Original Article

Vitamin A supplementation in Cambodia: program coverage and association with greater maternal formal education

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Vitamin A supplementation reduces morbidity, mortality, and blindness among children in developing countries. The objective of this study is to characterize the coverage of the Cambodian national vitamin A program among preschool children and to identify risk factors for not receiving vitamin A supplementation. The study subjects were preschool children and their families who participated in the 2005 Cambodian Demographic and Health Survey (CDHS), a nationally representative survey. Of 1,547 preschool children, aged 12-59 months, 42.8% received a vitamin A capsule within the last six months. There were no significant differences in paternal education, child age, fever within the last 2 weeks, stunting, underweight, or wasting between children who did or did not receive a vitamin A capsule. Maternal education of ≥10 years (Odds Ratio [OR] 2.09, 95% Confidence Interval [CI] 1.02 – 4.29), 7-9 years (OR 1.46, 95% CI 0.99 – 2.15), 4-6 years (OR 1.71, 95% CI 1.26 – 2.32), and 1-3 years (OR 1.50, 95% CI 1.10 – 2.06) was associated with the child receiving a vitamin A capsule compared to no formal education in multivariate analyses adjusting for other potential confounders. The national vitamin A supplementation program in Cambodia did not reach over one-half of preschool children in 2005. Greater maternal formal education appears to be an important determinant for receipt of a vitamin A capsule by preschool children.

Key Words: Cambodia, morbidity, mortality, nutritional blindness, vitamin A

INTRODUCTION

Vitamin A supplementation is recognized as a highly effective intervention to reduce morbidity, mortality, and blindness among children in developing countries.[1] Vitamin A is essential for normal growth, immunity, reproduction, and vision.[2] Worldwide, vitamin A deficiency affects an estimated 140 million children,[1] and vitamin A deficiency is a serious public health problem in Cambodia.[3] Over the past three decades, periodic high-dose vitamin A supplementation programs have increased child survival and decreased the incidence of pediatric blindness in many developing countries. Vitamin A supplementation is a highly cost-effective intervention for child health[4] and has been shown to decrease all-cause mortality among preschool children by nearly 25%.[5] The Millennium Development Goals include reducing child mortality by two-thirds between 1990 and 2015, and effective coverage of periodic high-dose vitamin A supplementation programs will be critical in reaching this goal. The objective of this study is to characterize the coverage of the Cambodian national vitamin A program among preschool children and to identify risk factors for not receiving vitamin A supplementation.

MATERIALS AND METHODS

The study subjects were preschool children and their families who participated in the 2005 Cambodian Demographic and Health Survey (CDHS), a nationally representative survey that was part of the worldwide Demographic and Health Surveys (DHS) project.[6] The primary objective of the CDHS was to provide the Ministry of Health, Ministry of Planning and other relevant institutions with updated and reliable data on the health of the people of Cambodia.[7]

The 2005 CDHS was a nationally representative sample of 16,823 women and 6,731 men age 15-49 drawn from 24 provinces in the country. To achieve a balance between the ability to provide estimates for all 24 provinces in the country and limiting the sample size, 19 sampling domains were defined, 14 of which correspond to individual provinces and 5 of which correspond to grouped provinces. The fourteen individual provinces

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were Banteay Mean Chey, Kampong Cham, Kampong Chhnang, Kampong Speu, Kampong Thom, Kandal, Kratie, Phnom Penh, Prey Veng, Pursat, Siem Reap, Svay Rieng, Takeo, and Otdar Mean Chey. The five groups of provinces were Battambang and Krong Pailin, Kampot and Krong Kep, Krong Preah Sihanouk and Kaoh Kong, Preah Vihear and Steung Treng, Mondol Kiri, and Rattanak Kiri.[7]

The sampling frame used for the 2005 CDHS is the complete list of all villages enumerated in the 1998 Cambodia General Population Census (GPC) plus 166 villages which were not enumerated during the 1998 GPC, provided by the National Institute of Statistics. It includes the entire country and consists of 13,505 villages. The GPC also created maps that delimited the boundaries of every village. Of the total villages, 1,312 villages are designated as urban and 12,193 villages are designated as rural, with an average household size of 161 households per village.[7] In the 50 percent subsample, all women eligible for interview and all children under the age of five were eligible for anemia testing, height and weight measurements, and other anthropometric measurements. This information was used to assess the nutritional status of the women and children.[7]

The study protocol complied with the principles enunciated in the Helsinki Declaration.[8] The field teams were instructed to explain the purpose of the survey to the mother or father, and data collection proceeded only after informed consent. Participation was voluntary, no remuneration was provided to subjects, and all subjects were free to withdraw at any stage of the interview. The data from the 2005 CDHS is in public domain and was obtained through Measure DHS (Calverton, MD).[6] The plan for secondary data analysis was approved by the Institutional Review Board of the Johns Hopkins University School of Medicine.

The World Health Organization Child Growth Standards were used as the reference growth curves for child height-for-age.[9] Maternal age was divided into quartiles. Maternal education was categorized as 0, 1-3 (first half of primary), 4-6 (second half of primary), 7-9 (junior high), and ≥10 years (high school or greater). Paternal education was categorized in a similar manner to maternal education, except 0 years of education was not used, since all survey responses were negative for paternal education in this category. Weighting was used to adjust for urban as well as rural population size, respectively, and all results reported in the tables are weighted. Chi-square tests were used to compare categorical variables between groups. Multivariate logistic regression models were used to examine the relationship between maternal and paternal education and other variables and receipt of a vitamin A capsule in the last six months. Variables were included in the multivariate models if significant in univariate analyses. A p value of <0.05 was considered significant. Data analyses were conducted using SAS Survey (SAS Institute, Cary, NC).[10]

RESULTS

The 2005 CDHS selected 15,046 households, of which 14,534 were identified and occupied at the time of the survey. Among these households, 14,243 completed the Household Questionnaire, yielding a response rate of 98 percent. There were 8290 households with children, of which 1,547 households had at least one child aged 12-59 months who was eligible for a vitamin A capsule within the last six months of the survey. Of the 1,547 preschool children, aged 12-59 months, 42.8% received a vitamin A capsule within the last six months. There were no significant differences in paternal education, child age, presence of a fever within the last 2 weeks, stunting, underweight, or wasting between children who did or did not receive a vitamin A capsule (Table 1). In multivariate logistic regression analyses, maternal education of ≥10 years (odds ratio [OR] 2.09, 95% confidence interval [CI] 1.02 – 4.29), 7-9 years (OR 1.46, 95% CI 0.99 – 2.15), 4-6 years (OR 1.71, 95% CI 1.26 – 2.32), and 1-3 years (OR 1.50, 95% CI 1.10 – 2.06) were associated with the child re-

Table 1. Demographic and health characteristics of children, aged 12-59 months, in Cambodia, by vitamin A capsule receipt

Characteristics		Did Not Receive Vitamin A		Did Receive Vitamin A		*p*
		N	%	N	%	
Maternal age, y	≤22	94	10.3	62	9.7	0.43
	23-26	231	25.4	158	24.8	
	27-30	142	15.6	98	15.4	
	31+	444	48.7	318	50.0	
	0	629	28.6	314	20.6	
Maternal education, y	1-3	536	29.1	399	31.1	0.0028
	4-6	426	25.6	358	30.0	
	7-9	208	13.9	166	14.7	
	10+	42	2.8	45	3.6	
	0	0	0	0	0	
Paternal education, y	1-3	427	28.0	288	25.2	0.11
	4-6	423	33.5	309	31.5	
	7-9	315	25.7	297	31.5	
	10+	142	12.8	115	11.8	
Child sex, male		935	59.3	623	40.7	0.76
Child age, mo	12-23	167	9.5	131	10.6	0.79
	24-35	654	34.5	444	35.0	
	36-47	599	32.8	414	31.2	
	48-59	426	23.2	298	23.2	
Height-for-age Z score < -2 (stunting)		531	52.4	386	55.3	0.37
Height-for-age Z score < -3 (severe stunting)		274	26.3	160	21.9	0.12
Weight-for-age Z score < -2 (underweight)		366	35.2	255	37.0	0.53
Weight-for-age Z score < -3 (severe underweight)		144	12.6	79	9.4	0.10
Weight-for-height Z score < -2 (wasted)		63	6.7	46	7.6	0.61
Weight-for-height Z score < -3 (severe wasting)		6	1.2	10	1.4	0.76
Diarrhea today		45	18.9	31	13.0	0.13
Diarrhea last 2 weeks		311	9.3	228	7.7	0.36
Fever last 2 weeks		644	33.9	443	33.6	0.90

Table 2. Multivariate logistic regression models of risk factors for child receiving a vitamin A capsule in the last six months in Cambodia1

Characteristic		OR	95% CI	*p*
Maternal age, y	≤24	1.00	---	---
	25-28	0.85	0.57 – 1.26	0.41
	29-32	1.16	0.74 – 1.81	0.52
	33+	0.90	0.62 – 1.30	0.57
Maternal education, y	0	1.00	---	---
	1-3	1.50	1.09 – 2.06	0.013
	4-6	1.71	1.26 – 2.32	0.0007
	7-9	1.46	0.99 – 2.15	0.058
	≥10	2.09	1.02 – 4.29	0.04
Paternal education, y	1-3	1.00	---	---
	4-6	0.97	0.74-1.28	0.83
	7-9	1.13	0.82-1.57	0.44
	≥10	0.83	0.54-1.31	0.43

[1]Model adjusted for all variables in the table and by the 22 regions of the survey.

ceiving a vitamin A capsule compared with no years of formal maternal education (Table 2).

DISCUSSION

Child mortality is a major problem in developing countries,[12] and in Cambodia, it is estimated that more than 50,000 children under the age of five die every year. The infant mortality rate in Cambodia was 95/1000 in 2000, which is four times higher than the neighboring countries, such as Vietnam or Thailand.[11] In 1993, the Royal Government of Cambodia (RCG) made a formal commitment to achieve the complete elimination of vitamin A deficiency. Multiple strategies have been utilized to address these aims, including efforts to combine vitamin A capsule distribution with National Immunization Days as well as with the Expanded Programme on Immunization. In the early 1990's, Cambodia combined vitamin A capsule distribution with the immunization days and had very high coverage rates.[13] However, in 1998 national immunization days were phased out and new distribution channels had to be utilized.[14] Cambodia began to integrate vitamin A capsule distribution with routine immunization outreach of the National Immunization Program, and through special supplemental campaigns, such as subnational immunization days, and measles outbreak responses. In 1998, vitamin A capsule distribution was fully integrated into the Expanded Programme on Immunization. Vitamin A capsules were distributed to children of 6-59 months twice yearly with the Expanded Programme on Immunization and during special supplemental campaigns. Although these programs showed promise and in many cases, success, no sustainable program has maintained the target coverage of 80% among children aged 6-59 months. The CDHS 2000 found that only 29 percent of children aged 6-59 months received a vitamin A capsule within the past 6 months. The CDHS 2005 showed that 42.8% of children from this age group received a vitamin A capsule within the past 6 months.[11,13]

Helen Keller International has advocated many strategies to expand vitamin A capsule distribution such as further education of health center staff, increasing incentive to programs, as well as various social marketing techniques. During the National Immunization Days from 1995 to 1998 and sub-national Immunization Days in 1999, vitamin A capsules were distributed to children aged 12-59 months together with oral poliomyelitis vaccine and an estimated 90% coverage was achieved during the campaigns.[11,13] Although these interventions have been shown to be extremely successful, they have yet to be shown to be sustainable and broadly applicable.

A potential long term strategy to increase the coverage of the vitamin A program in Cambodia may be to further the involvement of female community health volunteers. Nepal has what might be considered a model vitamin A supplementation program, with 96% of children aged 6-59 months receiving two doses of vitamin A in 2005.[15] The Female Community Health Volunteer programme is a large network of women, supported by UNICEF, who are responsible for vitamin A capsule distribution and other child health interventions in Nepal.[16] The female community health volunteers are highly respected in their villages and are credited for the high coverage of the vitamin A programme in Nepal.

Ideally, vitamin A supplementation programs should reach at least 85% of preschool children according to the World Bank[17] or at least 80%, which is the Cambodian National target. Because of the limited coverage of vitamin A capsule distribution, the prevalence of night blindness among children ages 18-59 months was above the WHO cut-off (1%) in five of the ten provinces included in the Cambodia National Micronutrient survey in 2000.[18]

Cambodia has an estimated 63,000 under-five child deaths per year.[19] According to Bryce and colleagues, 63% of these deaths could have been prevented through full implementation of a few known and effective interventions, such as vitamin A supplementation.[12] Also, vitamin A deficiency remains the single leading cause of blindness among children worldwide.[12] Expanded coverage of the national vitamin A capsule program may help protect children from nutritional blindness and help Cambodia reach Millennium Development Goals for reducing under-five child mortality.

This study revealed that the national vitamin A supplementation program in Cambodia did not reach over one-half of preschool children during the time of the survey in 2005 and that maternal education is an important factor associated with the child's receipt of a vitamin A capsule. The attainment of higher levels of formal education by girls and boys may be a key to breaking the intergenerational cycle of poverty and malnutrition in developing countries.[20] No study or reports to date have described interventions targeting this susceptible group who did not receive capsules. In addition to the strategies demonstrated by HKI to be effective in improving vitamin A capsule distribution such as social marketing, village health volunteers, and increased incentives for health center staff,[13] programs should also work to target populations that are typically missed by standard vitamin A capsule programs.

AUTHOR DISCLOSURES

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柬埔寨的維生素 A 補充：計劃涵蓋範圍及與母親教育程度較佳有關

在開發中國家，維生素 A 補充降低兒童的罹病率、死亡率及失明。本研究的目的是確認柬埔寨的學齡前兒童接受維生素 A 補充者的特徵及找出未能接受補充族群的風險因子。研究對象為參與 2005 年柬埔寨的全國人口統計與健康調查(CDHS)的學齡前兒童與其家庭。在 1,547 位學齡前兒童(年齡 12-59 個月)之中，有 42.8%在最後 6 個月接受過一個維生素 A 膠囊。父親的教育程度、兒童年齡、兩週以內有發燒、發育遲緩、體重不足或消瘦都與兒童接受維生素 A 膠囊與否無關。與母親未受教育者相比，在校正可能干擾因子後的多變項分析中，發現母親受教育 10 年或以上(OR 2.09)、7-9 年(OR 1.46)、4-6 年(OR 1.71)或 1-3 年(OR 1.50)都與兒童接受維生素 A 膠囊有相關性。柬埔寨的全國維生素 A 補充計劃在 2005 年還未涵蓋一半的學齡前兒童。母親教育程度較佳似乎是學齡前兒童接受維生素 A 膠囊的重要決定因子。

關鍵字: 柬埔寨、罹病率、死亡率、營養性失明、維生素 A