Published in final edited form as:

Int Health. 2011 December ; 3(4): 240–245. doi:10.1016/j.inhe.2011.08.002.

Integration of deworming into an existing immunization and vitamin A supplementation campaign is a highly effective approach to maximize health benefits with minimal cost in Lao PDR

Giulia Boselli^a, Aya Yajima^a, Padmasiri Eswara Aratchige^b, Keith Feldon^b, Anonh Xeuatvongsa^b, Kongxay Phounphenghach^c, Khampiou Sihakhang^d, Chanthavisouk Chitsavang^b, Sylvianh Phengkeo^b, Albis Francesco Gabrielli^a, Claudio Politi^c, and Antonio Montresor^a

^aDepartment of Control of Neglected Tropical Diseases, World Health Organization, Geneva, Switzerland ^bWorld Health Organization Country Office, Vientiane, Lao People's Democratic Republic ^cNational Immunization Programme, Ministry of Health, Lao People's Democratic Republic ^dMother and Child Health Center, Ministry of Health, Lao People's Democratic Republic ^eDepartment of Immunization, Vaccine and Biologicals, World Health Organization, Geneva , Switzerland

Abstract

Infection with soil-transmitted helminths (STHs) is a major public health problem in many developing countries; pregnant women and children are particularly at risk. Preventive chemotherapy (PC) - the intervention currently recommended by the World Health Organization (WHO) against the main helminth infections, including those caused by STHs - aims at reducing morbidity through periodical administration of anthelmintic drugs either alone or in combination.

The Expanded Programme on Immunization (EPI) is one of the most widely implemented health programmes in the world and has a well-established access to children and women. The present study investigated the cost of the provision of anthelmintic drugs during existing immunization campaigns.

In Lao PDR the use of this integrated approach compared to implementation of the vertical deworming campaign alone allowed reduction of the individual cost of deworming by 10 times (from US\$0.25 in the vertical deworming campaign to US\$0.02 in the integrated campaign). Burden posed on health workers by the integration process was perceived as minimal and manageable. Besides, delivery of anthelmintic drugs during the immunization campaigns enabled

Authors' contributions: All the authors conceived and designed the study; GB conducted the questionnaire survey; GB, PEA, KF, AZ, KP, KS, CC and SP collected the budget data; GB and AY carried out data analysis; GB, AY, AFG, CP and AM interpreted the results of the analysis; GB and AY prepared the draft manuscript, all the authors critically reviewed and gave final approval of the version to be published. AM is the guarantor of the paper.

Conflicts of interest: None declared.

Ethical approval: As the study was carried out as a part of the vaccination campaign, ethical approval was not required. Informed consent was obtained by all the interviewees prior to the questionnaire survey.

campaign teams to directly observe drug intake, which assured safety. Our findings prove that integration is an opportunity to maximize health benefits through the delivery of multiple health products and the attainment of a high coverage.

Keywords

Deworming; immunization; vaccination; integrated campaign; cost-effectiveness; soil-transmitted helminths

Introduction

Soil-transmitted helminths (STHs), commonly known as intestinal worms, afflict more than 2.5 billion people in the world.¹ Infection is caused either through ingestion of eggs in the contaminated soil (*Ascaris lumbricoides*, *Trichuris trichiura* and the hookworm *Ancylostoma duodenale*) or through the penetration of the skin by the larvae in the soil (the hookworms: *Ancylostoma duodenale* and *Necator americanus*). STH infections can adversely affect nutritional status, cause anemia, increase susceptibility to other communicable diseases, worsen iron and vitamin A deficiency and seriously jeopardize the physical and cognitive growth of children. Pregnant women and children are the groups most at risk of morbidity in reason of their increased need of nutrients.²

The health intervention that is currently recommended by the World Health Organization (WHO) against STHs is preventive chemotherapy (PC) that aims at reducing their morbidity through the periodical administration of a tablet of albendazole (ALB) or mebendazole (MBD).³ PC interventions are highly effective, inexpensive, and easy to implement. The World Health Assembly Resolution 54.19 (2001) has urged administration of PC to at least 75% of school-age children (SAC) at risk of morbidity due to STH infections by 2010.⁴

The Expanded Programme on Immunization (EPI), targeting primarily at mothers and children, is one of the most widely implemented health programmes in the world with the most well-established access to these population groups in a significant number of countries, currently reaching over 70% of pre-school age children (pre-SAC) worldwide.⁵ Integration of additional health interventions into immunization campaigns is increasingly recognized as an opportunity to maximize health benefits by achieving high coverage with multiple interventions.⁶ In 2008, over 100 millions pre-SAC received treatment against STH infections through immunization campaigns throughout the world.⁷

Lao People's Democratic Republic (PDR) is a landlocked country in Southeast Asia where only 60% of the population has access to adequate drinking water sources and 48% has access to sanitation facilities.⁸ A recent national survey has shown that the prevalence of STH infections is 41.6% among pre-SAC, (aged 12 months to 5 years) and 62% among SAC (aged 6 to 11 years).⁹ Among children under five years of age in Lao PDR, 48.2% are stunted and 36.4% are underweight for their age.¹⁰ STH infections are recognized as one of the factors contributing to this situation, and consequently the Ministry of Health (MoH) of Lao PDR endorsed the comprehensive National Plan of Action in March 2003 setting the following targets:

Provision of PC with ALB or MBD to:

- children aged 12 to 59 months (through CHD);
- women of child-bearing age (WCBA) aged 15 to 45 years (through CHD);
- to all SAC (through school deworming programmes).

Every year the MoH in Laos PDR organize the Child Health Days (CHD), a campaign to reach children aged 12 to 59 months and women of childbearing age, including pregnant women, with vitamin A and immunization, and since 2007 provision of anthelmintic drugs to children have been integrated into CHD.

For the first time in November 2009 also women of childbearing age, including pregnant women, were offered anthelmintic during CHD.

The 2009 CHD campaign lasts for one week, providing 544,471 pre-SAC (aged 6 to 59 months) with vitamin A capsules, 485,495 pre-SAC (aged 12 to 59 months) with mebendazole, and vaccinating 205,658 pre-SAC (under 5 years of age) with OPV. In addition, 671,349 WCBA was immunized with TT and 654,886 WCBA were provided with mebendazole (Table 1).

The present study aimed at generating evidence on the cost-effectiveness of the integration of STH deworming in the immunization and vitamin A supplementation campaign in Lao PDR. The challenges encountered by health workers in integrating multiple health interventions were also investigated and measures to improve the situation were discussed.

Methods

Costs of deworming 2007 campaign

The cost of the vertical national deworming campaign conducted in 2007 were collected retrospectively by checking on the files of MoH and WHO that was the main provider of funding for deworming and with interviews with MoH's national manager for control of parasitic diseases and with the WHO focal point for control of Neglected Tropical Diseases. In order to facilitate comparison between the 2007 (targeting 650,000 individuals) and the 2009 campaign (targeting 1,140,700 individuals), the 2007 cost have been multiplied by a factor of 1.75.

Coverage 2007 campaign

Data on coverage of the deworming activities were collected by analysing the report for the 2007 campaign.

Data on organization and coverage of the integrated campaign(2009)

The first author interviewed the national EPI manager as well as other staff of the MoH at different administrative levels, and investigated how the integrated campaign was organized and implemented. Data on numbers of children that received the different health products were obtained through registers, that included information generated by forms that were filled in the field.

Estimation of the cost of including deworming to the existing Vitamin A campaign

In 2002, WHO published the guidelines for estimating the cost of the introduction of new vaccines into the national immunization system, in order to help public health officials make an informed decision.¹¹ Considering that this concept is similar to that of integrating different health interventions in the routine immunization system, we adopted the said guidelines to estimate the incremental cost for adding deworming to the existing immunization and vitamin A campaign.

We estimated both the financial and economic incremental costs of introducing deworming into the immunization campaign. Based on WHO (2002), the inputs to assess the *financial costs* were identified as follows: (1) supplies, (2) Drug storage and transport, (3) surveillance and monitoring, and (4) other costs such as training, stationery, and social mobilization.

The *economic cost* associated with the introduction of deworming in the existing campaign was defined as in-kind contribution made by the MoH and time spent by health workers. To estimate such economic cost, information on the type of in-kind contribution made by the MoH and by the health workers, the time spent for each contribution and their monetary values were collected during the same interviews.

Questionnaire survey with health workers and WCBA

In order to investigate the challenges encountered by the implementers of the integrated intervention, questionnaires were delivered to health workers who were distributing drug and vitamin in the integrated campaign. The questionnaires were prepared in English and translated into the local language (Laotian). The first author of the manuscript administered the questionnaires assisted by a translator.

Every day of the campaign, a central team from MOH and WHO visited different villages to provide supervision and support. The villages to be visited were selected partially random, and partially where problems were reported.

The first author accompanied the central team and interviewed the health workers present on the site and a randomly selected sample of the women of child bearing age present on the site to receive the service for themselves or for their children.

Questionnaires for health workers contained 10 questions specifically investigating difficulties encountered in training, transport of material and administration of the different health products.

Questionnaires for WCBA contained 5 questions investigating the services that were received during the integrated campaign and their previous experience in receiving immunization and deworming services.

Health workers and WCBA selected for the administration of the questionnaire were explained the reason of the questionnaire and investigated only after consensus was obtained.

Results

Coverage of 2007 and 2009 campaigns

The estimated coverage of the two campaign was similar, approximately 84%.

Cost of 2007 campaign

The estimated cost of provision of mebendazole through the national deworming campaign implemented in 2007 was US\$150,000. The cost of covering 1,140,700 individuals obtained by applying the multiplication factor of 1.75 was estimated at US\$ 262,558. Details of the different components are presented in Table 1

Additional cost of adding deworming to the 2009 campaign

The additional cost to integrate deworming in the immunization campaign was estimated at US\$ 30,927, which is equivalent to US\$0.03 per dewormed individual.

Supply (tablet) cost—The cost of mebendazole for pre-SAC and WCBA both for the campaigns (2007 and 2009) was estimated at US\$22,808.

Additional cost for drug storage and transport—During the Child Health Day organized in November 2009, a number of health products (i.e. Oral Polio Vaccine, Tetanus Toxoid, vitamin A and mebendazole) were provided in one day at each of the campaign sites located at central, provincial and district hospitals, at local health centers as well as at the outreach posts in the 17 provinces of the country. Vaccines were transported from the MoH's premises in Vientiane to provincial offices and subsequently to district offices and health centres, with refrigerated containers in order not to spoil the vaccines. Vitamin A capsules and mebendazole tablets were transported together by MoH vehicles. Due to the limited volume of the mebendazole its transport did not require additional facilities (stored at central and peripheral level and vehicles).

Additional cost of surveillance and monitoring activities—The same registers used for the vaccination were also used for reporting treatments and potential side effects with anthelmintic drugs. No serious adverse events following administration of mebendazole were reported.

Additional personnel cost—The additional time spent for each child dewormed by a health worker was estimated at 1 minute for pre-SAC and 30 seconds for WCBA. Since 485,495 pre-SAC and 654,886 WCBA were treated, 13,549 additional hours of work were necessary to integrated deworming.

This corresponds to 1,693 working days with a monetary value of US\$ 5080 (US\$3 per day).

Additional cost for supervision, meetings at different levels and social mobilization—The same supervision team was used to provide supervision/support activities. No additional meetings were necessary to discuss deworming nor additional social mobilization was conducted. Therefore no extra costs were reported in these areas.

Additional cost for training—The integrated training on vaccination and administration of vitamin A and anthelmintics was provided to health workers between 19th and 26th October 2009.

The time dedicated to deworming was approximately 30 minutes during the one day seminar. According to the EPI manager, this additional ½ hour did not generate additional financial costs. We evaluated the value of this training time at 3,039 USD corresponding to 1/16 of the total cost of training.

Challenges experienced by health workers in the integrated campaign

30 health workers were interviewed in 7 areas in four provinces: one urban province Vientiane (capital city) and three rural provinces (Khammuane, Savannakhet, and Xieng Khounag).

Four health workers (13%), all from the rural province of Khammuane, reported a difficulty in transport of drugs and materials, while six (20%) reported a complication in providing the multiple health products and this complication resulted in longer waiting time for the people attending CHD. 28 individuals received a training on integration of deworming and vaccination, only one out of the 28 (4%) reported difficulties in understanding the concept and technical aspects of the integration. Two persons did not receive training prior to the campaign. There were also concerns expressed by some senior Ministry of Health officials about the safety of giving anthelmintics to women of child bearing age, especially pregnant women. WHO documents were referred to prove the safety of the drug administration after the first trimester.¹²

WCBA's acceptance of the integrated campaign

The authors interviewed 109 WCBA in the four areas visited. Out of 109 WCBA, 105 WCBA received albendazole in the integrated campaign in 2009, 71 of which ingested deworming tablet for the first time in their life. Those who had ingested deworming tablets before either purchased by themselves or received them from the local health centers or schools. Also, out of 109, the number of WCBA who were immunized with TT was 108 in the integrated campaign in 2009 and 86 before the integration. WCBA reported satisfaction for the deworming campaign and appreciation for the simultaneous delivery of multiple interventions. None expressed complaints or concerns. No reports of adverse events attributed to mebendazole were reported in the provinces visited during the study and very few reported nationwide.

Discussion

The present paper compares the estimated cost of providing mebendazole to pre-SAC and WCBA through an integrated intervention delivering a number of health products and through a vertical campaign exclusively dedicated to STH deworming, in Lao PDR.

The study indicated that the integration of anthelmintics distribution into the existing immunization and vitamin A supplementation campaign enabled deworming an individual with as little as US\$0.02. This is 10 times lower than the cost of deworming an individual

through implementation of the national campaign dedicated to deworming (US\$0.25). The factors that made the cost containment possible were twofold. The first was the shared use of the campaign venues and the meeting opportunities as well as the simultaneous mobilization of communities, health workers and social mobilization teams. The second was the non-remuneration of health workers for the additional time dedicated to deworming training and activities in the context of the integrated campaign, which was equivalent to monetary value of US\$6,160.

In spite of the concern that the integration of multiple health interventions might have overburdened the health workers in the field and also posed them logistic challenges in coordination, drug administration and social mobilization as suggested by Wallace et al.,⁵ 20% of the staff reported difficulties in logistics, drug administration and the integrated training however all were able to treat all the children and WCBA attending the CHD even if with some increased waiting time. In particular, the logistic difficulties were reported only from one rural province. Such difficulties are, in our opinion, well manageable through the development of a simple but comprehensive technical manual and the conduction of training sessions on integrated logistics, social mobilization and provision of health products for programme managers and health workers.

The advantage of the integration of deworming into ongoing public health interventions such as immunization campaigns is not limited to cost containment on the deworming side. The results of questionnaire survey with WCBA implied that the integrated campaign introduced the deworming to those who have never received such service. The present study also indicated the increased number of participants (WCBA) to the integrated campaign to receive vaccination and deworming together, compared to when vaccination and deworming were done separately. Anthelmintic treatment demonstrated to be very popular and well-received, because it often brings about immediate visible effects to the recipients or their relatives in the form of expelled intestinal worms in the faeces. This study confirmed that, as already shown in other populations,¹³ satisfaction of target individuals is higher when multiple health services are provided at the same time. Packaging of anthelmintics distribution and vaccination not only allows deworming to achieve a higher coverage through the use of the extensive communication and distribution channels that are well-established by the EPI but also allows the immunization campaigns to reach a higher number of people who are attracted by the addition of de-worming. Integration with the campaign also allows direct observation of clients actually consuming de-worming tablets. The Integrated Family Planning, Nutrition and Parasite Control Project in Bangladesh, for example, has utilized administration of deworming treatment as a tool for field workers to gain the respect, confidence and acceptance of the community members prior to implementation of other integrated components such as vaccination, child health care and oral rehydration therapy.¹⁴ Moreover, the delivery of anthelmintics during the immunization campaigns enabled the campaign teams to directly observe drug intake by the clients, which assured safety, as this was the first time ever that mebendazole was delivered at mass scale to WCBA in Laos.

In conclusion, the present study demonstrates the higher cost-effectiveness of integration of deworming into an existing immunization and vitamin A supplementation campaign

compared to the vertical implementation of an intervention exclusively delivering anthelmintic drugs. According to the WHO and UNICEF immunization summary,⁵ EPI has already achieved at least 75% national coverage in over 90% of the 130 STH-endemic countries in the world as of July 2010. Strengthened coordination and integration between EPI and STH deworming activities has therefore a high potential to increase the national coverage of deworming for pre-SAC and WCBA, as well as to further increase the number of people reached by EPI.

Acknowledgements

We are indebted to all the participants and health workers of the vaccination campaign who kindly cooperated with our questionnaire survey and provided us with their valuable opinions.

Funding: None declared.

References

1. de Silva NR, Brooker S, Hotez PJ, Montresor A, Engels D, Savioli L. Soil-transmitted helminth infections: updating the global picture. *Trends Parasitol.* 2003; 19:547–551. [PubMed: 14642761]
2. Crompton DWT, Nesheim MC. Nutritional impact of intestinal helminthiasis during the human life cycle. *Annu Rev Nutr.* 2002; 22:35–59. [PubMed: 12055337]
3. WHO. Coordinated use of anthelmintic drugs in control interventions: a manual for health professionals and programme managers. Preventive chemotherapy in human helminthiasis. Geneva: World Health Organization; 2006.
4. WHA. The Fifty-Fourth World Health Assembly Resolution (WHA 54.19). Schistosomiasis and soil-transmitted helminth infection. Geneva: World Health Organization; 2001.
5. WHO/UNICEF. Immunization Summary - A statistical reference containing data through 2008. Geneva: United Nations Children's Fund and the World Health Organization; 2010.
6. Wallace A, Dietz V, Cairns KL. Integration of immunization services with other health interventions in the developing world: what works and why? Systematic literature review. *Trop Med Int Health.* 2009; 14:11–19. [PubMed: 19017307]
7. WHO. Soil-transmitted helminthiasis: estimates of the number of children needing preventive chemotherapy and number treated, 2009. *Weekly Epidemiological Record.* 2011; 25:257–268.
8. WHO/UNICEF. Progress on Sanitation and Drinking-Water 2010 Update. Geneva: The World Health Organization and the United Nations Children's Fund; 2010.
9. Phommasack B, Sakloham K, Chanthavisouk C, Nakhonesid-Fish V, Strandgaard H, Montresor A, et al. Coverage and costs of a school deworming programme in 2007 targeting all primary schools in Lao PDR. *Trans R Soc Trop Med Hyg.* 2008; 102:1201–1206. [PubMed: 18554674]
10. Phimmasone K, Douangpoutha I, Fauveau V, Pholsena P. Nutritional status of children in the Lao PDR. *J Trop Pediatr.* 1996; 42:5–11. [PubMed: 8820613]
11. WHO. Guidelines for estimating costs of introducing new vaccines into the national immunization system. Geneva: World Health Organization; 2002.
12. World health Organization. , editor. WHO. WHO/CDS/SIP/96.1. Report of the informal consultation on hookworm infection and anaemia in girls and women. Geneva: World Health Organization; 1995.
13. Ching P, Birmingham M, Goodman T, Sutter R, Loevinsohn B. Childhood mortality impact and costs of integrating vitamin A supplementation into immunization campaigns. *Am J Public Health.* 2000; 90:1526–1529. [PubMed: 11029982]
14. Ahmad S. Maternal and child health: effective entry points for family planning. *JOICFP Rev.* 1985; 10:1–3. [PubMed: 12313880]

Table 1

Comparison between the incremental costs of adding deworming to the integrated national campaign for immunisation and vitamin A supplementation and the financial costs of implementing a national deworming campaign in Lao People's Democratic Republic, targeting 1 140 381 individuals

Item	Integrated national campaign			National deworming campaign	
	Immunisation (OPV, TT, vitamin A)	Cost (\$US)	Deworming (added)	Deworming	Cost (\$US)
Supplies					
	TT, \$0.25 × 671 349 WCBA	167 837	MBZ, \$0.02 × 485 495 pre-SAC	MBZ, \$0.02 × 485 495 pre-SAC	9 710
	OPV, \$0.16 × 205 658 pre-SAC	32 905	MBZ, \$0.02 × 654 886 WCBA	MBZ, \$0.02 × 654 886 WCBA	13 098
Drug storage and transport	Vitamin A, \$0.03 × 544 471 pre-SAC	16 334			
	(\$100/province × 17 provinces) + (\$50/district × 99 districts) + (\$20/health centre × 700 health centres	20 650		No additional costs	17 500
Surveillance and monitoring	\$5 000 (AEFI response)	5 000		No additional costs	8 750
	\$5 000 (printing)	5 000		No additional costs	8 750
Others					
Personnel	\$56 000 (central authority) + \$56 000 (province authority) + \$40 000 (district authority)	146 920		5 080	66 500
Supervision visits	\$15 000 (central authority) + (\$1 500/province × 17 provinces) + (\$500/district × 99 districts)	90 000		No additional costs	35 000
Provincial meeting	\$2 500/province × 17 provinces	42 500		No additional costs	29 750
Administration	\$10 000 (central authority)	10 000		No additional costs	8 750
Social mobilisation	\$30 000 (central authority) + (\$300/province × 17 provinces) + (\$150/district × 99 districts)	49 950		No additional costs	21 000
Training(1 day)	\$500/district × 99 districts	46 461		3 039	43 750
Total		633 557		30 927	262 558
Cost/treated individual				0.03	0.23
Cost/treated individual, excluding drug cost				0.007	

OPV: oral polio vaccine; TT: tetanus toxoid; WCBA: women of child-bearing age; MBZ: mebendazole; SAC: school-age children; AEFI: advanced events following immunisation.