



# Understanding Discrepancies in Nutritional Outcomes Among Under-Fives in Laos: A Mixed-Methods Study Using the Positive Deviance Approach

Sayvisene Boulom, MSc<sup>1,2</sup> , Daniëlle M. Bon, MSc<sup>1</sup>, Dirk Essink, MSc, PhD<sup>1</sup>, Sengchanh Kounnavong, MSc, PhD<sup>3</sup>, and Jacqueline E. W. Broerse, MSc, PhD<sup>1</sup>

## Abstract

**Background:** Stunting is one of the main contributing factors in the under-five mortality rate worldwide. In Laos, the prevalence of stunting remains high, particularly in mountainous rural areas. To prevent stunting, insight into positive deviant behaviors can help understand how people can cope or adapt in resource-poor settings.

**Objective:** This study aims to analyze the practices and underlying factors that explain discrepancies in nutritional outcomes in children under the age of 5 in remote mountainous areas in Laos.

**Methods:** This mixed-methods study included all children under the age of 5 living in 6 selected villages. Anthropometric measurements were taken, and a Z-score for stunting was calculated to select the positive and negative deviant children. To identify the causes of discrepancies in childhood stunting, household questionnaires, focus group discussions, observations, and individual interviews with family members and health workers were conducted.

**Results:** Fifty-five percent of children were stunted. Inappropriate care and feeding practices were observed such as providing unbalanced diets and not attending health facilities. Positive deviant mothers were less likely to follow inappropriate practices, experienced less food insecurity, and had higher motivation and autonomy, which resulted in prioritizing their children's health. An active role of fathers seemed to benefit positive practices within households.

**Conclusions:** The combination of many different practices in which positive deviant families are doing slightly better was associated with less stunting of children. Those practices are related to the

<sup>1</sup> VU Amsterdam University, Amsterdam, the Netherlands

<sup>2</sup> National University of Laos, Vientiane, Lao PDR

<sup>3</sup> Lao Tropical and Public Health Institute, Ministry of Health, Laos

## Corresponding Author:

Sayvisene Boulom, Athena Institute, Faculty of Science, VU Amsterdam University, 1081 HV, Amsterdam, the Netherlands.

Emails: sayvisene@gmail.com; sayvisene.b@nuol.edu.la

household resources, such as access to food and social support; and the mother's motivation, autonomy, and perspectives on child health.

## Keywords

stunting, care practices, feeding practices, nutrition, positive deviance, Lao PDR

## Introduction

Undernutrition is a main contributing factor in the under-five mortality rate worldwide; 45% of their deaths are related to undernutrition.<sup>1</sup> Chronic undernutrition, leading to stunting, is associated with increased morbidity,<sup>1</sup> increased susceptibility to infection, impaired physical and cognitive development, reduced learning capacity, and reduced economic productivity in the long term.<sup>2</sup> The first 1000 days of life are an especially vulnerable period because of the complete dependence on others for care and feeding combined with rapid growth.<sup>3</sup>

Despite the implementation of interventions to move toward Sustainable Development Goal 2: ending hunger by achieving food security, improved nutrition, and sustainable agriculture,<sup>4</sup> the global prevalence of stunting among children under 5 (CU5) remained high at 5-22% in 2020. This prevalence is highly variable between countries, ranging from less than 3% in high-income countries to more than 30% in low- and middle-income countries.<sup>5</sup> The immediate causes of stunting are inadequate nutrition and frequent diseases.<sup>6</sup> Important underlying factors influencing a child's diet are care and feeding practices, food security, and household's environment.<sup>1</sup>

In Laos, the prevalence of stunting among CU5 was 33% in 2017,<sup>7</sup> but among mountainous ethnic minorities may be as high as 73%.<sup>8</sup> In remote upland villages of Savannakhet province in particular, inappropriate practices and food insecurity are prevalent and access to safe drinking water and sanitary facilities are poor.<sup>9,10</sup> There are both major inequalities between villages in Laos and also within villages, as some CU5 are stunted and some not.<sup>9</sup> The positive deviance (PD) approach is based on the idea that within populations some are able to arrive at novel solutions, while others are not, despite facing the same challenges.<sup>11</sup> By focusing

on the PD families (families with CU5 that are not stunted), it may be possible to understand how some have been able to avoid stunting while others may not. Positive deviance studies have been shown to contribute to contextualized strategies to decrease stunting in areas where it is endemic.<sup>12</sup>

Globally, there have been few PD studies conducted in relation to malnutrition. Research in rural India showed that a PD approach is effective in understanding why PD families experience less malnutrition compared to negative deviant (ND) families (families with CU5 who are stunted): they have better feeding practices, household diet, and hygiene and sanitation practices.<sup>13</sup> Research in Bangladesh showed that PD parents take more initiatives, adopt modern hygiene practices for themselves and their children, have a less fatalistic and more enterprising attitude, have higher educational aspirations, and make more effective use of health and education facilities. Overall, PD parents had a higher intrinsic motivation to take care of their children and to pay attention to their health status.<sup>11</sup>

Furthermore, previous (non-PD) research showed that high maternal autonomy had a positive impact on infant care and growth outcomes in India.<sup>14</sup> Studies in Laos showed that some aspects of autonomy including high self-esteem, intra-household decision-making power, and mothers' effective use of health services were protective factors related to stunting in CU5. However, there have been no PD studies conducted in Laos aimed at understanding discrepancies in stunting or the mechanisms and reasons behind the relationship between these aspects and stunting.<sup>9,15</sup> Still, there is benefit in focusing on the stunting-prevention practices of PD families, especially since these indigenously derived practices are likely to be feasible, culturally acceptable, and relevant (including in rural areas where traditional practices are prevalent).<sup>16</sup>

The present research therefore aimed to identify the practices and underlying factors that explain discrepancies in nutritional outcomes in CU5 in remote mountainous areas in Laos by comparing behaviors of rural households with CU5 who are not stunted with those who have stunted children. Understanding the beneficial practices is relevant to enhancing the capacity of the case-study communities to be more effective in encouraging the beneficial practices. Lessons may also be relevant for similar communities, especially in remote areas, in other countries in southeast Asia and elsewhere.

## Methods

### Study Design

A sequential, explanatory mixed-method design was used. This included anthropometric measurements and a household questionnaire, followed by observations, health-care worker (HW) and family member interviews, as well as focus group discussions (FGDs) that sought to achieve a more in-depth understanding. This enabled triangulation of data sources, methods, and theories. In addition, the research process and findings were discussed with all the researchers to reduce potential bias.<sup>17</sup>

### Study Setting

This research is part of an NWO-WOTRO-funded project, called Scaling up Nutrition-Sensitive Agriculture in mountainous areas in Laos and Vietnam, in collaboration with the European Union-funded *Collaboration And Networking To Enhance Education and Nutrition* (CANTEEN) project and managed by Medical Committee Netherlands-Vietnam (MCNV).<sup>18</sup> During a program running from December 2016 to June 2021, a participatory action research (PAR) approach was used to provide nutrition sensitive agriculture (NSA) to improve food security, nutrition, and overall well-being in 20 remote villages in Nong District, Savannakhet Province. These villages are culturally and socio-economically homogeneous. Nong is a remote, upland, mountainous district where poorly

resourced, ethnic minorities live. For this research, 6 of the 20 villages (Xuong Ngai, Talung, Por, Along, Kenglin, and Alaokuki) were selected for in-depth investigation,<sup>19</sup> based on their diverse geographical location (in terms of landscape and proximity to the city and hospital).

### Study Population and Sampling Procedure

Family members from the 6 villages and HWs were included in this study. First, 277 CU5 attended the anthropometric measurement sessions. This was followed by a household questionnaire, FGDs, and observations involving 58 mothers with CU5. These mothers were selected through purposive sampling<sup>20</sup> and included both PD and ND mothers with CU5 who were willing to participate and living in one of the 6 villages. Between 5 and 8 mothers participated in each FGD depending on their availability. Third, 20 family members of the children who attended the anthropometric measurement sessions were sampled purposively for individual interviews based on the nutritional status of their CU5.<sup>20</sup> This included PD and ND mothers, fathers, and grandmothers. Last, 5 district HWs (3 women and 2 men) were purposively sampled for individual interviews. All HWs were qualified primary health-care and medical assistants who had received nutrition education and had an important role in providing education, training, and health services. The ethnicity of the HWs differed: 3 HWs were Lao, 1 was Putai, and 1 was Blue Mang-Kong. Three HWs spoke both of the languages that were spoken in the villages (Putai and Mang-Kong), while the other 2 spoke only Lao.

### Data Collection

To identify the PD and ND families through their CU5, *anthropometric data* were collected from 277 CU5 by weighing them, measuring their length either lying down or standing, ascertaining their birth date, and noting their sex.

Second, a researcher-administered *household questionnaire* was completed by 58 mothers of CU5. The questionnaire consisted of both multiple-choice and open questions regarding household food sources and feeding practices,

food security and coping strategies, hygiene and sanitation practices, well-being, and vaccination behavior.

Third, the researchers completed an *observation checklist* at the home of the participants ( $n = 58$ ) consisting of questions about the household environment, hygiene and sanitation practices, food preparation practices, and how their CU5 looked in terms of health.

Both the household questionnaire and the observation checklist were validated questionnaires developed for the Australian Centre for International Agricultural Research Lao Livelihood Adaptation Project and adapted for this research.<sup>21</sup> The data from the household questionnaire and observation checklist were combined with the anthropometric data to understand the differences between PD and ND mothers.

Fourth, 12 *FGDs*<sup>22</sup> ranging from 3 to 9 participants were conducted. These aimed to increase general understanding, by identifying the differences in practices of mothers and exploring the underlying reasons for these varying practices (such as discrepancies in household resources and knowledge). During these FGDs, mixed groups of both PD and ND mothers collectively discussed their knowledge, attitude and practices and collaborated in prioritizing activities for future interventions. A semistructured FGD guide adapted from the feeding guidelines for infants and young children feeding guidelines was used to structure the FGDs and covered topics such as feeding, health care, and hygiene knowledge and practices.

Fifth, *semistructured interviews with HWs* ( $n = 5$ ) were conducted to understand their practices and perceptions of the problem of stunting and any discrepancies in the villages. In contrast to all previous data collection methods, interviews with HWs were done online because of strict coronavirus disease 2019 regulations during that time.

Lastly, 20 *semistructured interviews* were conducted with PD ( $n = 8$ ) and ND ( $n = 8$ ) mothers, PD ( $n = 1$ ) and ND ( $n = 1$ ) fathers, and PD ( $n = 1$ ) and ND ( $n = 1$ ) grandmothers. These interviews were conducted face-to-face by a researcher from the National University of Laos who lived in Nong and was able to visit the

villages. For these interviews, an interview guide was developed based on the results of the household questionnaire, FGDs, and previous research in Laos.<sup>15</sup> Questions were asked about perceptions of discrepancies, motivation, social support, flexibility, and autonomy. For this study, mother's autonomy is defined as:

the control women have over their own lives, the extent to which they have an equal voice with their husbands in matters affecting themselves and their families, control over material and other resources, access to knowledge and information, the authority to make independent decisions, freedom from constraints on physical mobility, and the ability to forge equitable power relationships within families.<sup>23</sup>

The autonomy is multidimensional and therefore determined by 5 dimensions: freedom of mobility, self-esteem, control of money, decision-making power, and self-efficacy.

All data collection, except for the interviews with HWs, was conducted in the local language with a village head or HW to translate. The responses to the household questionnaire and FGDs were transcribed in Lao and translated into English. Interviews with HWs were conducted in Lao and during the interviews translated into English.

### Data Analysis

Statistical Package for the Social Sciences was used to descriptively analyze the anthropometric data, household questionnaire, and observations.<sup>24</sup> The Z-score for stunting defines the number of standard deviations (SDs) below or above the World Health Organization (WHO) standard median and was calculated using the WHO anthropometric calculator. A negative Z-score indicated the child had a lower height-for-age z-score (HAZ) than the standard median, while a positive score meant the child had a higher HAZ. Children were excluded when they were over the age of 5 years or when they had an HAZ below  $-6$  and above  $6$  or for wasting below  $-5$  or above  $5$ .<sup>25</sup> A categorical variable was made for describing the HAZ scores in the 6 villages and divided into 3 groups: severe stunting (below

–3SD), moderate stunting (between –3SD and –2SD), and no stunting (above –2SD). A dichotomous variable was also made to determine the ND (below –2SD) and PD CU5 (above –2SD). Other continuous variables from the anthropometric data, household questionnaire, and observations were also categorized.

For the qualitative analysis, ATLAS.ti analytic software (version 8.4.24.0) was used.<sup>26</sup> Preset coding schemes were based on existing literature such as the conceptual framework of the determinants of child undernutrition.<sup>27</sup> An inductive approach was important to include (context-specific) factors, which did not emerge from existing literature.<sup>28</sup> By combining these approaches, the practices and underlying factors were subdivided into several categories: feeding practices, care and hygiene practices, household environment, household food insecurity and poverty, knowledge, motivation and attitude, gender roles and empowerment, and social support and time allocation.

### *Ethical Considerations*

The NSA project in Nong obtained ethical approval from the National Ethical Committee for Health Research (N009/NECRH, Vientiane Capital 2019).<sup>29</sup> Malnourished CU5 were included in an intervention that provided food to improve their nutritional status. All analyses were anonymized. Verbal informed consent was given by all participants of FGDs and interviews. All family members and HWs voluntarily agreed to participate, they were informed that they could refuse to answer any question and to leave the study at any time without explanation.

## **Results**

### *Sociodemographic Characteristics and Nutritional Status of CU5*

In total, 264 CU5 were included for the analysis of the anthropometric measurements: 134 boys (51%) and 130 girls (49%). Of these, 145 CU5 were stunted (55%), 75 severely stunted (28%), and 70 moderately stunted (27%; Table 1). Descriptive analyses showed that the prevalence

of stunting was higher in boys than girls and that the average HAZ decreased with age.

Fifty-five mothers with CU5 who attended the anthropometric measurement sessions were included in the household questionnaire and observations. The sociodemographic characteristics of these mothers are shown in Table 2. The main ethnic groups in this study area were Mang-Kong (86%) and Ta-oy (15%). The majority of the fathers (66%) and 23% of the mothers had attended school (mostly primary school, which was not always completed). As their main occupation, most household heads and all mothers were farmers working in upland rice fields. More than half of the mothers had their first child before the age of 20 and 30% before the age of 18. Of the CU5, 48% were boys and 52% were girls.

### *Practices and Underlying Factors*

The following sections explain what practices of PD mothers may result in better nutritional status of their children: feeding practices, care and hygiene practices, household environment, household food insecurity and poverty, knowledge, motivation and attitude, gender roles and empowerment, and social support and time allocation. The results of the household questionnaire and observations can be found in Table B1 and an overview of these practices and underlying factors is given in Table 3.

*Feeding practices.* Many CU5 did not receive an optimal diet in terms of quality and quantity because of a number of traditional feeding practices. Although these practices were prevalent among both PD and ND mothers, inappropriate breastfeeding and complementary feeding practices were less common among PD mothers. Inappropriate breastfeeding practices consisted of more than half of the mothers not giving colostrum to their child and this was more prevalent among ND mothers compared to PD mothers. The colostrum was often considered as dirty and unhealthy for the child, although this was recommended for a better immune system. While recommended, hardly any mother practiced exclusive breastfeeding for 6 months. However,

**Table 1.** Analyses of Anthropometric Measurements of CU5 in 6 Villages in Nong.

Total population, N	264
Z-scores malnutrition, mean (SD)	
Stunting	−2.1 (1.6)
Wasting	−1.0 (1.2)
Underweight	−1.9 (1.2)
Prevalence of malnutrition, n (%)	
Stunting	145 (54.9)
Moderate stunting	70 (26.5)
Severe stunting	75 (28.4)
Wasting	45 (17.0)
Underweight	122 (46.2)
Prevalence stunting by gender, n (%)	
Male	82 (61.2)
Female	63 (48.5)
Z-score stunting by village, mean (SD)	
Xuong Ngai	−2.27 (1.5)
Talung	−2.50 (1.9)
Por	−2.06 (1.1)
Along	−2.26 (1.4)
Kenglin	−2.13 (1.8)
Alaokuki	−1.77 (1.5)
Z-score stunting by age, mean (SD)	
49-59 months	−3.10 (1.1)
36-48 months	−2.77 (1.3)
24-35 months	−2.18 (1.6)
12-24 months	−2.04 (1.6)
6-11 months	−1.14 (1.4)
<6 months	−1.07 (1.4)

Abbreviations: CU5, children under 5; n, number of people; SD, standard deviation.

during interviews some PD mothers did mention that they practiced exclusive breastfeeding for 6 months, while none of the ND mothers did. According to HWs, tradition made mothers resistant to change:

Some [mothers] can change [their feeding practices] but only for a short time and after that they fall back to tradition. And other families are resistant to any change. (Interview HW3)

Inappropriate (complementary) feeding practices included giving meals that were not balanced, not preparing separate meals for CU5, and CU5 who were missing meals. In the interviews and FGD, it was mentioned that the differences in feeding practices between PD and ND mothers were due to underlying causes such as food insecurity, poverty, insufficient knowledge,

mother's autonomy, social support, and motivation. As one PD mother said:

The children cannot miss rice or a meal, so we have to buy food and rice. (Interview PD mother Pataoy Yai)

In contrast, an ND mother stated:

I just feed my child with rice if we have it. Some days we did not have rice and other foods, so children missed meals. If we have food, children will eat the same foods as us. (Interview ND mother Por)

**Care and hygiene practices.** In terms of care and hygiene practices, the following practices were observed: health-care attendance, vaccination rates, boiling water, and washing practices.

**Table 2.** Sociodemographic Characteristics of Mothers With CU5 Living in 6 Villages in Nong.

	Not stunted, n (%)	Stunted, n (%)	Total, n (%)
Total	24 (43.6)	31 (56.4)	55 (100)
Village	(n = 24)	(n = 31)	(n = 55)
Xuong Ngai	5 (55.6)	4 (44.4)	9 (16.4)
Talung	1 (12.5)	7 (87.5)	8 (14.5)
Por	4 (40.0)	6 (60.0)	10 (18.2)
Along	5 (45.5)	6 (54.5)	11 (20.0)
Kenglin	4 (50.0)	4 (50.0)	8 (14.5)
Alaokuki	5 (55.6)	4 (44.4)	9 (16.4)
Ethnicity	(n = 24)	(n = 31)	(n = 55)
Mang-Kong	23 (48.9)	24 (51.1)	47 (85.5)
Ta-oy	1 (12.5)	7 (87.5)	8 (14.5)
Number of children/mother	(n = 23)	(n = 31)	(n = 54)
5-7 children	6 (40.0)	9 (60.0)	15 (27.8)
3-4 children	10 (52.6)	9 (47.4)	19 (35.2)
1-2 children	7 (35.0)	13 (65.0)	20 (37.0)
Educational level of HH	(n = 24)	(n = 29)	(n = 53)
School	16 (45.7)	19 (54.3)	35 (66.0)
No school	8 (44.4)	10 (55.6)	18 (34.0)
Occupation of HH	(n = 24)	(n = 30)	(n = 54)
Farmer	23 (44.2)	29 (55.8)	52 (96.3)
Teacher	0 (0.0)	1 (100.0)	1 (1.9)
Engineer	1 (100.0)	0 (0.0)	1 (1.9)
Educational level of mother	(n = 23)	(n = 29)	(n = 52)
School	5 (41.7)	7 (58.3)	12 (23.1)
No school	18 (45.0)	22 (55.0)	40 (76.9)
Occupation of mother	(n = 24)	(n = 29)	(n = 53)
Farmer	24 (45.3)	29 (54.7)	53 (100.0)
Mother's age in years	(n = 22)	(n = 30)	(n = 52)
36-46	7 (58.3)	5 (41.7)	12 (23.1)
26-35	8 (34.8)	15 (65.2)	23 (44.2)
15-25	7 (41.2)	10 (58.8)	17 (32.7)
Maternal age in years	(n = 14)	(n = 19)	(n = 33)
20-29	3 (30.0)	7 (70.0)	10 (30.3)
18-19	8 (61.5)	5 (38.5)	13 (39.4)
11-17	3 (30.0)	7 (70.0)	10 (30.3)
Sex of child	(n = 23)	(n = 31)	(n = 54)
Male	13 (50.0)	13 (50.0)	26 (48.1)
Female	10 (35.7)	18 (64.3)	28 (51.9)
Child's age in months	(n = 24)	(n = 31)	(n = 55)
49-59 months	1 (25.0)	3 (75.0)	4 (7.3)
36-48 months	1 (14.3)	6 (85.7)	7 (12.7)
24-35 months	4 (28.6)	10 (71.4)	14 (25.5)
12-24 months	10 (71.4)	4 (28.6)	14 (25.5)
6-11 months	2 (28.6)	5 (71.4)	7 (12.7)
<6 months	6 (66.7)	3 (33.3)	9 (16.4)

Abbreviations: CU5, children under 5; HH, household head; n, number of people.

All mothers were aware that health services in public centers and hospitals are free of charge for pregnant women and children. Although no

notable differences in the prevalence of diseases were seen between PD and ND children, a trend toward differences in health-seeking behavior

**Table 3.** Overview of Practices and Underlying Causes of Stunting Among CU5 in 6 Villages in Nong.

Practices and Underlying Causes of Stunting	
Feeding practices	Feeding practices were often inadequate; CU5 did not receive sufficient nutrition in terms of quality and quantity. Traditional feeding practices were prevalent, but less so among PD mothers. Examples of prevalent poor feeding practices that were more prevalent among ND mothers were not giving colostrum, not practicing exclusive breastfeeding for 6 months, and not giving diverse foods to CU5.
Care and hygiene practices	Health-care attendance and vaccinations rates were higher among PD than among ND CU5. Hygiene practices such as washing hands were sufficient among PD and ND mothers, although they had no soap. Boiling water was low among all mothers, although more PD mothers boiled water than ND mothers.
Household environment	The use of spring water, which is irregularly available during seasons, was higher among ND mothers compared to PD mothers.
Household food insecurity and poverty	All mothers were from a poor community, but there was some heterogeneity in the level of poverty; ND mothers tended to be poorer than PD mothers. All mothers experienced food insecurity, but poor households were more food insecure because of having to depend on their own food production. PD households were more often food secure for a longer period of time and got support from cousins and relatives.
Knowledge	Although only 25% of mothers attended school, both PD and ND mothers had good hygiene and sanitation-related knowledge. Knowledge of providing colostrum and nutrient-rich food was below par and especially ND mother's perceptions about the health of their CU5 were often incorrect: only 10% of the ND mothers thought their child was stunted. The mobile education was effective in improving knowledge among PD mothers, resulting in a more diverse diet.
Motivation and attitude	Differences were seen in motivation between PD and ND mothers with higher motivation among PD mothers resulting in better practices. Differences were seen in several aspects of motivation: caring about their CU5, prioritizing their child's nutrition, thinking ahead, and a more enterprising attitude among PD mothers. However, both ND and PD mothers emphasized the importance of education.
Gender roles and empowerment	Traditional gender roles were prevalent, all mothers had more tasks than fathers and all mothers were dependent on their child's father to access health care. However, higher mother's autonomy and self-efficacy was seen among PD mothers compared to ND mothers.
Social support and time allocation	Social support was important for care and feeding practices. There were differences in perceived support between PD and ND mothers. PD mothers more often lived in an extended family and received more support from family members, such as their partner, compared to ND mothers. Living in extended families was beneficial as the family members could take care of the child when the mother had to go to the field. This support for PD mothers was important for having more food and time to take care of and feed their CU5.

could be observed with higher vaccinations and attendance of health facilities among PD children. Among PD children, the health-care attendance was 78%, and 87% had received at least one vaccination, while these percentages were 68% and 76%, respectively, for ND children. Deeper exploration of these findings during the

interviews showed that differences in knowledge, motivation and attitude, gender roles and empowerment, social support, and time allocation influenced the uptake of health services and vaccinations.

Hygiene practices were not optimal in general. Many mothers did not boil water, but PD mothers



did so more often (54%) than ND mothers (37%). In the interviews and FGDs, both PD and ND mothers noted that some reasons for not boiling water were lack of motivation, social support, and time, as illustrated in the following quote:

If we stay at home, we boil water before we drink it, but if we are in the field for work, we drink fresh water directly, because we do not have time. (FGD-Por)

Mothers often washed their hands before eating to prevent diseases transmitted by feces, although none had soap. HWs and mothers mentioned during the interviews that there were differences in hygiene practices between PD and ND mothers. For example, PD mothers mentioned washing themselves before breastfeeding while ND mothers did not mention this. Moreover, PD mothers continually emphasized the importance of hygiene during the interviews, while ND mothers did not. This is illustrated with the following quote:

I try to keep cleanliness in our family, I saw other children in my village who were still dirty because their parents did not have time to clean. (Interview PD mother Pataoy Yai)

**Household environment.** One of the main findings from the descriptive analysis of the household questionnaire was that there were variations in the water source used between ND and PD households. The use of spring water, which is irregularly available during seasons, was more often used by ND mothers compared to PD mothers (42% and 17%, respectively). Positive deviant mothers more often used river and underground water (50% and 50%, respectively) compared to ND mothers (36% and 32%, respectively).

**Household food insecurity and poverty.** Almost all families faced food insecurity (97%), which was seen as an important reason for stunting. Nevertheless, it appeared that more PD mothers were food secure. Positive deviant households experienced food insecurity for 2 to 4 months, while ND mothers experienced this for 6 to 9 months. Food insecurity was mainly a problem because of poverty, drought, and unreliable weather. According to the household questionnaire and FGDs, the

most food-insecure months were during the dry season. As there was little access to markets, food availability depended mostly on their own production (mainly rice), foraged foods, and help from family. As one ND mother from the poor community Por said:

We try to gather food from nature; some days we have food but other days we return home with empty hands. (Interview ND mother Por)

In contrast, differences can be seen in the approach taken by PD mothers from this same community to combat food insecurity. As one PD mother stated:

If we have a food shortage in my household, I ask for rice and other food from my cousins. I exchange food with friends to feed my kids. (Interview PD mother Por)

Differences in wealth within this poor community were also seen between PD and ND mothers. Although almost all families in this community could be considered poor, ND mothers attending the interviews tended to be even poorer than PD mothers. This subsequently created an additional barrier to obtaining food security. The HWs also mentioned that there were differences in wealth:

Poor families do not have money to buy food or meat. Even though we train them, it is still a challenge to feed their children well. Other moms can secure food for the family, they raise animals, and they have home gardens (. . .). Then they can feed the children well. (Interview HW1)

**Knowledge.** Findings from the household questionnaire and the FGDs showed that overall, mothers knew the importance of hygiene, sanitation, nutritious food, and vaccinations. Nevertheless, some mothers did not know what “good” food is for their children, as one ND mother said in an interview:

We only think it is good to have food to eat and we eat food every day, we eat the same food every day, I don't know if it is good or bad, we just eat what we have. (Interview ND mother Phonmakmy).

The community nutrition training was effective in improving knowledge about feeding practices among PD mothers. This resulted in a more diverse diet and increased micronutrients in children's food. According to one PD mother:

I know from people around what to give my child to eat, so I started mixing boiled vegetables in the rice soup [...] I try to practice according to doctors and nurse's advice on child's nutrition. I try to feed my children with diverse foods if I have them. If I did not have diverse foods, children will eat only rice. I also try to cook mix porridge rice for my kids after learning cooking class from the project. (Interview PD mother Pataoy Yai)

Moreover, there were discrepancies between mothers' perceptions of their child's health and the anthropometric measurements. Only 10% of the ND mothers who filled in the household questionnaire saw their child as small for their age, although all of these children were stunted. Second, positive practices were less prevalent when mothers were afraid or not aware of the benefits of good feeding and health practices. For example, some mothers were afraid that giving yellow rice porridge and drinking colostrum would cause stomach ache and that breast milk was not enough for their child. A mother illustrated these fears, saying:

We practiced exclusive breastfeeding for only 2 months and then we fed our child with chewed rice. We were afraid that our children were not full, and that they did not eat enough. (FGD-Talung)

Despite the mobile education and training sessions provided by HWs to improve mothers' knowledge and practices, mothers mentioned they experienced several problems following the advice: difficulty in understanding the information about nutrition and feeding practices, HWs not speaking the local language, poor communication skills, and little time for consultations. As one ND mother explained:

Nurses teach us many topics. Some topics are easy and understandable; I will do it immediately. But other topics were hard to understand, I did not know what to do. (Interview ND mother Por)

**Motivation and attitude.** Throughout interviews, it became apparent that the motivation and the perseverance to ensure the child stays healthy and has a future was more prominent among PD mothers. In the following quote, a PD mother was highly motivated to feed her child well:

I try to make sure that my child can eat according to the feeding principles and to prevent malnutrition. I have to feed them from time to time, and the child has to eat on time. And my child is chubby. (Interview PD mother Por)

We do not claim that ND mothers are not motivated or do not care for their children, but FGDs, interviews with mothers and HWs all gave evidence that motivation does play an important role in consistently prioritizing the child's nutrition to ensure their health now and in the future. This is illustrated with the following quote:

I work hard to find food. I want my child to graduate [from] secondary school because I want my child to be an employee, so he will have a good job and can earn money. (Interview PD mother Pataoy Yai)

Positive deviant mothers are more often thinking ahead. They had a broader scope (being healthy rather than simply finding food), thought more about the future, and had a more enterprising attitude as illustrated with the following quotes:

My motivation is that I want to see my child healthier, I want to breastfeed more and keep them clean by showering. I hope my children will be healthier and prevent illness. I try to practice according to doctor's and nurse's advice on child's nutrition. I try to feed my children with diverse foods if I have them. (Interview PD mother Pataoy Yai)

*[When I have to go to the upland rice field] I pumped breastmilk into a milk bottle. When it is time to work, I will let my baby eat that instead. (Interview PD mother Por)*

During the interviews, ND mothers more often prioritized finding food for the whole family in the here and now, over immunization, training, and nutrition for the longer term, as the following quote illustrates:

I did not [think about the future], I think only about the daily meal, which is our urgent need. I cannot think of or dream about the future. (Interview ND mother Pataoy Yai)

One exception in thinking ahead was that both PD and ND mothers mentioned the importance of education, although ND mothers experienced more difficulties in paying for their children to go to school.

Strong motivation on child feeding based on knowledge of nutrition and family support was shown in the quote from a PD mother:

I started mixing boiled vegetables in the rice soup. I give my child some onion, lotus root, spinach, garden vegetables and boiled pumpkin. A doctor, a programmer and a nurse at the health center told me [to do] so. I give my child some meat and fish often, but eggs occasionally. [...] The most convenient thing to do to find food is fishing, the fish can be found at any time along streams, rivers. During the rainy season, shrimp, snails, crabs and fish will be convenient. I give a lot of things to my child to eat so they can grow faster, so I work harder to find food. My opinion is that my child should be smart, should grow fast and should learn to earn money. [...] If I feed my child well, my child will be healthy and able to learn well. [...] and in the future the child will support me, support its parents; we raise the child well, the child will feed us well. (Interview PD mother Pataoy Yai)

**Gender roles and empowerment.** Traditional gender roles were prevalent in Nong. Mothers always had more daily tasks than fathers and were responsible for taking care of their children. In addition, mothers mentioned that the fathers liked to watch television, to party, and to drink alcohol. Differences in gender roles were seen between PD and ND families, as illustrated in the following quotes:

I take care of my child too, I don't want my child to be thin and weak. Also, sometimes I try to get some fruit for my children. (Interview PD father Phonmakmy)

*My wife must do the housework and take care of the children. I should not do that. It is an*

*embarrassment if a husband does that. It means he is afraid of his wife, because normally men do not do that. (Interview ND father Phonmakmy)*

When the father assumed his responsibilities in taking care of his child and supported the mother, this was beneficial for care and feeding practices and often resulted in shared decision-making. In this way, mothers could convince their partner to buy food for their child, because if the father had control of the money independently of his partner, he would not spend it on food. This is illustrated in the following quote:

The mothers with children that have a better nutritional status have a higher self-esteem. (...) They can convince their husband so they can control resources and can think about the future of their child. (Interview HW5)

The father often enjoyed greater autonomy than the mother. Although higher autonomy was seen more often among PD mothers than among ND mothers, according to the HWs, for access to health care all mothers were dependent on the child's father:

If a family lives far [from the hospital] it depends on the husband. If the husband takes initiative to take them to the hospital, they will come. But in general, they will say they do not have money to buy petrol and do not come. (Interview HW3)

In addition, PD mothers had higher self-efficacy, believing they could improve practices by themselves, while the ND mothers thought they could not, as illustrated in the following quote:

I cannot improve the diet of my children because we do not have food and money. (...) I dream that my children will be better, but I have no solution. I feel hopeless because we are so poor. (Interview ND mother Pataoy Yai)

**Social support and time allocation.** Based on the household questionnaire, the observations, and the interviews, it was found that PD mothers received more support from family members

compared to ND mothers. Positive deviant mothers were also more likely to live in households with extended family members, which was beneficial since other family members could provide childcare when the mother had to go to the field.

The father's social support was also important for care and feeding practices. Fathers could help in acquiring food and offering social support, which resulted in more time for caring for and feeding their child, as shown in the following quote:

If the husband tries to help (...) the mother has more time to feed and take care of the children. If the husband is not doing this, the mother has to do every household work including cooking, so she has no time to take care of the child. (Interview HW4)

All mothers mentioned they had social support from their partner and family, although according to the HWs there were differences in the extent. In some families, the father tried to help, but often mothers mentioned during the FGDs that the father was lazy and got angry when the mother did not do "her" tasks. Differences in social support are clear from the following quotes:

My husband likes to make baskets and boxes for steaming rice (...). Both men and women work the same amount, men try to help the women now. (FGD-Alaokuki)

*My oldest daughter and my husband help in taking care of the youngest child. [...] My husband helps with cooking. He also helps with gardening, watering vegetables. (Interview PD mother Pataoy Yai)*

*When I return from the rice field I have to grind or mill rice and collect water, if I don't do it then my husband will be angry with me. (...) My husband doesn't do anything, only eat[s] and sleep[s]. (FGD-Alaokuki)*

Mothers often lacked time for practices such as boiling water and practicing exclusive breastfeeding for 6 months. Often someone else in the family fed the CU5 with rice when the mothers were working, for example, the grandparents or an older sibling (ranging from the ages of 5 and 10 in the FGDs). The grandmothers of both PD and ND children mentioned that they were

motivated to take care of the children, but they lacked knowledge about what to feed them.

I wash and take care of the child. I don't know what food to give to the grandchildren to ensure they are healthy, but I used to make boiled rice for them sometimes. I want them to grow-up so they can work on the farm and help with raising the animals. (Interview PD grandmother Kenglin)

For mothers whose main occupation was as a government official, it was easier to practice exclusive breastfeeding for 6 months, because they have maternity leave. Differences in time available for other practices are illustrated with the following quotes:

We work in agriculture; we have to go to the fields. We cannot give only breastmilk, so we have to give them rice too. (FGD-Along)

[It is] quite hard to practice exclusive breastfeeding in this working area. Government officials can practice exclusive breastfeeding because they have a 6-month break for exclusive breastfeeding. Other farmers have many activities so are too busy. (Interview HW2)

## Discussion

This study reveals a myriad of PD behaviors that led to less stunting in children of families in remote, upland areas. These behaviors included better hygiene and feeding practices, facilitated by underlying causes such as higher motivation, mothers' autonomy, and increased social support. However, in order to unpack and explore these findings, one first needs to understand the nutritional status in this area.

Nong District does not (yet) benefit from the national reductions in stunting: the prevalence remains high (55%), much higher than the provincial (28%) and national average (33%). Both the income and the prevalence of stunting in Nong are similar to the poorest quintile in national data (prevalence of stunting of 48%).<sup>7</sup> A similarly high prevalence has been reported in another rural and mountainous province in Laos, Phongsaly, also largely populated by ethnic minorities (54%).<sup>30,31</sup> Previous research

in 23 villages in Nong showed a higher prevalence of stunting (73%); a reason for this difference could be that this measurement took place before the NSA services had been delivered.<sup>8</sup> However, the prevalence in Nong was higher than the measured prevalence in comparable areas (poor, upland areas that are home to ethnic minorities) in neighboring countries. For example, in Chin province in Myanmar, the prevalence<sup>32</sup> was 41% and in Lai Chau in Vietnam, 39%.<sup>33</sup> As has been reported in sub-Saharan Africa, anthropometric measurements showed that boys were more likely to be stunted than girls.

In Laos, nutrition policies tend to focus on the first 1000 days of life. However, this research showed that the average HAZ is actually lower after this period, implying CU5 are more at risk of stunting. Similar trends were found in Ghana where it was also found that stunting is more prevalent after this period.<sup>34,35</sup> Previous research showed that a reason for a higher prevalence among older children is that older CU5 are no longer dependent on breastfeeding and require a diverse diet that can be difficult to provide in the study area, which has a high prevalence of poverty and food insecurity.<sup>13</sup> Nevertheless, the level of poverty was relatively heterogeneous in Nong; some households were not as poor as others, which also resulted in some variation in food security.

With respect to care and feeding practices, almost all mothers had good practices, such as washing their hands (although they did not have soap), and mothers often had good hygiene-related knowledge. Nevertheless, as noted in other studies, many inappropriate care and feeding practices were observed among both PD and ND mothers.<sup>36-38</sup> However, PD mothers had better practices: they more often focused on hygiene, practiced exclusive breastfeeding for 6 months, provided a more diverse diet, and used river and underground water (instead of spring water). These PD behaviors were also evident from research in India.<sup>13,39</sup>

Almost all families faced food insecurity, but to a lesser extent among PD families. This can be linked to autonomy because PD mothers had, for example, more power to decide to buy or borrow food. Moreover, gender roles and women's

empowerment, social support, and motivation all appeared to be important for better care and feeding practices. Furthermore, PD mothers were more autonomous and were consequently doing slightly better in many practices, which resulted in major advantages for their children. Previous research also showed that social support for mothers is important in being able to prioritize their child's health. When fathers assume their parental responsibilities and mothers receive more social support, mothers have more time to take care of and feed their CU5 well. Furthermore, it is easier for these mothers to prioritize their child's health. As a result, mothers with greater autonomy are less likely to have a stunted CU5.

Motivation is also an important factor in ensuring that the child's nutrition is prioritized. Positive deviant mothers in Laos prioritize their child's health in terms of vaccinations, hygiene, and sanitation and nutrition, whereas ND mothers pay little attention to hygiene and sanitation and are busy finding food for the whole family. Previous research showed that focusing on children's health status means they are less likely to fall sick.<sup>11</sup> This saves the family both time and money, which can lead to less poverty and more food availability in the long term.<sup>40</sup> In addition, PD mothers more often come up with solutions and think ahead. Research in Mexico also showed that PD mothers were entrepreneurial, exhibiting a more enterprising attitude as opposed to a fatalistic one.<sup>11</sup> When mothers have more intrinsic motivation, they tend to seek out novelty and challenges.<sup>41</sup>

### *Strengths and Limitations of the Study*

The use of multiple data-collection techniques and sources strengthens the validity of the study's findings. The aim was to ensure a greater depth, not only understanding the PD behaviors but also the reasons for differences in behaviors. The research process and findings were also discussed with peers and experts to reduce potential bias. The findings are context-specific, but they might be generalizable in areas in Laos with similar contexts and in similar neighborhoods. Although this article does not explicitly report on PAR activities, the findings from this study were

incorporated in subsequent PAR activities for the overarching NSA project, such as a Water, Sanitation, and Hygiene (WASH) program, cooking demonstrations, and home gardens. Moreover, HWs were responsible for acute management of malnutrition.

Although this study identified several practices and underlying factors that resulted in nutritional status differences in CU5, more research is needed to understand why these differences exist. In addition, correlations between variables could not be established through the quantitative analyses of the household questionnaire and observations. However, some links were made evident through the descriptive data gained from the interviews. For example, despite previous research showing that the mother's age at the birth of their firstborn<sup>42</sup> and exclusive breastfeeding for 6 months were related to nutritional status,<sup>13</sup> this was not seen within this study because no inferential statistical analyses were conducted due to the small sample size. Furthermore, the inclusion of more fathers and grandmothers could have increased richness in the data analyses by means of increased triangulation. Lastly, a limitation was that data were collected from ethnic minorities speaking different languages, which might have led to inaccuracies in translation. To reduce translation and interpretation bias, all English transcripts of the FGDs were read by 2 Lao researchers.

### **Recommendations**

Over the course of this study, several recommendations for future research and for improving the nutritional status of ND children were identified. First of all, there is a need for more in-depth qualitative research to understand the reasons for PD behaviors, as well as quantitative studies with larger sample sizes to enable inferential statistics,

better correlation, and stratification analyses. Moreover, engaging more family members might be necessary to address the factors associated with discrepancies in nutritional outcomes. For example, gaining more insight from the fathers of the children could be valuable due to the traditional role of a father as head of the household. This is supported by other research that shows that interventions focusing on fathers and grandmothers can increase both the quantity and quality of social support.<sup>37</sup> Therefore, a family-centered approach should be used to improve a mother's autonomy, gender equality, and intrinsic motivation. For this, more research is needed to understand how a multisectoral and family centered approach can be implemented and how mothers' intrinsic motivation can be stimulated. Lastly, it might be necessary to shift the focus of program efforts toward the nutritional status of CU5 rather than only children under the age of 2, as both this research and past research showed low HAZ and high stunting rates among CU5.<sup>43</sup> However, it should be noted that programs addressing stunting in the first 1000 days do have long-term positive health and social effects.<sup>3</sup>

### **Conclusion**

By using the positive deviant approach, several PD behaviors of mothers in poor and remote communities are identified. The combination of many different care and feeding practices, in which PD families are performing slightly better, resulted in major advantages for their CU5. Those practices are related to household resources such as access to food and social support, as well as the motivation, autonomy, and perspectives of the mothers on the child's health. Therefore, it is critical to address these practices and underlying factors when designing future interventions aiming to reduce childhood stunting.

**Table B1.** Results Household Questionnaire and Observations.

	Not stunted	Stunted	Total
Total, n (%)	24 (43.6)	31 (56.4)	55 (100)
Household food insecurity and poverty			
Place collecting the foods you eat, n (%)	(n = 24)	(n = 30)	(n = 54)
Forest			
Yes	24 (100.0)	30 (100.0)	54 (100.0)
No	0 (0.0)	0 (0.0)	0 (0.0)
River			
Yes	8 (33.3)	8 (26.7)	16 (29.6)
No	16 (66.7)	22 (73.3)	38 (70.4)
Pond			
Yes	1 (4.2)	3 (10.0)	4 (7.4)
No	23 (95.8)	27 (90.0)	50 (92.6)
Bought			
Yes	1 (4.2)	0 (0.0)	1 (1.9)
No	23 (95.8)	30 (100.0)	53 (98.1)
Thinking it is enough food, n (%)	(n = 24)	(n = 30)	(n = 54)
Yes	1 (4.2)	1 (3.3)	2 (3.7)
No	23 (95.8)	29 (96.7)	52 (96.3)
Which season can you get most food from forest, n (%)	(n = 23)	(n = 30)	(n = 53)
Rainy season	3 (100.0)	27 (90.0)	50 (94.3)
Dry season	0 (0.0)	3 (10.0)	3 (5.7)
Family status, n (%)	(n = 23)	(n = 29)	(n = 52)
Rich	1 (4.3)	0 (0.0)	1 (1.9)
Medium	11 (47.8)	17 (58.6)	28 (53.8)
Poor	11 (47.8)	12 (41.4)	23 (44.2)
Feeding practices			
Who feeds child, n (%)	(n = 20)	(n = 25)	(n = 45)
Mother	19 (95.0)	21 (84.0)	40 (88.9)
Father	1 (5.0)	0 (0.0)	1 (2.2)
Grandmother	0 (0.0)	1 (4.0)	1 (2.2)
Eats by him or herself	0 (0.0)	3 (12.0)	3 (6.7)
Cooked food yesterday, n (%)	(n = 24)	(n = 30)	(n = 54)
Bamboo soup			
Yes	13 (54.2)	19 (63.3)	32 (69.3)
No	11 (45.8)	11 (36.7)	22 (40.7)
(Boiled/mixed) vegetables			
Yes	5 (20.8)	6 (20.0)	11 (20.4)
No	19 (79.2)	24 (80.0)	43 (79.6)
Chili paste			
Yes	5 (20.8)	6 (20.0)	11 (20.4)
No	19 (79.2)	24 (80.0)	43 (79.6)
Fish soup			
Yes	5 (20.8)	2 (6.7)	7 (13.0)
No	19 (79.2)	28 (93.3)	47 (87.0)
Boiled bamboo			
Yes	1 (4.2)	1 (3.3)	2 (3.7)
No	23 (95.8)	29 (96.7)	52 (96.3)
Other			

(continued)

**Table B1.** (continued)

	Not stunted	Stunted	Total
Yes	6 (25.0)	5 (16.7)	11 (20.4)
No	18 (75.0)	25 (83.3)	43 (79.6)
Number of different foods eaten yesterday, mean (SD)	(n = 24) 1.5 (0.7)	(n = 31) 1.4 (0.6)	(n = 55) 1.4 (0.6)
When food shortage, food for children below the age of 2, n (%)	(n = 13)	(n = 12)	(n = 25)
Only rice	9 (69.2)	5 (41.7)	14 (56.0)
Rice and milk	3 (23.1)	4 (33.3)	7 (28.0)
Milk	0 (0.0)	2 (16.7)	2 (8.0)
Dried noodles (bought)	1 (7.7)	1 (8.3)	2 (8.0)
<b>Care and hygiene practices</b>			
Health problems children last 2 weeks, n (%)	(n = 20)	(n = 29)	(n = 49)
Stomachache/diarrhea			
Yes	7 (35.0)	10 (34.5)	17 (34.7)
No	13 (65.0)	19 (65.5)	32 (65.3)
Fever			
Yes	4 (20.0)	5 (17.2)	9 (18.4)
No	16 (80.0)	24 (82.8)	40 (81.6)
Cough			
Yes	3 (15.0)	5 (17.2)	8 (16.3)
No	17 (85.0)	24 (82.8)	41 (83.7)
Malaria			
Yes	1 (5.0)	2 (6.9)	3 (6.1)
No	19 (95.0)	27 (93.1)	46 (93.9)
Headache			
Yes	2 (10.0)	0 (0.0)	2 (4.1)
No	18 (90.0)	29 (100.0)	47 (95.9)
Attended health center, n (%)	(n = 23)	(n = 28)	(n = 51)
Yes	18 (78.3)	19 (67.9)	37 (72.5)
No	5 (21.7)	9 (32.1)	14 (27.5)
Vaccinated child, n (%)	(n = 23)	(n = 29)	(n = 52)
Yes	20 (87.0)	22 (75.9)	42 (80.8)
No	3 (13.0)	7 (24.1)	10 (19.2)
Antibiotics for worms, n (%)	(n = 23)	(n = 29)	(n = 52)
Yes	20 (87.0)	23 (79.3)	43 (82.7)
No	3 (13.0)	6 (20.7)	9 (17.3)
Received vitamins, n (%)	(n = 23)	(n = 29)	(n = 52)
Yes	13 (56.5)	11 (37.9)	24 (46.2)
No	10 (43.5)	18 (62.1)	28 (53.8)
Techniques for cleaning water, n (%)	(n = 24)	(n = 30)	(n = 54)
Boiling	13 (54.2)	11 (36.7)	24 (44.4)
Sometimes boiling	4 (16.7)	6 (20.0)	10 (18.5)
Not boiling	7 (29.2)	13 (43.3)	20 (37.0)
Washed products before cooking, n (%)	(n = 23)	(n = 30)	(n = 53)
Yes	23 (100.0)	30 (100.0)	53 (100.0)
No	0 (0.0)	0 (0.0)	0 (0.0)
Hand washing practices, n (%)	(n = 24)	(n = 30)	(n = 54)
Before and after eating	17 (70.8)	24 (80.0)	41 (75.9)
Before cooking	4 (16.7)	7 (23.3)	11 (20.4)
Before eating	4 (16.7)	3 (10.0)	7 (13.0)

(continued)



**Table B1.** (continued)

	Not stunted	Stunted	Total
Morning, afternoon, evening	2 (8.3)	6 (20.0)	8 (14.8)
Frequency per day	2 (8.3)	1 (3.3)	3 (5.6)
Before feeding	0 (0.0)	1 (3.3)	1 (1.9)
Household environment			
Type of house (%)	(n = 23)	(n = 30)	(n = 53)
Stilt house	20 (87.0)	30 (100.0)	50 (94.3)
(Small) hut	2 (8.7)	0 (0.0)	2 (3.8)
Wooden house	1 (4.3)	0 (0.0)	1 (1.9)
House structure, n (%)	(n = 23)	(n = 30)	(n = 53)
Roof			
Steel	18 (78.3)	23 (76.7)	41 (77.4)
Grass	3 (13.0)	4 (13.3)	7 (13.2)
Tile	2 (8.7)	3 (10.0)	5 (9.4)
Wall			
Wooden	17 (73.9)	24 (80.0)	41 (77.4)
Bamboo	6 (26.1)	6 (20.0)	12 (22.6)
Floor			
Wooden	19 (82.6)	28 (93.3)	47 (88.7)
Earth	1 (4.3)	0 (0.0)	1 (1.9)
Bamboo	3 (13.0)	2 (6.7)	5 (9.4)
Water source for hand washing and cooking, n (%)	(n = 24)	(n = 31)	(n = 55)
River water			
Yes	12 (50.0)	11 (35.5)	23 (41.8)
No	12 (50.0)	20 (64.5)	32 (58.2)
Underground water			
Yes	12 (50.0)	10 (32.3)	22 (40.0)
No	12 (50.0)	21 (67.7)	33 (60.0)
Spring water			
Yes	4 (16.7)	13 (41.9)	17 (30.9)
No	20 (83.3)	18 (58.1)	38 (69.1)
Satisfied with water, n (%)	(n = 21)	(n = 23)	(n = 44)
Yes	9 (42.9)	13 (56.5)	22 (50.0)
No	12 (57.1)	10 (43.5)	22 (50.0)
Knowledge			
Knowledge benefits of handwashing, n (%)	(n = 23)	(n = 30)	(n = 53)
Good for health/prevent diseases			
Yes	16 (69.6)	24 (80.0)	40 (75.5)
No	7 (30.4)	6 (20.0)	13 (24.5)
Is clean			
Yes	11 (47.8)	18 (60.0)	29 (54.7)
No	12 (52.2)	12 (40.0)	24 (45.3)
Has good benefits			
Yes	4 (17.4)	3 (10.0)	7 (13.2)
No	19 (82.6)	27 (90.0)	46 (86.8)
Knowledge about open defecation, n (%)	(n = 24)	(n = 30)	(n = 54)
Difficult			
Yes	7 (29.2)	16 (53.3)	23 (42.6)
No	17 (70.8)	14 (46.7)	31 (57.4)
Causes disease			

(continued)

**Table B1.** (continued)

	Not stunted	Stunted	Total
Yes	10 (41.7)	8 (26.7)	18 (33.3)
No	14 (58.3)	22 (73.3)	36 (66.7)
Is unclean			
Yes	6 (25.0)	4 (13.3)	10 (18.5)
No	18 (75.0)	26 (86.7)	44 (81.5)
There are mosquitoes/worms/other animals			
Yes	6 (25.0)	5 (16.7)	11 (20.4)
No	18 (75.0)	25 (83.3)	43 (79.6)
Perception child compared to other children, n (%)	(n = 23)	(n = 29)	(n = 52)
Strong			
Yes	3 (13.0)	5 (17.2)	8 (15.4)
No	20 (87.0)	24 (82.8)	44 (84.6)
Normal			
Yes	9 (39.1)	9 (31.0)	18 (34.6)
No	14 (60.9)	20 (69.0)	34 (65.4)
Thin			
Yes	11 (47.8)	17 (58.6)	28 (53.8)
No	12 (52.2)	12 (41.4)	24 (46.2)
Short/small			
Yes	5 (21.7)	3 (10.3)	8 (15.4)
No	18 (78.3)	26 (89.7)	44 (84.6)
<b>Motivation</b>			
Who skipped food if there was not enough, n (%)	(n = 24)	(n = 29)	(n = 53)
Everyone starves	1 (4.2)	5 (17.2)	6 (11.3)
Parents starve for children	8 (33.3)	8 (27.6)	16 (30.2)
Parents eat differently	2 (8.3)	1 (3.4)	3 (5.7)
Everyone eats differently	1 (4.2)	2 (6.9)	3 (5.7)
Food is for children and mother (father starves)	2 (8.3)	0 (0.0)	2 (3.8)
Nobody starves	10 (41.7)	13 (44.8)	23 (43.4)
Earning income, n (%)	(n = 23)	(n = 30)	(n = 53)
Yes	17 (73.9)	23 (76.7)	40 (75.9)
No	6 (26.1)	7 (23.3)	13 (24.1)
Way of receiving income, n (%)	(n = 24)	(n = 30)	(n = 54)
Selling food and animals			
Yes	12 (50.0)	17 (56.7)	29 (53.7)
No	12 (50.0)	13 (43.3)	25 (46.3)
Working on farm/factory			
Yes	6 (25.0)	4 (13.1)	10 (18.5)
No	18 (75.0)	26 (86.7)	44 (81.5)
Others			
Yes	0 (0.0)	3 (10.0)	3 (5.5)
No		27 (90.0)	51 (94.5)

Abbreviations: n, number of people; SD, standard deviation.

## Authors' Note

SB, DB, SK, DE, and JB contributed to designing and contextualizing the research. Data collection, analysis, and interpretation were undertaken by SB and DB in close collaboration with DE. Drafting and editing the manuscript were undertaken by SB and DB, while SK, JB, and DE supported this process.

## Acknowledgments

We are grateful for the assistance and collaboration of MCNV staff and health authority of Nong District for coordinating and participating in the interviews. We would like to thank all participants (HWs and family members) for their participation during the data collection which contributed to revealing the PD practices and underlying factors in remote mountainous areas of Laos. Finally, we sincerely thank Professor Pamela Wright for commenting on and editing this manuscript.

## Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

## Funding

This research was funded by NWO-WOTRO Science for Global Development from the Dutch Ministry of Foreign Affairs under the Nutrition Sensitive Agriculture project in Lao PDR and Vietnam.

## ORCID iD

Sayvisene Boulom, MSc  <https://orcid.org/0000-0003-0164-8442>

## References

1. WHO. *Ambition and Action in Nutrition 2016-2025*; 2017.
2. Hoddinott J, Maluccio JA, Behrman JR, Flores R, Martorell R. Effect of a nutrition intervention during early childhood on economic productivity in Guatemalan adults. *Lancet*. 2008;371(9610):411-416. doi:10.1016/S0140-6736(08)60205-6
3. Martorell R. Improved nutrition in the first 1000 days and adult human capital and health. *Am J Hum Biol*. 2017;29(2):1-24. doi:10.1002/ajhb.22952
4. UN. *Transforming Our World: The 2030 Agenda for Sustainable Development*; 2015. doi:10.1201/b20466-7
5. UNICEF, WHO, World Bank Group. Malnutrition. Published 2020. Accessed April 25, 2022. <https://data.unicef.org/nutrition>
6. WHO. Malnutrition. Published 2018. Accessed April 25, 2022. <https://www.who.int/news-room/fact-sheets/detail/malnutrition>
7. UNICEF, WHO, World Bank Group. Databases stunting (national and disaggregated). 2020.
8. Boulom S, Essink DR, Kang MH, Koumnavong S, Broerse JEW. Factors associated with child malnutrition in mountainous ethnic minority communities in Lao PDR. *Glob Health Action*. 2020;13(suppl 2):1785736. doi:10.1080/16549716.2020.1785736
9. Pahlisch TH, Parvathi P, Waibel H. *Comparing Peri-Urban versus Rural Poverty and Child Malnutrition Reduction: Insights from Southeast Asia*. Leibniz Universitaet Hannover, Institute of Development and Agricultural Economics, Project TVSEP; 2017.
10. WFP. *Food and Nutrition Security Atlas of Lao PDR*. Federal Ministry for Economic Cooperation and Development; 2013.
11. Zeitlin M, Ghassemi H, Mansour M. *Positive Deviance in Child Nutrition with Emphasis on Psychosocial and Behavioural Aspects and Implications for Development*. World Health Organization; 1990:163.
12. Sosanya ME, Adeosun FF, Okafor DT, Ifitezue LC. Positive deviance—an expeditious tool for action to ameliorate malnutrition in resource-poor settings. *J Nutr Ecology Food Res*. 2017;4(2):178-187. doi:10.1166/jnef.2017.1165
13. Saha C, Nambiar VS. Relationships between Positive Deviant Behaviors and Children of Normal Growth Pattern in Poorly Resourced Rural Communities. *Indian J Community Med*. 2018;43(3):161-164. doi:10.4103/ijcm.IJCM\_236\_17
14. Shroff MR. *Child nutritional status, feeding practices and women's autonomy in rural Andhra Pradesh, India*. Carolina Digital Repository; 2007:161. doi:10.17615/gtv8-sa77
15. Kamiya Y, Nomura M, Ogino H, Yoshikawa K, Siengsounthone L, Xangsayarath P. Mothers' autonomy and childhood stunting: Evidence from semi-urban communities in Lao PDR. *BMC Womens Health*. 2018;18(1):70. doi:10.1186/s12905-018-0567-3
16. Wishik SM, Vynckt S. The use of nutritional 'positive deviants' to identify approaches for modification

- of dietary practices. *Am J Public Health*. 1976; 66(1): 38-42. doi:10.2105/ajph.66.1.38
17. Moon MD. Triangulation: a method to increase validity, reliability, and legitimation in clinical research. *Journal Emerg Nurs*. 2019;45(1): 103-105. doi:10.1016/j.jen.2018.11.004
  18. MCNV. Scaling-Up Nutrition-Sensitive Agriculture (NSA) In Lao PDR and Vietnam. Published 2017. Accessed April 25, 2021. <https://mcnv.org/news-center/news/news-scaling-up-nutrition-sensitive-agriculture-nsa-in-lao-pdr-and-vietnam/>
  19. MCNV. For health and development in South East Asia, 2017. Accessed April 25, 2022. <https://mcnv.org/nl/>
  20. Etikan I. Comparison of Convenience Sampling and Purposive Sampling. *Am J Theor Appl Stat*. 2016;5(1):1-4. doi:10.11648/j.ajtas.20160501.11
  21. ACIAR. Lao PDR. Australian Government, 2008. Accessed April 25, 2022. <https://www.aciar.gov.au/East-Asia/Lao-PDR>
  22. Hygiene and Prevention Department Ministry of Health. *Infant and Young Child Feeding Guidelines For Lao PDR*; 2012.
  23. Jejeebhoy SJ, Sathar ZA. Women's Autonomy in India and Pakistan: The influence of religion and region. *Popul Dev Rev* 2001;27(4):687-712.
  24. IBM. *SPSS statistics for Windows*; 2016.
  25. WHO. WHO Child Growth Standards SPSS syntax file.
  26. ATLAS.ti 8.4 Windows. 2019.
  27. UNICEF. *UNICEF's Approach to Scaling up Nutrition for Mothers and Their Children. Discussion Paper*. Programme Division; 2015.
  28. Rose AJ, McCullough MB. A practical guide to using the positive deviance method in health services research. *Health Serv Res*. 2017;52(3): 1207-1222. doi:10.1111/1475-6773.12524
  29. National Institute of Public Health. Lao P.D.R. Health Research Portal: Ethics, 2019.
  30. Lao Statistics Bureau and UNICEF. *Lao Social Indicator Survey II 2017, Survey Findings Report*. Vientiane; 2018.
  31. UNIAP. *Report on an Exploratory Research about Migration and Human Trafficking to China in Luang Namtha and Phongsaly, Lao PDR*; 2013.
  32. Khaing HT, Nomura S, Yoneoka D, Ueda P, Shibuya K. Risk factors and regional variations of malnutrition among children under 5 in Myanmar: cross-sectional analyses at national and subnational levels. *BMJ Open*. 2019;9:e030894. doi:10.1136/bmjopen-2019-030894
  33. Mbuya NVN, Atwood SJ, Huynh PN. *Persistent Malnutrition in Ethnic Minority Communities of Vietnam: Issues and Options for Policy and Intervention*; 2019. doi:10.1596/978-1-4648-1432-7
  34. Boah M, Azupogo F, Amporfro DA, Abada LA. The epidemiology of undernutrition and its determinants in children under five years in Ghana. *PLoS One*. 2019;14(7):e021966. doi:10.1371/journal.pone.0219665
  35. UNICEF. *Laos - 1,000 days Program Phase 2*; 2017.
  36. Black RE, Allen LH, Bhutta ZA, et al. Maternal and child undernutrition: global and regional exposures and health consequences. *Lancet*. 2008;371(9608): 243-260. doi:10.1016/S0140-6736(07)61690-0
  37. Mukuria AG, Martin SL, Egondi T, Bingham A, Thuita FM. Role of social support in improving infant feeding practices in western Kenya: a quasi-experimental study. *Glob Health Sci Pract*. 2016;4(1):55-72. doi:10.9745/GHSP-D-15-00197
  38. Kajjura R., Veldman F, Kassier S. Effect of nutrition education on knowledge, complementary feeding, and hygiene practices of mothers with moderate acutely malnourished children in Uganda. *Food Nutr Bull*. 2019;40(2):221-230. doi:10.1177/0379572119840214
  39. Levinson F., Barney J, Bassett L, Schultink W. Utilization of positive deviance analysis in evaluating community-based nutrition programs: an application to the Dular program in Bihar, India. *Food Nutr Bull*. 2007;28(3):259-265. doi:10.1177/156482650702800301
  40. Corbett J. Poverty and Sickness: The high costs of III-health. *IDS Bull*. 2009;20(2):58-62.
  41. Ryan RM, Deci EL. Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *Am Psychol*. 2000;55(1): 68-78. doi:10.1037/0003-066X.55.1.68
  42. Yu SH, Mason J, Crum J, Cappa C, Hotchkiss DR. Differential effects of young maternal age on child growth. *Glob Health Action*. 2016;9:31171. doi:10.3402/gha.v9.31171
  43. Akombi BJ, Agho KE, Hall JJ, Merom D, Astell-Burt T, Renzaho AMN. Stunting and severe stunting among children under-5 years in Nigeria: A multi-level analysis. *BMC Pediatr*. 2017;17:15. doi:10.1186/s12887-016-0770-z