EDUCATION FOR HEALTH

ORIGINAL RESEARCH PAPER

Strengthening Immunization in a West African Country: Mali

JB Milstien[1], M Tapia[1], SO Sow[2], L Keita[2], K Kotloff[1]

[1]*University of Maryland School of Medicine, Baltimore, MD, USA*

[2]*Centre pour les vaccins en development, Bamako, Mali*

Published: *22 October 2007*

Milstien JB, Tapia M, Sow SO, Keita L, Kotloff K

Strengthening Immunization in a West African Country: Mali
***Education for Health*, Volume 20, Special Section on Poverty and Human Development**

Available from: http://www.educationforhealth.net/

ABSTRACT

Objectives and context: This paper describes the preliminary outcomes of a collaborative capacity-building initiative performed in Mali to strengthen the immunization program.

Methods: We conducted baseline assessments, training and post-training assessments in four programmatic areas: vaccine management, immunization safety, surveillance, and vaccine coverage, using adapted World Health Organization (WHO) tools. Impact assessment was done by evaluation of trainee performance, programmatic impact and sustainability.

Results: Qualitative and quantitative improvement of trainee performance was seen after the training interventions: some knowledge improvement, greater compliance with vaccine management practices and improved vaccine coverage. Deficiencies in information transfer to the periphery were identified.

Conclusions: The program involves shared responsibility for planning, implementation and financing with national stakeholders while emphasizing the training of leaders and managers to ensure sustainability. Although short-term gains were measured, our initial assessments indicate that sustained impact will require improvements in staffing, financing and guidelines to ensure delivery of information and skills to the periphery.

Keywords: capacity building, indicators, sustainability, vaccine coverage, cold chain, immunization safety

Objectives and context

Mali is a large country in West Africa, with a population of 13.4M and is one of the poorest countries in the world. Mali has a GNP/capita of $240 and 4.3% of this is spent on health, which is around $11/person/year (Global Alliance for Vaccines and Immunization, 2006b). Vaccine delivery is achieved through a hierarchical infrastructure, with nine regions, 58 districts, and approximately 650 primary health centers. Since 2005, some support for immunization activities has come from the Global Alliance for Vaccines and Immunization Vaccine Fund (GAVI) and by 2010 this will total about $26.6M (Global Alliance for Vaccines and Immunization, 2006a). In 2000, prior to receiving GAVI support, the Malian government spent $2M annually on routine immunization activities and $2.3M on supplementary immunization activities. Currently, annual routine immunization spending has more than doubled to $4.8M (World Health Organization, 2006). Government figures show a steady increase in immunization coverage of 74% in 2002.

The *Centre pour le Développement des Vaccins* in Mali (CVD-Mali), a collaboration between the Ministry of Health (MOH) in Mali and the Center for Vaccine Development at the University of Maryland School of Medicine, is situated within the *Centre National d'Appui à la Lutte contre la Maladie* in Bamako and it works closely with the national immunization program (NIP). With the support of the Merck Vaccine Network in Africa (MVN-A), CVD-Mali initiated a four-year training program in 2003 targeting mid- and high-level NIP managers who could improve all aspects of immunization delivery. The subsequent decision to introduce routine *Haemophilus influenzae* type b vaccination into the Malian NIP provided an opportunity for the training. The MNV-A program applies a capacity-building approach and the principles of adult learning in five steps: 1) needs assessment at all levels; 2) setting training goals with major stakeholders; 3) development of the training intervention; 4) implementation of this intervention; and 5) assessment of impact against indicators.

Methods: Project planning

A Technical Advisory Group (TAG) for the project includes officials of the MOH, other Malian health institutions, representatives of the community and major immunization partners, including WHO. Personnel from the NIP played a major role in project planning and implementation.

Baseline and post-training assessment methodology and tools

For these assessments, the country was divided into three geographic/climatic zones (desert, sahelian/savannah and sudano/sahelian) plus Bamako, the capital city, where 10% of the population resides. In each zone, a region and a district within this region were selected that were both accessible and also reported low immunization coverage relative to other parts of the zone. Community health centers were identified with the highest and lowest immunization coverage in each selected district. Between February 2004 and October 2005 baseline assessments of immunization performance were done at a total of 20 sites at national, sub-national and service levels. To measure program impact, the assessments were repeated in Bamako in 2006, one year after completion of training (five sites) and are planned for the other regions as training is completed.

accine management assessments used the WHO vaccine management assessment tool (World Health Organization, 2003a), which measures achievement in 11 areas through specific indicators, as shown in Table 1.

Table 1: Vaccine management assessment performance level: overall results for assessed areas in Mali before training intervention (shaded elements are discussed in the text)

	Facility level		
Assessment subject	**National**	**Sub-national**	**Service**
Vaccine arrival process	90	NA	NA
Storage temperature	58	56	67
Cold chain capacity	88	73	100
Equipment	83	65	55
Maintenance	61	59	90
Stock management	73	60	56
Vaccine delivery	51	40	44
Diluents	50	34	69
Vaccine vial monitors	91	85	64
Multi-dose vial policy	100	93	97
Vaccine wastage	60	48	25

Immunization safety assessments used a modification of a WHO tool (World Health Organization, 2001a) to document policies, practices and implementation through site visits. Disease surveillance assessments focusing on detection and reporting of cases of measles, meningitis, yellow fever and acute flaccid paralysis used a tool based on WHO surveillance documents (World Health Organization, 2001b). The Expanded Programme on Immunization cluster survey (Hoshaw-Woodard, 2001) technique was modified to include all 12- to 23-month old toddlers in each village surveyed and intensive house-to-house coverage surveys were done in eight villages in the ten health center areas assessed.

The assessment of the impact of the training activity used three separate types of evaluation: 1) evaluation of the pre- and post-training performance of trainees; 2) evaluation of impact on the immunization program; and 3) assessment of sustainability. To assess trainee performance, the following four indicators were used: performance on identical pre- and post-tests administered before and after the training; facilitator observation of training and presentation skills; understanding of concepts through class performance and group work; and supervisory skills. The pre- and post-tests used a standard written test developed by WHO's African Region which included 25 questions covering all training modules except supervision.

The assessment of a programmatic impact, in Bamako only, involved repeating the initial program assessments of vaccine management, immunization safety, surveillance activities and vaccine coverage using the same assessment tools compared to baseline. Coverage with the third dose of diphtheria-tetanus-pertussis vaccine (DTP3), defined as proportion of children <1 year old receiving DTP3 as documented either by vaccination card or by mother's report and measured when children reached 12-23 months of age, was compared with the baseline measurements. The impact of supportive supervision (see below) was assessed using a standard checklist that was completed during health center visits so the immunization process could be directly observed.

The third impact measure was an assessment of the potential sustainability of the program using three indicators as outlined in the Towards Unity for Health (TUFH) principles (TUFH, 2006): stakeholder involvement, training of leaders and sharing responsibilities.

Training program

The baseline assessments formed the basis for curriculum development adapted from WHO's Training of Midlevel Managers and specific training modules in vaccine management, surveillance, monitoring and micro-planning and immunization safety. For example, for vaccine management, the areas of vaccine storage temperatures, delivery, diluents and wastage were specifically targeted because of assessment results in Table 1. Training was delivered through interactive adult learning activities, including practicums in which trainees were divided into randomly assigned groups who were to complete exercises, case studies and give formal presentations as well.

This training program was targeted at national, regional and district level staff. It followed a seven-day curriculum; five days on technical areas and a two-day module on supportive supervision, which employed supervisory techniques, planning and implementation of a supervisory field visit to provide on-the-job training. Its purpose was to train regional and national level staff in supervisory skills and in the training of these skills and also to train district level staff to perform supportive supervision at the peripheral level. This was done because previous experience in immunization training in Africa had suggested that off-site training at this level was ineffective in communicating new concepts (World Health Organization African Regional Office, 2003).

Upon completion of their training, district level staff in Bamako performed supportive supervision in their respective districts, using a checklist of approximately 80 indicators in 11 areas and an abbreviated curriculum module based on the nine-volume module used in the training for higher-level staff. The introduction of the new vaccine was the particular focus.

Results

The results of the impact assessment are summarized in table 2.

Table 2: Summary of results by indicators of training intervention

Target Outcome	Assessment Methods	Results
Trainee Performance	Pre- and post-tests Presentations Understanding of concepts Supervisory skills	Mean improvement 7.5-14% Improved clarity and quality Mastery demonstrated as required to follow course sequence Basic skills mastered
Immunization Program Improvement	Pre- and post-vaccine coverage level Formal assessments using WHO tools Evaluation of supervisory training through protocol/checklist	Increase of up to 20% in coverage levels Improvement in key indicators at sub-national and service level Some key points not covered, with weakness at service delivery level
Sustainability	Stakeholder involvement Training of managers and leaders Sharing of management/ financing/development	Yes Yes Yes

Evaluation of performance of trainees

Results of trainee performance on the written test from two different regional training courses demonstrated a 7.5-14% increase in scores. A marked improvement was seen in the quality and clarity of the oral presentations as a result of the intervention. Participant presentations indicated at least a basic mastery of the concepts, suggesting that the subject area of the previous units had been mastered, as the units and exercises built on the preceding day's work.

The facilitators' assessments of trainee mastery of the supportive supervision process indicated that participants could develop supervisory plans and observation checklists on specific assigned topics, conduct supervisory visits and report back to the group on the results and planned follow-up.

Evaluation of programmatic impact

Comparison between pre- and post-levels of vaccine coverage. Notable improvements in direct measurements of vaccine coverage were observed (Table 3). In one village, DTP3 vaccine coverage increased by 13% and measles vaccine coverage increased by 18% after training. In the other village, baseline high DTP3 vaccine coverage (90%) was sustained after training, while measles vaccine coverage increased by 10%.

Table 3: Coverage data as determined by survey in 12-23 months old infants in Bamako before and after training intervention

Coverage %		**2004**	**2006**
Lafiabougou	DTP3	90	91
	Measles	74	84
Sebenikoro	DTP3	74	87
	Measles	56	74

Comparison of pre- and post-training assessments for vaccine management, immunization safety and surveillance. These assessments showed changes in key areas. For example, the vaccine management assessment at the sub-national and service levels showed increases, in the four areas of interest (diluents, storage temperatures, vaccine delivery and wastage) noted above, as shown in Table 4, though some scores remained below 50%.

Table 4: Vaccine management at Bamako regional and health center levels before and after training

Assessment Subject	**Bamako regional level**		**Health center level**	
	Pre	Post	Pre	Post
Diluents	50%	100%	50%	75%
Storage temperatures	75%	96%	54%	100%
Vaccine delivery	20%	27%	7%	21%
Wastage	50%	100%	8%	21%

However, even after 24 months, each level lacked written emergency plans and there were large discrepancies in stock inventories between numbers of vaccine vials and their diluents. The injection safety assessments revealed improvements in the stock for injection equipment and in the utilization of incinerators for safe disposal of injection wastes, previously an issue throughout the country. However, at the peripheral level, some unsafe immunization techniques continued to be observed. The surveillance assessments showed that the vast majority of reports were received on time, case definitions were understood and used, and a system of feedback to reporting units was in place. The major deficiency was in laboratory sample collection and transportation.

Evaluation of supervisory training through systematic field visits using a standard protocol. Supervision assessments in three communes in Bamako detected deficiencies in knowledge about the new vaccine being introduced, including its components and storage requirements, how it should be registered in vaccine logs, as well as technical errors in its reconstitution.

Evaluation of program sustainability

Involvement of stakeholders in planning and implementation. The MVN-A program has maintained close ties with the NIP. Its coordinator is a member of the NIP Interagency Coordination Committee (ICC) and the project training officer was designated by the NIP. The TAG includes MOH officials and members of the ICC. Development of the project was a collaboration of this project, NIP staff and the TAG. Thus, on the level of collaboration, this project seems to have done well.

Training of leaders. One indicator of success is that participants identified as strong trainers during the training process have gone on to positions of higher responsibility at regional and national levels. One agent has been released from a regional level post to take over the MVN-A training program, at least two trained regional staff members have moved to positions of greater responsibility at the national level and another two staff members have moved to positions of greater authority at the regional level. This training program is currently delivered by Malian health care professionals, which is another indicator of success.

Sharing of management, financing, and deployment. National staff and partners have not only been involved in planning, but also in the implementation process. Significant support in training has been received from partners such as WHO and USAID for course facilitation and curriculum development. Perhaps the most important evidence of collaboration has been the co-financing of the supervisory training program, partially financed by funds provided to the NIP.

Discussion

Impact assessments

We have developed and implemented a training program for mid and high-level NIP managers in Mali. Although much immunization training relies on ‘training-of-trainer’ concepts, this training program is, to our knowledge, the first one to be implemented in an African country, that has training skills built into the program and that evaluates the ability of trainees to serve as trainers. We have also assessed programmatic impact, although some of the indicators used may not directly measure this. Some of the assessment indicators were subjective, such as those based on observations of trainee performance. Apart from this, indicators which measure changes in the quality of immunization delivery can be influenced at several levels, which makes it difficult to factor out the impact of training. Nonetheless, several objective measures provide good evidence for improvements in performance following training. Participants demonstrated improvements in knowledge when their scores on pre- and post-training

tests were compared. Using a standardized assessment tool, substantial improvements were observed in vaccine management in four targeted areas identified as being deficient in the baseline assessment. Finally, increases in vaccine coverage by 10% or more were measured during coverage surveys. Similar observations for more remote regions of the country would provide a strong basis for optimism.

Long-term project sustainability

More work will be needed to ensure the project's sustainability, but first a home for the project within the NIP is needed. Currently, training is not an integral part of the national immunization plan.

We propose and the TAG strongly recommends that training in immunization and vaccines be incorporated into the basic education program provided for all Malian health professionals. As part of the development of this program, we held pilot training in the nursing school. Since this school is a primary source for Malian immunization staff, new staff knowledge could be significantly improved if these concepts were introduced into their curriculum.

Another issue is financing of supervisory activities. While donors may be willing to support training, few want to support supervision, feeling that this is a national responsibility. Thus, to-date, financing for quarterly supervisory visits to each health center has been limited.

Finally, supervisory activities must be well-planned and well-implemented. Many supervisory programs cover too many topics at a time. We suggest that the supervisors focus first on one or two elements, for example, a policy change, or address a weak practice seen during an assessment.

Acknowledgements

This study/initiative was supported by an unrestricted educational grant from The Merck Company Foundation, the philanthropic arm of Merck & Co., Inc., Whitehouse Station, New Jersey, USA (to KK).

References

Global Alliance for Vaccines and Immunization (2006a). 5 year commitments. Retrieved August 14, 2006, from http://www.gavialliance.org

Global Alliance for Vaccines and Immunization. (2006b) Mali country profile. Retrieved August 14, 2006, from http://www.gavialliance.org/support/what/iss/index.php

Hoshaw-Woodard, S. (2001). Description and comparison of the methods of cluster sampling and lot quality assurance sampling to assess immunization coverage. WHO Immunization, Vaccine and Biologicals Document Centre. Retrieved September 18, 2006, from http://www.who.int/vaccines-documents/DocsPDF01/www592.pdf

World Health Organization (2001a). Immunization Safety. WHO/V&B/01.30 (Annex 2).

World Health Organization (2001b). Pour une surveillance efficace. Module 1. Evaluation rapide de la surveillance des maladies évitables par la vaccination. WHO/V&B/01.08, 2001.

World Health Organization (2003a). Vaccine Management Assessment Tool. Retrieved from http://www.who.int/immunization_standards/en/

World Health Organization (2003b). WHO Vaccine-preventable disease monitoring system. 2003 global summary. P. R-148, WHO/V&B/03.20, 2003.

World Health Organization African Regional Office (2003). Management training course for EPI mid-level managers. Supportive supervision of EPI workers, Module 21. (in French: "Cours de formation en gestion des cadres du PEV."

World Health Organization (2006). Mali, Immunization financing. Retrieved August 14, 2006, from http://www.who.int/immunization_financing/countries/mli/en

g