are a leading cause of death among children in developing countries, accounting for an estimated annual toll worldwide of 4 million deaths among children under 5 years of age (1, 2).

The World Health Organization (WHO) has developed a case management strategy to combat childhood ARI (3, 4). Patients judged to have the common cold are not treated with antibiotics. Children with pneumonia are treated with either parenteral or oral antibiotics, depending on the severity of the case. The guidelines for dealing with pneumonia define community health worker (CHW) tasks with respect to history taking, physical assessment, illness classification, treatment, follow-up, and registration of case information.

In Bolivia, ARI are considered the second most common cause of childhood mortality (5). More specifically, it is estimated that during the first 5 years of life ARI account for some 172 deaths per 1 000 live births—one of the highest levels of ARI mortality in the Americas.

Bolivia's ARI program has adopted the current WHO guidelines (revised by WHO

in early 1990) with several modifications, the most significant being the use by health workers of two age-specific respiratory rates for identifying tachypnea, as opposed to the three recommended by WHO. This ARI program recognizes the importance of utilizing CHWs without medical training for health care delivery because of the country's large and dispersed rural population with limited access to health facilities.

It is also true, however, that appropriate implementation of the modified technical guidelines requires more sophisticated CHW skills than most other community-level health interventions; and until now there has been limited information available regarding the ability of CHWs to master these guidelines.

Within this context, a competency-based training approach can be used to identify the component tasks of specific skills. Such an approach typically identifies such component tasks and emphasizes extensive practice of prioritized skills while keeping the teaching of the subject's theoretical aspects to a minimum. Competency-based training is usually brief, and new skills can be taught readily in refresher courses, making it a practical and financially feasible approach for health programs that utilize CHWs (6–10). Competency-based methods can also be used to measure the impact of training and to measure competency over time.

The aims of the work reported here were (1) to evaluate the ability of CHWs to acquire the skills needed to manage children with ARI, (2) to determine the impact of a one-day competency-based refresher course, and (3) to develop methods for evaluating the competency of CHWs.

METHODS

The study utilized a simple method to train CHWs in use of the Bolivian-modified WHO ARI case management guidelines and to evaluate their competency. Three groups of CHWs that had been previously trained with the WHO guidelines were chosen by the Bolivian Ministry of Health for this study. Random selection of these CHW groups was not practical. The particular groups chosen were selected because of the high rates of ARI-associated childhood morbidity and mortality in the areas they served and because of their cultural and linguistic diversity. All three groups came from areas where health care was provided by private nongovernmental organizations.

The members of two groups (those belonging to the Proandes and Jesús María organizations) had received between 1 and 2 weeks of training in the preceding year that covered both the outdated WHO ARI case management guidelines and other health interventions such as childhood immunization. Members of the third (Plan Altiplano) CHW group had received two or three ARI-specific courses using the Bolivian-modified WHO guidelines during the preceding 6 months. Routine supervision of all the CHWs, provided by the sponsoring nongovernmental organizations, was not assessed in this study.

The tasks required to competently use the WHO ARI guidelines, which were stressed in the refresher course and evaluations (11), were grouped under the following headings: (1) history taking, with an emphasis on the danger signs specified by WHO; (2) physical evaluation, with an emphasis on counting respirations and recognizing chest indrawing and danger signs; (3) disease classification; (4) assignment of a treatment site (home versus health facility); (5) use of medications (such as cotrimoxazole and aspirin) and traditional remedies; (6) education of mothers about appropriate home therapy; (7) patient follow-up; and (8) record keeping.

Before receiving the refresher course, all the CHWs were evaluated in order to determine their ability to perform the technical tasks required for appropriate implementation of the Bolivian ARI case management protocol. Basic personal information collected on each CHW before the refresher course included demographic and personal data regarding the CHW's education, prior health care experience, previous training, and literacy.

Literacy was evaluated using an index card with three lines in Spanish. The first line showed a series of letters, the second a group of words, and the third a simple sentence. Each CHW was handed a literacy card upside down and then asked to read each line. A point was given for turning the card right-side up and for the correct reading of each line.

The ability of CHWs to count was assessed because determination of a patient's respiratory rate is a crucial component of the WHO pneumonia case management guidelines. CHWs were given a sheet of paper displaying between 60 and 70 figures and were given a maximum of 2 minutes to determine the number of figures. Those CHWs giving the correct number scored 4, those off by plus or minus 1 scored 3, those off by plus or minus 2 scored 2, those off by plus or minus 3 scored 1, and those off by more than 3 scored 0. Each CHW was also given four simple multiplication problems to perform and received one point for each correct answer.

In addition, a questionnaire was administered before the refresher course to assess CHW knowledge of the various tasks involved as well as CHW attitudes and practices related to their ability to carry out the case management protocol. As described below, portions of this questionnaire were also used in the postcourse evaluation.

Within the context of the study, upper respiratory infection (URI) was defined as the common cold. Pneumonia was defined as tachypnea (≥ 60 respirations per minute for children under 12 months old and ≥ 50 respirations per minute for children 12–59 months old) with no chest indrawing. Severe pneumonia was defined as the presence of chest indrawing regardless of the respiratory rate, although all severe pneumonia cases used in this study were also tachypneic.

Treatment guidelines used in Bolivia are consistent with WHO ARI case management guidelines. URI is treated in the household without antibiotics. Pneumonia is treated in the household with antibiotics. Severe pneumonia is treated initially in the household with antibiotics and is then referred immediately to more highly trained medical personnel.

The ARI Refresher Course

A competency-based training method that emphasized the task categories was employed to develop the ARI refresher course. The results of the precourse evaluation were used to develop a refresher course for each group, this course being given 2 to 4 weeks after the precourse evaluation.

Each refresher course lasted 1 day and was given in a single 8-hour period. Those CHWs taking the course were divided into groups of three to five, and each group followed a predetermined training schedule. According to this schedule, each group worked for 30 to 45 minutes at one of five or six stations where instructors taught a single topic, after which the group would rotate to the next station. The instructors were physicians, nurses, and auxiliary health workers who were routinely involved with training CHWs in ARI management.

Instruction in basic skills was emphasized during the first 4 hours of the course, while during the last 4 hours training

Above: One of the authors (Dr. Miriam López) introducing the refresher course to the Proandes CHWs. Below: Plan Altiplano CHWs following their training.

techniques such as role playing and problem solving were used to reinforce the most important basic skills. Individual trainer-trainee interaction was maximized using this approach, which permitted rapid identification and correction of individual weaknesses.

CHW Competency-Based Evaluation

The postcourse evaluation was carried out in 2 hours on the day after the refresher course. Only data on CHWs who were present for both the precourse and postcourse evaluations were included in this part of the analysis. The techniques described below, designed to obtain a thorough understanding of CHW competency, had also been incorporated into the refresher course as training tools. CHWs were evaluated individually before and after the course, during which CHW interaction was minimized.

Role-play Evaluation

Role-play simulation of mothers with pneumonia-afflicted children, the children being represented by dolls, was used to evaluate the CHW's ability to carry out the most crucial diagnostic and therapeutic tasks of the ARI case management protocol. To keep variation from one actor to another from affecting CHW responses, one actor was trained for each case simulated. The appropriate use of each essential skill was scored.

Problem-solving Evaluation

ARI cases were described orally. The CHW was asked to indicate the appropriate tasks required for correct history taking, physical assessment, classification, and treatment.

Case Evaluation of Videotaped Cases

The CHW was asked to count respirations, identify chest retractions, classify disease, and specify a treatment plan using modules from a WHO ARI videotape. The videotape showed children with upper respiratory infection (URI) and severe pneumonia. The respiratory rate counted had to be within plus or minus 10% of the actual rate to be considered correct. The CHWs counted respirations using the timing mechanisms recommended by each respective sponsoring organization for this evaluation, either a timer or a watch.

Information System Evaluation

The CHWs were given two case histories and asked to record all of the information required by their program on a standard form. A revised form incorporating modifications for improving the information system had been introduced in each refresher course, and the postcourse evaluation required that the CHWs record all information using the revised form.

Medication Evaluation

The CHWs were given case histories of children with different types of ARI and asked to state the appropriate drugs needed, as well as each drug's dosage, duration, and route of administration. The evaluation focused on the use of cotrimoxazole and aspirin, which were the drugs recommended in the national ARI program guidelines at the time of this study.

To evaluate the impact of the refresher course, scores were developed in each of the various task categories. For this purpose, variables selected from the different evaluation instruments were used to compile scores. For example, the physical

evaluation score included variables from the problem-solving competency evaluation that assessed the CHW's intention to count respirations, check for chest retractions, determine temperature, and look for danger signs. Each variable was assigned one point; the actual score expressed the CHW's number of points as a percentage of the total possible points. Hypothetically, for example, a total of 6 correct variables out of 15 variables evaluated would yield a score of 40%. The sample size varied in the different task categories because the evaluation instruments were not uniformly applied within each CHW group.

A knowledge score was derived from selected KAP (knowledge, attitudes, and practices) survey variables. These dependent variables were correlated with a 0.78 Cronbach's alpha coefficient, reflecting a strong correlation among variables that allows for a joint analysis (12).

Statistical Assessment

The data were analyzed using the chi-square test and Fisher's exact test for dichotomous variables and Wilcoxon's rank sum test for continuous variables.

RESULTS

Basic features of the three CHW groups are shown in Table 1. Both Quechua-speaking and Aymara-speaking communities were included, as these languages are the mother tongues of 60% of all Bolivians. The Plan Altiplano CHWs were predominantly male and had the highest average age and years of education. The Jesús María CHWs were also predominantly male but tended to be younger. The Proandes CHWs were predominantly female and tended to have fewer years of education than the other groups.

Table 1. Selected CHW characteristics in each of the three groups studied.

| | Nongovernmental organizations | | |
	Plan Altiplano	Proandes	Jesús María
Community served	Tambillo	Mizque	Anzaldo
Province	La Paz	Cochabamba	Cochabamba
No. CHWs evaluated, precourse	31	28	21
No. CHWs evaluated, postcourse	24	22	18
% males	90	39	76
% married	87	14	29
Average education (years)	7.2	4.7	6.3
Average age (years)	34	23	25
Languages	Aymara/Spanish	Quechua/Spanish	Quechua/Spanish
% literate	94	96	100
% able to count	90	85	82
% able to multiply	52	52	61
Occupation:			
% agriculture	87	54	86
% housework	13	28	5
% other	—	18	9
Program emphasis	ARI	Integrated	Integrated
Prior training in outdated versus current WHO guidelines	Current	Outdated	Outdated

Small group training and individual evaluation. Above: Plan Antiplano CHWs studying the use of an ARI case management information system. Center: A group of CHWs using timers and videotaped cases to count respirations and identify chest retractions. Below: A study worker conducting postcourse evaluation of a Proandes CHW.

In general, the CHWs spent most of their time doing agricultural labor or housework and were not compensated for their CHW activities. Over four-fifths of the members of all three groups were literate and able to count.

Eighty CHWs participated in the baseline (precourse) evaluation, and 64 (80%) of these took the refresher course and participated in the postcourse evaluation. Personal reasons accounted for the attrition between the two evaluations. No significant differences in demographic or personal characteristics were found between those who dropped out and those who participated in both evaluations. An average of 88% (ranging from 71% to 100% for the three groups) had received formalized ARI training during the previous year. Only 59% (in a range of 48% to 74% for the three groups) reported having evaluated a case of ARI during the month preceding the study.

Figure 1 shows the immediate impact of the refresher course on the 64 CHWs who went through both evaluations. De-spite their previous ARI training, the precourse evaluation showed most of the CHWs to be deficient in many of the skills needed to correctly manage children with ARI. For example, the mean score for identification of danger signs was only 10%, and the mean score for knowing the correct treatment of ARI cases was only 34%.

The average scores of the CHWs demonstrated substantial improvement between the precourse and postcourse evaluations. Because the pattern of improvement was very similar for all three CHW groups, the results are presented in aggregate. Statistically significant improvements were seen in certain key skills—including identification of danger signs, ARI classification, ARI treatment, and knowledge of how to use cotrimoxazole. The average score for classification of ARI improved from 60% to 83%, while the average score for ARI treatment rose from 34% to 76%.

Results from the postcourse evaluation were also used to see whether there was

Figure 1. Average scores (expressed as percentages) of the CHWs in different task categories before and after the refresher course, showing the effect of the course. The number of CHWs tested in each category is shown above the appropriate columns. All of the precourse and postcourse differences charted were found to be statistically significant (p < 0.005).
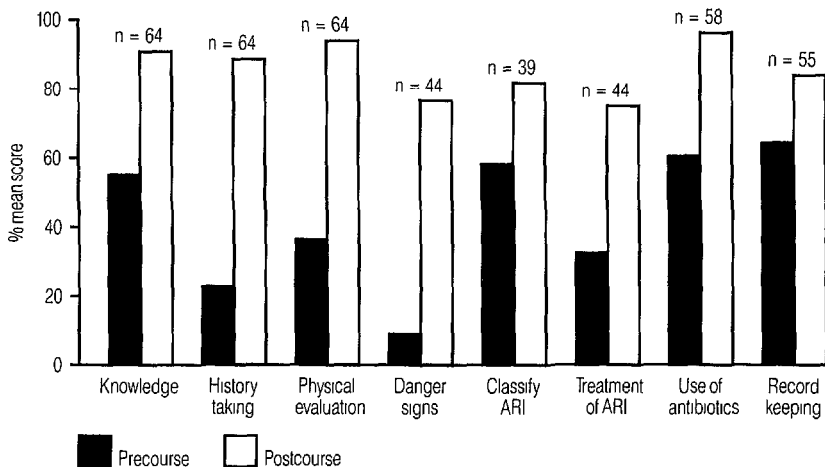
any correlation between health worker performance and any of the measured demographic and personal characteristics. No consistent patterns of deficient performance were found to be correlated with any of these characteristics.

The ability to correctly classify and treat children with ARI after the refresher course was stratified by ARI type. With respect to URI, 94% of 60 cases were correctly classified and 84% of 54 cases were correctly treated. With respect to severe pneumonia, 84% of 54 cases were correctly classified and 86% of 55 cases were correctly treated.

As noted above, videotaped cases of ARI were used after the refresher course to evaluate the CHWs' ability to count respirations, identify chest retractions, classify a case, and specify a treatment plan. Twelve CHWs from the Plan Altiplano group were each asked to evaluate one URI case. All 12 CHWs accurately counted respirations, correctly identified the lack of chest indrawing, and knew the appropriate treatment.

Each CHW assessed two or three different cases of children with severe pneumonia on video after the refresher course, for a total of 138 evaluations. Of these, 68% (94 of 138) were correctly classified. CHWs correctly counted the respiratory rate 37% of the time (in 51 of the 138 cases) and recognized chest indrawing 80% of the time (in 110 of the 138 cases). Eighty percent (88 of 110) of the cases where chest indrawing was recognized were correctly classified, as compared to only 21% (6 of 28) of the cases where chest indrawing was missed ($p = 0.0000006$).

DISCUSSION AND CONCLUSIONS

The significant impact of our one-day refresher course indicates that competency-based methods are useful for training CHWs to provide ARI case management. The major advantage of this method is its relative brevity and its focus on the essential tasks required. The competencies to be examined in this study were identified by determining which skills were most important for the achievement of ARI program goals (namely, reductions in pneumonia-related mortality and the inappropriate use of antibiotics for children with URI). Other aims of the ARI program with lower priority (such as the treatment of otitis) were not included in this study because of the concern that their inclusion might compromise learning of the more important skills.

This study also demonstrated the usefulness of competency-based methods for evaluating CHWs. These methods provide an objective way of assessing CHW capabilities over time. We chose a combination of several simulation methods for both training and evaluation of CHWs because we believed that no single method would be sufficient. Although the use of actual children with different types of ARI would have been ideal, this was not feasible in our setting. We also believe that showing videotaped cases is important in settings like ours, where actual cases are not available. These evaluation methods can be used to monitor CHW competency to implement the ARI case management protocol.

The results showed that after taking the one-day refresher course, the CHWs were able to absorb most of the information needed to competently implement the WHO ARI case management protocol, most of them being able to correctly classify and treat the different types of ARI. Their ability to correctly count respirations and classify the illnesses of children with URI is encouraging and suggests that CHWs are technically capable of reducing the inappropriate use of antibiotics. Their ability to correctly classify most of the severe pneumonia

cases suggests that CHWs may be able to contribute to reduction of ARI-related mortality. This latter idea is supported by previous intervention studies demonstrating reduced mortality in special study areas where CHWs applied the WHO guidelines (13–16).

In addition to these positive findings, the study identified several CHW limitations that persisted after the refresher course. Although most of the CHWs were able to correctly count the respiratory rates of children with URI, they had difficulty counting the rates of children with tachypnea. This finding suggests that the training should stress the ability to count the respiratory rates of rapidly respiring children. Also, approximately one-third of the severe pneumonia cases were misclassified, principally through failure to recognize chest indrawing. This indicates that identification of chest indrawing must be heavily emphasized during CHW training. Additional improvement is also needed in recognizing danger signs and knowing the appropriate treatment to provide for children with ARI.

Although no correlation was found between health worker performance and any of the personal or demographic characteristics assessed, it should be noted that no analysis of potential confounding variables was performed. Also, because nearly all the CHWs were literate, we were unable to evaluate a possible correlation of literacy with competency. In addition, use of some of the same cases in the precourse and postcourse evaluations could have meant that the improvement following the course was due to learning the cases as opposed to learning the guidelines. However, the CHWs were exposed to multiple cases during training, and there was a time lapse of at least 2 weeks between the two evaluations. Moreover, the CHWs were not given the correct answers to the precourse evaluation cases and were unaware of how they were being evaluated. Although this study suggests that a one-day competency-based refresher course is adequate, the content and duration of the CHWs' initial training was not addressed. Random selection of CHWs was not employed, although we believe that the groups chosen were representative of Quechua and Aymara CHWs in Bolivia. Finally, this study did not address how CHWs actually performed in the community.

Other studies are needed to establish how well knowledge and skills are retained over time; the appropriate frequency for refresher courses; the appropriate content and frequency of supervisory visits; and whether training can improve the ability of CHWs to correctly count the respiratory rates of children with tachypnea. In addition, the matter of whether these methods can be adapted to train CHWs in several health interventions during a single course should be determined.

The reliance of many developing countries on a large number of relatively unsophisticated health workers to diagnose and treat children with ARI underscores the need to use relatively brief but highly focused competency-based methods for training and evaluation. Although we focused on ARI, the methods described could be appropriate for improving CHW competence, and hence helping to ensure quality, in the delivery of other community-based health care interventions.

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