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## Changes in household food security, access to health services, and income in northern Lao PDR during the COVID-19 pandemic: a cross-sectional survey

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4 1 **Changes in household food security, access to health services, and income in**  
5 2 **northern Lao PDR during the COVID-19 pandemic: a cross-sectional survey**

6  
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27 14 **Keywords:** food security; dietary diversity; underweight; wasting; income; COVID-19; Lao PDR;  
28 15 malnutrition; local food production  
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## 16 Abstract

17 **Objectives:** We assessed the relative difficulty in meeting food needs during the COVID-19 pandemic  
18 compared to before; determined associations between pandemic-associated difficulties in food access  
19 and household, maternal and child food security; and identified resiliency-promoting strategies.

20 **Design:** A cross-sectional survey of households undertaken in November 2020.

21 **Setting:** Rural districts of Luang Prabang Province, Lao People's Democratic Republic

22 **Participants:** Households (N=1,122) with children under five years.

23 **Primary and secondary outcomes measured:** Survey respondents reported the relative ease of access of  
24 food and health care as well as changes in income and expenditures compared to before March 2020.  
25 We determined indicators of food security and source of foods consumed for households, women, and  
26 children, as well as prevalence of malnutrition in children under five.

27 **Results:** Nearly four-fifths (78.5%) found it harder to meet household food needs during the pandemic.  
28 The most common reasons were increased food prices (51.2%), loss of income (45.3%), and decreased  
29 food availability (36.6%). Adjusting for demographics, households with increased difficulty meeting food  
30 needs had lower food consumption scores and child dietary diversity. Over 85% of households lost  
31 income during the pandemic. Decreased expenditures was associated with reliance on more extreme  
32 coping strategies to meet food needs. The households who experienced no change in meeting food  
33 needs produced a greater percentage of their food from homegrown methods (4.22% more, 95% CI:  
34 1.28, 7.15), than households who found it more difficult. We estimated that decreases in child  
35 bodyweight by 0.5 – 1% would increase wasting in this population by 1.7 – 2.1 percentage points.

36 **Conclusions:** Pandemic-associated shocks may have large effects on malnutrition prevalence. Action is  
37 needed to mitigate consequences of the pandemic on nutrition. Local food production and safety net  
38 programs that offset income losses may help.

## 39 List of abbreviations:

40 **LMICs:** low- and middle-income countries

41 **FAO:** Food and agriculture organization

42 **FCS:** food consumption score

43 **CSI:** coping strategies index

44 **DDS:** dietary diversity score

45 **HAZ:** height-for-age Z-score

46 **WAZ:** weight-for-age Z-score

47 **WHZ:** weight-for-height Z-score

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451 **Strengths and limitations of this study**

- 8 52 • We characterize food security across all members of the household, including  
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10 53 women and children, through a series of standardized measures, and describe the  
11  
12 54 source of foods consumed, permitting identification of strategies to promote  
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14 55 resilience in this population.  
15  
16 56 • We capture a large, representative sample of Luang Prabang Province, a  
17  
18 57 marginalized population with high prevalence of ethnic minorities, for whom little  
19  
20 58 data on nutrition was previously available.  
21  
22 59 • The results of this study may not be generalizable to other counties with varying  
23  
24 60 economic profiles or rates of COVID-19, to urban communities, or to rural provinces  
25  
26 61 with lower reliance on tourism.  
27  
28 62 • The analyses are cross-sectional, preventing establishment of causal relationships.  
29  
30 63 • Self-reported measures, including food consumption patterns and relative ability to  
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32 64 meet food needs during the pandemic as compared to before, are subject to recall  
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34 65 bias.  
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## 67 Introduction

68 Disruptions to food, economics, and health systems during the COVID-19 pandemic are expected to  
69 increase the risk of malnutrition among low- and middle-income countries (LMICs) [1-4]. The food  
70 supply chain has faced challenges across multiple stages, including loss of labor for agricultural  
71 production and postharvest handling due to movement restrictions or illnesses; closure of processing  
72 and distributing facilities; disruptions in distribution networks under restricted trade policies; and  
73 changes in consumer demand and market access [5]. Such challenges have resulted in increases in food  
74 prices, with the Food and Agricultural Organization (FAO) reporting that wheat and rice prices increased  
75 by 8% and 25%, respectively, between March 2019 and April 2020 [6]. Economic disruptions, such as  
76 business closures and declines in tourism, are simultaneously expected to reduce country-specific gross  
77 national incomes (GNI) by around 8% in most LMICs [7]. Losses in income are expected to push an  
78 additional 1.4 million people into extreme poverty, classified as earning less than \$1.90 per day [7].  
79 Overall, the World Food Programme projects that the number of people in LMICs who are food insecure  
80 will double, from 135 million in 2019 to 265 million by the end of 2020 [8]. Compounding this effect,  
81 health services designed to catch and treat acute malnutrition may be disrupted in many LMICs. For  
82 instance, UNICEF estimates a reduction of 30% in the coverage of essential nutrition services in LMICs  
83 due to difficulties in mobility of both users and providers, interruption of non-COVID-19 services in  
84 communities, higher burdens on the health care workers, and limited personal protective equipment  
85 [9].

86 Increased food insecurity coupled with a decline in access to essential nutritional services is expected to  
87 lead to increases in the prevalence of childhood wasting, an acute form of malnutrition associated with  
88 elevated risk of mortality [10, 11]. One study estimates that there could be a 14.3% increase in the  
89 prevalence of moderate or severe wasting among children younger than five years in the 118 LMICs due  
90 to COVID-19-related income losses [2]. By another projection, an increase in wasting of this order of

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3 91 magnitude (10-50%), coupled with a decline in maternal and child health services by 9.8-15.9%, would  
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5 92 be associated with an increase of 9.8-44.7% in under-five deaths per month [12]. To prevent a global  
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7 93 malnutrition crisis, leaders from four United Nations agencies (UNHCR, UNICEF, FAO, WHO) have issued  
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10 94 an immediate call to action, recommending \$2.4 billion be directed to avoiding child malnutrition  
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12 95 through wasting treatment and prevention, vitamin A supplementation, and breastfeeding support [13].  
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14 96 Alongside these efforts, leaders have called for research that estimates the scale and reach of nutrition  
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16 97 challenges, including country-specific estimates of the effect of the pandemic on incomes, and the  
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18 98 ability to meet food needs and access health services.

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21 99 Lao People's Democratic Republic (PDR) has one of the highest rates of malnutrition in southeast Asia,  
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23 100 with a national prevalence of stunting of 33%, underweight of 21% and wasting of 9% [14]. Lao PDR  
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25 101 experienced its first case of COVID-19 infection in March 2020 [15]. Shortly afterwards, the government  
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27 102 imposed a strict lockdown for six weeks, stopping human movement between districts, provinces, and  
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29 103 across the border. A total of six cases were identified between March and April 2020. Beginning in May  
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31 104 2020, restrictions on within-country movement eased along with adherence to protective measures  
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33 105 (e.g., mask wearing and social distancing), but borders remain closed to everyone except those who  
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35 106 entered the country via special mission flights, who must undergo strict quarantine and testing in  
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37 107 government authorised facility [16]. Between March 2020 and February 2021, only 45 cases had been  
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39 108 reported in Lao PDR, mainly among individuals returning to the country [17]. In April 2021, a second  
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41 109 outbreak of COVID-19 occurred that spread quickly during New Year celebrations. A second lockdown  
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43 110 was imposed on April 25<sup>th</sup> with provincial and district travel restricted, surveillance on closed country  
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45 111 borders increased, and testing and contact tracing efforts increased. Between April 1, 2021 and June 1,  
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47 112 2021, over 1,800 cases were confirmed, the majority in the capital city, Vientiane, with the first  
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49 113 confirmed death from COVID-19 occurring in May of 2021 [17].  
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3 114 While Lao PDR has reported fewer cases of COVID-19 than its neighbouring countries, it may experience  
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5 115 substantial economic and food security effects of the pandemic. The FAO reports that food prices in Lao  
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7 116 PDR have increased by 7.1% between February 14, 2020 to January 30, 2021 [18]. At the same time, the  
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9 117 Ministry of Labour and Social Welfare reported a surge in unemployment from 2% before the pandemic  
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11 118 to 25% as of May 2020 [19]. Moreover, in a national assessment, UNICEF found that between August  
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13 119 2019 and August 2020, there was a 10-24% decline in the coverage of maternal health services,  
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15 120 newborn services, routine vaccinations, screening for child wasting, and treatment of child wasting [9].  
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17 121 The economic effects of the pandemic are expected to be felt most strongly in Luang Prabang province,  
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19 122 a popular tourist destination. In 2019, Luang Prabang received about 638,000 international visitors and  
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21 123 222,000 domestic tourists. In May 2020, 78% of Luang Prabang's tourism enterprises were closed, and  
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23 124 those that remained open did so largely at partial capacity [20]. This is particularly concerning, as the  
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25 125 Luang Prabang province bears a disproportionate burden of children who are stunted (41.3%) or  
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27 126 underweight (25%) [14].  
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33 127 In rural provinces of Luang Prabang where documented COVID-19 transmission was low, we aimed to 1)  
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35 128 assess the relative difficulty in meeting food needs and accessing health care during the COVID-19  
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37 129 pandemic compared to before the pandemic; 2) compare self-reported difficulty in meeting food needs  
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39 130 to indicators of food security among women, children and the household; 3) identify strategies  
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41 131 associated with increased resiliency to food insecurity.  
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## 132 **Methods**

### 133 *Survey region and population*

134 We obtained data on a cross-sectional, household survey conducted in November 2020 from the Lao  
135 Provincial Health Department. Data were collected as part of the Lao Health Department's endline  
136 evaluation of the Primary Health Care Program to monitor and evaluate public health activities over a

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3 137 three-year period, starting in 2017. Data were collected from three districts - Nan, NamBak, and Pak Ou  
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5 138 - in Luang Prabang Province. These districts have a high prevalence of ethnic minorities, particularly  
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7 139 Hmong and Khmu ethnicities. Livelihoods are largely agriculturally based.  
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#### 10 140 *Sampling plan*

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13 141 The target overall sample size was 1,200 households. The sample size was chosen to detect with 95%  
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15 142 confidence and 80% power a change from 77.7% to 83% in the proportion of women delivering with a  
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17 143 skilled birth attendant since the baseline survey in 2017, accounting for a design effect of 1.5 and a non-  
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19 144 response rate of 5%. A household was considered eligible for selection if members have lived in the  
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21 145 village for at least two years, if it contained a child under the age of five, and if an adult respondent  
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23 146 provided verbal, informed consent to participate.  
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27 147 Household selection followed a multistage clustered sampling design that stratified by the three  
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29 148 districts. In the first stage, 25 villages were selected using probability proportional to size sampling. In  
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31 149 the second stage, 30 households per village were selected using simple random sampling from a list of  
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33 150 eligible households prepared by the village head in collaboration with the village health volunteer. The  
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35 151 health and diet of one child under the age of five per household was assessed, and anthropometric  
36  
37 152 measurements taken. If there were more than one child under five years in the house, a third stage of  
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39 153 sampling was used, in which one child was selected using simple random sampling.  
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#### 44 154 *Household questionnaire*

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47 155 Household questionnaires were administered verbally by trained data collectors. Information of  
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49 156 household demographics, household food security, maternal and child diet, child anthropometrics, and  
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51 157 self-reported changes in food access, income, expenditures and access to health services during the  
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53 158 pandemic were collected. The survey was translated into Lao language, and back translated to ensure  
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55 159 correct translation. One enumerator per team was also fluent in the local languages of Khmu and  
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3 160 Hmong, in case the respondent did not speak Lao. A copy of the reduced survey tool is included in the  
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5 161 Supplemental Info.  
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8 162 The endline survey used the same questionnaire as the baseline survey, which was adapted from global  
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10 163 standard reproductive, maternal, newborn and child health and nutrition surveys, and added questions  
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12 164 related to food security and access to health services during the pandemic. These additional questions  
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14 165 were adapted from a standardized questionnaire developed by Save the Children, International to  
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16 166 assess the impact of COVID-19 globally [21]. Respondents were asked if, compared to before the  
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18 167 pandemic, it was much harder, somewhat harder, easier, or the same to meet their family's food needs.  
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20 168 If harder, families were asked to list the reasons why. Similarly, respondents were asked if, compared to  
21  
22 169 before the pandemic, it was much harder, somewhat harder, easier, or the same to access health care.  
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24 170 Finally, families were asked if they lost income or reduced their expenditures during the pandemic, and  
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26 171 if so, asked to estimate by what percent.

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31 172 *Calculation of household food security and maternal and child dietary diversity*  
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34 173 Household food security was assessed through two standard indicators: the food consumption score  
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36 174 and coping strategy index. The food consumption score (FCS) is a frequency weighted household dietary  
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38 175 diversity score calculated by multiplying the frequency of consumption of different food groups  
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40 176 consumed by a household during the 7 days before the survey by a weighting factor, and summing [22].  
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42 177 The food groups, and their respective weights include: main staples (2), pulses (3), vegetables (1), fruit  
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44 178 (1), meat and fish (4), dairy (4), sugar (0.5), and oils/butter (0.5). Higher scores indicate better food  
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46 179 security.

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50 180 The Coping Strategies Index (CSI) was also used to compare household food security. CSI is calculated by  
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52 181 multiplying the weekly frequency of five behaviors by the weight of the behavior and summing for all  
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54 182 behaviors [23]. The five standard coping strategies and their severity weightings are: Eating less-

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3 183 preferred foods (1.0); Borrowing food/money from friends and relatives (2.0); Limiting portions at  
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5 184 mealtime (1.0); Limiting adult intake (3.0), and reducing the number of meals per day (1.0). Lower scores  
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7 185 indicate better food security. The CSI has good agreement with other indicators of household food  
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9 186 insecurity, including the household food insecurity and access scale [24].

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12 187 In addition, we calculated an individual dietary diversity score (DDS) for women and children aged 6-59  
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14 188 months [25]. DDS for children aged 24-59 months is calculated by summing the total number of food  
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16 189 groups consumed in the previous 24 hours, where the food groups are defined as: grains, roots and  
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18 190 white tubers; legumes and nuts; dairy products; meat; eggs; vitamin A-containing fruits and vegetables  
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20 191 (i.e., dark-green, leafy vegetables, fruits that are orange on the inside); other fruits and vegetables. The  
21  
22 192 child must consume at least four of the seven food groups to meet their minimum acceptable dietary  
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24 193 diversity [25]. For children aged 6-23 months, breastmilk is added as an eighth food group and the child  
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26 194 must consume five out of eight food groups to meet minimum acceptable dietary diversity.

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29 195 DDS for women is tallied by adding up the number of food groups consumed out of the following ten  
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31 196 groups: grains, roots, and white tubers; legumes; nuts and seeds; dairy products; meat; eggs; dark, leafy  
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33 197 greens and vegetables; other vitamin-A-rich fruits and vegetables; other vegetables; other fruits. The  
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35 198 woman must consume at least five of the ten food groups to meet her minimum dietary diversity [25].  
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37 199 Women who reported having an abnormal diet (i.e., ate much more or much less than normal) in the  
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39 200 past 24 hours were excluded from analysis.

#### 201 *Anthropometric analysis*

202 Weight and height of children were recorded to the nearest 0.01 kg and 0.1 cm, respectively. Weight-  
203 for-age (WAZ), height-for-age (HAZ), and weight-for-height (WHZ) Z-scores were determined using 2006  
204 WHO Growth Standards [26]. A child was considered stunted, wasted, or underweight if they had a  
205 WAZ, WHZ, or WAZ score below -2SD, respectively. The degree to which even small changes to body

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3 206 weight will translate into changes in the proportion of children classified as underweight or wasted  
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5 207 varies between populations, as it depends on the density of Z-scores clustered around the dichotomous  
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7 208 classification threshold of -2SD [27]. As undernutrition prevalence is a key indicator used to monitor  
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9 209 progress and allocate nutrition and other health services, we considered the theoretical implications of  
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11 210 increased food insecurity on undernutrition prevalence in our population. We examined the change in  
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13 211 childhood undernutrition in our study population to a simulated reduction in bodyweight. Following  
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15 212 prior study, we presumed potential COVID-19 associated shocks to range between a 0.5% and 1%  
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17 213 reduction in bodyweight [27]. We simulated a reduction of 0.5% and 1% by multiplying child weight by  
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19 214 0.995 and 0.99, respectively, and recalculated the WAZ and WHZ scores under this simulated weight.  
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#### 24 215 *Statistical analysis*

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27 216 Data were analyzed in R version 3.5 [28]. Survey weights were calculated using the inverse probability of  
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29 217 selection for a child (for child outcome) or a household (for household or maternal outcomes). The  
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31 218 survey package in R was used to calculate means and percentages accounting for survey weights, and  
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33 219 standard errors used to calculate 95% confidence intervals were determined accounting for clustering  
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35 220 [29]. Univariate and multivariate associations were assessed using generalized linear models, accounting  
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37 221 for survey weights, and using cluster robust standard errors to adjust for clustering at the village level. A  
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39 222 directed-acyclic-graph (DAG) was used to identify variables that may confound the relationship between  
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41 223 pandemic-associated changes and household food security, where a confounder is defined as a variable  
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43 224 associated with the exposure, causally associated with the outcome, and not on the causal pathway  
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45 225 between exposure and outcome. Multivariate models examining the relationship between pandemic-  
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47 226 associated changes and household food security included fixed effects for potential confounding factors  
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49 227 of household ethnicity, household size, education level of mother and the head of household, and  
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51 228 district. Adjusted models for maternal outcomes additionally included mother's age, and models for  
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53 229 children outcomes additionally included child's age and sex.  
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3 230 *Ethics*  
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6 231 Data were collected by the Lao Provincial Health Department as part of routine, non-research public  
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8 232 health activities. We obtained data from the Lao Provincial Health Department. Ethical clearance for  
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10 233 secondary data analysis was obtained from the Research Ethics Committee in the University of Health  
11  
12 234 Sciences within the Lao Ministry of Health and Committee for the Protection of Human Subjects within  
13  
14 235 University of California, Berkeley (protocol ID: 2021-05-14365). A copy of the ethical approval is included  
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16 236 in the Supplemental Info.  
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21 237 *Patient and Public Involvement*  
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24 238 Community members were involved in the conduct of this research. During the survey, community  
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26 239 volunteers assisted in locating other community members for participation in the survey. Community  
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28 240 members were informed of the results of this study during one of their monthly village health days. The  
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30 241 results were conveyed verbally and with posters by the village health volunteers.  
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34 242 **Results**  
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37 243 Interviews were completed for 1,122 households, corresponding to a 93.5% response rate. Reasons for  
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39 244 non-response included empty house (53.8%), parent not at home (38.5%) and inaccessible house (5.1%).  
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41 245 The most common ethnicities of those interviewed were Khmu (463, 41.3%), Lao Lom (340, 30.3%), and  
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43 246 Hmong (281, 25.0%). Undernutrition among children under five years in the study region was high, with  
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45 247 the survey-weighted prevalence of wasting at 4.5% (95% CI: 3.5, 5.8), underweight at 18.2% (95% CI:  
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47 248 15.9, 20.7%), and stunting at 32.9% (95% CI: 29.6, 36.4%).  
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51 249 *Food security*  
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250 Nearly four-fifths (78.5%) of the study population reported that it was harder to meet their family's food  
251 needs during the pandemic, as compared to before (Table 1). A weighted 60.9% (95% CI: 57.6, 64.1%) of  
252 individuals reported that it was somewhat harder to meet food needs, while 17.6% (95% CI: 15.4, 20.0%)  
253 reported that it was much harder. Among the 874 individuals who found it harder to meet food needs,  
254 the most common reason reported was that foods were more expensive (51.2%), followed by household  
255 losing income (45.3%), food not available at markets (36.6%), and markets being closed (36.5%). The  
256 median monthly expenditure among households was US\$133. Households spent, on average, 40% of  
257 their income on food, which was increased from 30% in 2017.

258 The mean food consumption score was 60.9 (95% CI: 59.7, 62.3) (Table 2). Households consumed rice  
259 daily and meat and vegetables an average of 3.0 and 4.8 days per week, respectively. On average,  
260 children consumed 4.21 (95% CI: 3.95, 4.18) food groups in the day prior to the survey, corresponding to  
261 62.5% (95% CI: 59.1, 65.8) of children that met the minimum DDS requirement. Women consumed an  
262 average of 5.38 (95% CI: 5.25, 5.51) food groups, corresponding to 67.7% (95% CI: 64.4, 70.9) meeting  
263 her minimum DDS. Compared to 2017, households in 2020 demonstrated significantly ( $p < 0.05$ ) lower  
264 dietary diversity and household food security. In 2017, 76% of women and 69% of children met their  
265 minimum dietary diversity score, and the average CSI for households was 0.7 points lower. There was no  
266 change in household FCS from 2017 to 2020.

267 The distribution of both household food security indicators differed by whether or not households found  
268 it harder to access food during the pandemic (Figure 1). Among households who found it harder to meet  
269 their food needs during the pandemic, there was greater density of lower FCS (indicating worse food  
270 security) and higher CSI (indicating worse food security) compared to those who experienced no change.  
271 These relationships between household FCS and access to food during the pandemic were also seen in  
272 multivariate regression analyses (Table 2; Figure 2). Adjusting for ethnicity of the household, size of the  
273 household, district, and education level of the mother and head of household, we estimated that the

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3 274 average food consumption score among households who found it harder to meet their food needs was  
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5 275 2.74 points lower (95% CI: 0.55, 4.92) than the average food consumption score among households who  
6  
7 276 experienced no change (Figure 2). This is roughly equivalent to consuming vegetables nearly three fewer  
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9  
10 277 times per week, or consuming rice one less time per week. The household coping strategies index  
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12 278 among households who had a harder time meeting their food needs was higher, indicating lower food  
13  
14 279 security, but not significantly so. Dietary diversity scores for women and children were lower among  
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16 280 households who had more difficulty meeting their food needs during the pandemic, but not significantly  
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19 281 so in adjusted analyses.  
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24 283 **Figure 1.** Violin plot showing distribution of two household food security measures, together with their  
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26 284 median and interquartile range (IQR). Household food security was measured through food  
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28 285 consumption score (FCS) (A, B) and coping strategies index (CSI) (C, D). Food insecurity is associated with  
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30 286 low FCS and high CSI.  
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37 288 **Figure 2.** The difference in mean of food security indicator among households who had a harder time  
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39 289 meeting their food needs during the pandemic compared to those who did not. Vertical bars represent  
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41 290 95% confidence intervals. Adjusted models for households control for household ethnicity, household  
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43 291 size, education level of mother and the head of household, and district. Adjusted models for mothers  
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45 292 include additionally mother's age. Adjusted models for children include additionally child's age and sex.  
46  
47 293 FCS = food consumption score; CSI = coping strategy index; DDS = dietary diversity score. Lower values  
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49 294 for FCS and DDS and higher values of CSI indicate greater food insecurity.  
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54 295 *Resiliency to food insecurity*  
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296 We estimated the percentage of a household's food sources in the past week that was self-produced  
297 (e.g., farmed, fished, hunted, gathered). On average, families met 42% of their food needs through self-  
298 production (interquartile range: 27%, 57%). Commonly self-produced foods included: insects, aquatic  
299 animals other than fish, mushrooms, and roots (Figure 3). Over half of households also self-produced  
300 rice and vegetables, and about one quarter self-produced fish, meat, and fruits. We found that  
301 households who derived a greater proportion of their food needs through homegrown methods were  
302 more resilient than families who purchased their foods. Adjusting for ethnicity of the household, size of  
303 the household, district, and education level of the mother and head of household, we estimated that the  
304 average percentage of food obtained from homegrown methods was 4.22% (95% CI: 1.28, 7.15%) lower  
305 among households who found it harder to meet their food needs compared to household who  
306 experienced no change. Persons who found it harder to meet their food needs during the pandemic also  
307 spent fewer hours per week fishing, gathering, or hunting, though the results were not significant.

308

309 **Figure 3.** Proportional source of each food group consumed during the past week by households.

310 Numbers in parenthesis above the bars indicates the mean number of days per week household  
311 consumed these food groups.

### 312 *Income and expenditures*

313 Over 85% of the study population reported losing income during the pandemic, with the majority of  
314 respondents (54.4%, 95% CI: 51.3, 57.4%) reporting losing between 25-50% of their income. Households  
315 who reported declines in income were more likely to reduce spending, with the greater the reduction in  
316 income corresponding to greater reductions in household expenditures (Figure 4a). A weighted 23.3%  
317 reported reducing household expenditures by 1-25%, while 35.7% reported reducing expenditures by

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3 318 25-50%. The distribution of both household food security indicators also differed by whether or not  
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5 319 households lost income during the pandemic (Figure 1).  
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8 320 Households who reduced expenditures during the pandemic had significantly decreased food security in  
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10 321 adjusted analyses, as measured by the FCS, and significantly decreased food security in univariate  
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12 322 analyses as measured by the FCS, CSI, and child's DDS (Figure 4b, Table 2). In adjusted analyses, families  
13  
14 323 who reported spending less during the pandemic had a household FCS that was 5.23 (95% CI: 3.41, 7.05)  
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16 324 units lower, and a CSI that was 0.83 (95% CI: -0.07, 1.74) units higher than families who did not reduce  
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18 325 spending. Dietary diversity scores for children were lower among households who had more difficulty  
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20 326 meeting their food needs during the pandemic, but not significantly so in adjusted analyses.  
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28 328 **Figure 4.** A) Mean decrease in expenditures reported, stratified by the percent reduction in household  
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30 329 income. Vertical bars represent 95% confidence intervals. B) The difference in mean of food security  
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32 330 indicator among households who reduced spending during the pandemic compared to those who did  
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34 331 not. Vertical bars represent 95% confidence intervals. Adjusted models for households control for  
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36 332 household ethnicity, household size, education level of mother and the head of household, and district.  
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38 333 Adjusted models for mothers include additionally mother's age. Adjusted models for children include  
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40 334 additionally child's age and sex. FCS = food consumption score; CSI = coping strategy index; DDS =  
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42 335 dietary diversity score. Lower values for FCS and DDS and higher values of CSI indicate greater food  
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44 336 insecurity.

#### 337 *Access to health care*

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51 338 A weighted 37.4% (95% CI: 34.6, 40.2%) of individuals reported that it was somewhat harder to access  
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53 339 healthcare compared to before the pandemic, while 4.8% (95% CI: 3.7, 6.1%) reported that it was much  
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55 340 harder (Table 1). We identified 123 (11%) women and 557 (50%) children who had experienced fever,

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3 341 diarrhea, or respiratory infection in the two weeks prior to the survey. Of these, a weighted 69.7% (95%  
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5 342 CI: 66.3, 73.0%) of children and 81.2% (95% CI: 73.3, 87.2) of women sought care from a health facility.  
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7 343 We found no association between healthcare seeking behavior and relative ability to access health care.  
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#### 10 344 *Sensitivity of undernutrition prevalence to small shocks in bodyweight*

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13 345 We did not find any difference in WAZ or WHZ scores among children from households who experienced  
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15 346 greater difficulty meeting their food needs or among children from households who lost income or  
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17 347 reduced spending. We examined the change in the proportion of children classified as wasted or  
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19 348 underweight under simulated shocks in which bodyweight decreased by 0.5% and 1%. In the study  
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21 349 population, we observed a prevalence of wasting of 4.5%. If bodyweight were to decrease by 0.5% or  
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23 350 1%, we estimated a prevalence of wasting of 6.2% and 6.6%, respectively, in our population (Figure 5). In  
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25 351 other words, a decrease in bodyweight by 0.5 – 1% would be associated with a disproportionate  
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27 352 increase in wasting of 1.7 – 2.1 percentage points in our study population. Similarly, we observed a  
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29 353 prevalence of underweight of 18.2%. If bodyweight were to decrease by 0.5% or 1%, we estimated a  
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31 354 prevalence of underweight of 19.0% and 20.5%, respectively. Therefore, a decrease in bodyweight by  
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33 355 only 0.5 – 1% would be associated with an increase in underweight of 0.8 – 2.3 percentage points in our  
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35 356 study population.  
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44 358 **Figure 5.** WHZ and WAZ curves among children under 5 under observed (cyan) conditions and under a  
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46 359 simulated shock in which body weight reduces by 1% (pink). Area shaded to the left of -2 represents the  
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48 360 proportion of children classified as wasted or underweight, respectively.  
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## 52 362 **Discussion**

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3 363 In a rural setting in Lao PDR with low documented COVID-19 transmission and high dependence on  
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5 364 tourism, we found prevalent loss of income and increased difficulty in meeting household food needs  
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7 365 following the start of the COVID-19 pandemic and a national border closure. In our household survey,  
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9 366 we found that nearly four-fifths of the study population reported that it was harder to meet their  
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11 367 family's food needs during the pandemic, with the most common reason being increases in food prices;  
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13 368 indeed, families reported that the proportion of their household expenditure on food had doubled since  
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15 369 baseline in 2017. At the same time, we found that over 85% of the study population reported losing  
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17 370 income during the pandemic, with over half of respondents reported losing between 25-50% of their  
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19 371 income. Respondents who reported losses in income and and/or reported greater challenges meeting  
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21 372 their food needs had small, but significant declines in household food security, as measured by the food  
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23 373 consumption score and coping strategies index. Nevertheless, the small differences in food security  
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25 374 indicators suggests that people in this population may have been able largely able to protect their  
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27 375 consumption without heavy reliance on negative coping strategies, despite some deterioration. Self-  
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29 376 production of food via farming, hunting, fishing, or fathering is common in this population, accounting  
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31 377 for 42% of food consumed. Our study found that individuals who derived a greater proportion of the  
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33 378 food from self-produced means were more resilient to pandemic-associated shocks.  
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39 379 Our results support a limited, but growing, body of empirical data that suggests wide scale difficulty in  
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41 380 meeting food needs and pervasive loss in income associated with the pandemic. In Kenya, surveys  
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43 381 administered before and after the COVID-19 lockdown found that 52% of the population changed their  
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45 382 dietary habits, most commonly via reductions in meat, dairy, and bread [30]. Nearly all (95%) of  
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47 383 respondents reported loss of income during the pandemic, with 88% finding that the resulting income  
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49 384 was insufficient to meet food needs. Over one third also attributed changes in food consumption to  
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51 385 lower food availability [30]. An interrupted time series analysis in Bangladesh found that median  
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53 386 incomes fell from US\$212 to \$59 during a two-month stay at home order, while the proportion of  
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3 387 families living on less than \$1.90 per day rose from 0.2% to 47.3% [31]. In this study, the proportion of  
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5 388 households classified as moderately or severely food insecure rose from 5.6% and 2.7%, respectively, to  
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7 389 36.5% and 15.3% [31]. Finally, in a Save the Children global survey, 85% of families living in Asia reported  
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10 390 income loss, with a strong negative association between income loss and dietary diversity [21]. No study  
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12 391 has yet to be published from Lao PDR, but an unpublished household survey in Phongsaly Province,  
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14 392 another rural province, found that 46% of households reduced their expenditures, and 24% took out  
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16 393 loans to buy food (personal communication).  
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19 394 Randomized control trials demonstrate that improved access to proper nutrition can improve WAZ and  
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21 395 WHZ Z-scores [32-34]. We examined theoretical implications of a decrease in bodyweight on  
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23 396 undernutrition prevalence, finding that a decrease in bodyweight of only 0.5 – 1% would be associated  
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25 397 with a larger percentage point increase in wasting (1.7 – 2.1 percentage points) and underweight (0.8 –  
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27 398 2.3 percentage points) in our study population. While LMICs have seen progress in reducing prevalence  
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29 399 of wasting and underweight, yearly reductions are small. Analysis of DHS data collected between 1990  
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31 400 and 2012 from 36 LMICs found that, on average, the prevalence of wasting decreased by 0.07  
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33 401 percentage points per year [35], while in Lao PDR, the prevalence of underweight decreased by an  
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35 402 average of 1.1 percentage points per year between 2012 and 2017 [14, 36]. This suggests that even  
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37 403 small effects of COVID-19 on food security, and thus bodyweight, could undo years of progress. This  
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39 404 echoes findings from a study conducted in India and is likely generalizable to many LMICs where there is  
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41 405 a high prevalence of undernutrition [27]. At the same time, we did not observe a difference in the WAZ  
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43 406 or WHZ scores between children whose household reported greater difficulty meeting food needs and  
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45 407 those who did not, nor did we see a difference in child dietary diversity score between these groups in  
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47 408 multivariate analyses. This may suggest that households in our study population prioritized maternal  
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49 409 and child consumption patterns even as families struggled to meet food needs. All villages in the study  
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51 410 population have been receiving interventions focused on sustainable behavioral change for maternal  
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3 411 and child nutrition, so individuals in the population may have been more likely to prioritize the nutrition  
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5 412 of these vulnerable populations.  
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8 413 Our study suggests possible interventions that might mitigate the effect of the pandemic on food  
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10 414 security. We found that households who were more likely to experience no change in meeting food  
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12 415 needs during the pandemic derived a greater proportion of their food needs through homegrown  
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14 416 methods (as opposed to purchasing foods) as compared to households who found it more difficult to  
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16 417 meet their food needs. Reducing reliance on food supply from other places or countries is recognized by  
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18 418 others to be a means of reducing the impact of the COVID-19 pandemic on food insecurity. Farm-  
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20 419 system-for-nutrition approaches have been suggested as one solution, in which location-specific farm  
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22 420 systems that integrate arable farming, horticulture, backyard farming, and animal farming [37]. The FAO  
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24 421 advocate for improving the resilience of local food systems by facilitating access to locally produced  
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26 422 food, shortening the supply chain by promoting direct purchase from local producers, and promoting  
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28 423 urban or backyard gardens that also offer financial and environmental co-benefits [38].  
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33 424 Our study also identified that loss of income and higher food prices are among the most important  
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35 425 reason households are less able to meet their food needs. As such, social safety net programs may be  
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37 426 particularly suited to addressing the challenge of food insecurity [7, 39, 40]. A randomized control trial in  
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39 427 Colombia in March 2020, at the start of a national quarantine, found that 90% of families randomized to  
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41 428 an arm that received cash transfers of \$19 every 5-9 weeks spent the cash on food, which helped to  
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43 429 offset the effects of the pandemic on food insecurity in the treatment arm [41]. Other randomized  
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45 430 control trials demonstrate reductions of severe food insecurity among those who received a cash  
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47 431 transfer or a direct food transfer by nearly 25% [42, 43]. Systematic review and meta-analysis of 74  
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49 432 studies found that children from households who received cash transfers had reduced stunting by 2.5%  
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51 433 and improved consumption of animal foods by 4.5% [44].  
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3 434 This study has limitations. First, the results of this survey may not be generalizable to other countries,  
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5 435 particularly those with higher COVID-19 incidence and greater restrictions on within-country movement.  
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7 436 At the time of the survey (November 2020), fewer than 50 cases had been reported in Lao PDR, and  
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10 437 health systems were not experiencing the same overwhelming of capacity as in many other countries  
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12 438 [45]. Additionally, while initial control measures limited local movement, these restrictions were largely  
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14 439 relaxed by May 2020, seven months prior to the survey, with the main intervention remaining being  
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16 440 strict border closure. We expect, therefore, that compared to other LMICs, the effects of food security  
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18 441 and access to health care found in this study may be smaller than would be seen in other countries. At  
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20 442 the same time, however, the effects of the pandemic on food security and income and expenditures  
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22 443 may be seen more strongly in Luang Prabang as compared to other provinces within Lao PDR. As the  
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24 444 province is home to the UNESCO World Heritage City of Luang Prabang, Luang Prabang province  
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26 445 receives a greater proportion of its income from tourism as compared to other provinces [20]. Indeed,  
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28 446 our survey found a greater proportion of household reduced expenditures (64%) compared to another,  
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30 447 unpublished, survey in a different rural province, where 46% of households reduced expenditures  
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32 448 (personal communication). As mentioned, households in the study population had been receiving  
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34 449 educational messaging regarding the importance of maternal and child malnutrition, so may have  
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36 450 prioritized meeting the needs of mothers and children even as they struggled to meet the families' food  
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38 451 needs. Thus it is possible that other areas may have seen more dramatic declines in maternal and child  
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40 452 nutrition. Moreover, the results of the survey may not be generalizable to larger, more urban areas.  
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42 453 Finally, the relationships with FCS may not be generalizable to other areas with different dietary  
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44 454 patterns. The mean FCS in our study was 60.9, well above the generic cut off of  $\geq 35$  for an acceptable  
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46 455 score. While diversity of foods consumed was low, consumption of staples and meat/fish/insects was  
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48 456 high, and these food groups are given large weights in calculating the weighted mean.  
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3 457 Another limitation of our study relates to recall bias. Because control measures were first implemented  
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5 458 in March 2020, and we implemented this survey in November 2020, there could be substantial recall  
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7 459 bias, as participants are asked to compare ability to meet food needs, ability to access health care, and  
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9 460 income and expenditures to a time period that extended 8 months prior up until the current time. The  
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11 461 ideal observational research design would be to compare our estimates of food security and  
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13 462 malnutrition to repeated estimates taken longitudinally, leading up to just prior to the pandemic. While  
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15 463 we lack data from just before the pandemic, we have data from household surveys in the region  
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17 464 collected in 2017. Estimates of food insecurity and the prevalence of children underweight and wasted  
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19 465 from 2020 are higher than estimates from 2017, while estimates of dietary diversity from 2020 are  
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21 466 lower than estimates from 2017. However, because changes in indicators between 2017 and 2020  
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23 467 cannot be attributed to the effects of the pandemic alone, we do not emphasize 2017 data here.  
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## 28 468 **Conclusion**

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31 469 Lao PDR's early efforts to control the spread of COVID-19 have been successful, with fewer documented  
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33 470 cases to date relative to neighboring countries. Nevertheless, the effect of the pandemic on food  
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35 471 security in livelihoods in LMICs may be severe, and the second wave of cases, and associated lockdown  
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37 472 measures, in April 2021 demonstrates that the threat of continued food security remains present.  
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39 473 Increasing self-sufficiency through local food production, and/or supporting incomes via social safety  
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41 474 nets such as cash transfer programs, may mitigate some of these effects. As control measures to curb  
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43 475 the transmission of COVID-19 continue, and as outbreaks occur intermittently with concomitant  
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45 476 restrictions on movement, further study may be useful to understand what coping strategies people are  
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47 477 using so that government and agencies can support the resilience of households in the long term.  
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4  
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8  
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### 13 483 **Contributorship statement**

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15  
16 484 PC, HC, and JRH conceptualized the research. PC and HC assisted in data collection. PC and JRH analyzed  
17  
18 485 the data. HC and JRH wrote the manuscript. AV and KK lead the Save the Children health program in  
19  
20 486 Luang Prabang and the Vientiane country office, respectively. All authors edited and read the  
21  
22 487 manuscript.  
23  
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### 26 488 **Competing interests**

27  
28  
29  
30 489 HC, AV and KK, were or are currently employees of Save the Children, International. Save the Children  
31  
32 490 supports a government led Primary Health Care Program in Luang Prabang which includes nutritional  
33  
34 491 interventions.  
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37

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39  
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42  
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44  
45

### 46 495 **Data sharing statement**

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50 496 Data is owned by the Luang Prabang Provincial Health Department and permission has been granted for  
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52 497 its use.  
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612 **Table 1.** Self-reported effects of the pandemic on household access to food, health care, and income.

	<b>Weighted percentage (95% Confidence interval)</b>	<b>N</b>
<b>Relative ability to meet family's food needs now compared to before the pandemic (N = 1120)</b>		
Easier	0.83 (0.38, 1.82)	8
No change	20.7 (18.3, 23.3)	238
Somewhat harder	60.9 (57.6, 64.1)	698
Much harder	17.6 (15.4, 20.0)	176
<b>Reasons it is harder to meet food needs during the pandemic (N = 874)</b>		
Items more expensive	51.2 (46.4, 56.0)	415
Household lost income	45.3 (40.9, 49.9)	465
Less food is available	36.6 (33.1, 40.2)	561
Markets are closed	36.5 (32.3, 41.0)	555
<b>Proportion of household income lost during the pandemic (N = 1122)</b>		
No income lost	14.4 (12.3, 16.6)	165
1-25%	17.5 (14.6, 20.7)	192
26-50%	54.4 (51.3, 57.4)	607
51-75%	9.2 (1.7, 11.2)	104
76-100%	4.6 (3.5, 6.1)	54
<b>Percent reduction in household expenditures during the pandemic (N = 1122)</b>		
No reduction	36.3 (33.2, 39.6)	415
1-25%	23.2 (19.4, 27.4)	257
26-50%	35.7 (32.9, 38.6)	400
51-75%	3.9 (2.9, 5.3)	41
76-100%	0.89 (0.44, 1.8)	9
<b>Relative ability to access health care now compared to before the pandemic (N = 1121)</b>		
Easier	0.40 (0.15, 1.09)	8
No change	47.0 (44.0, 50.0)	544
Somewhat harder	37.4 (34.6, 40.2)	413
Much harder	4.8 (3.7, 6.1)	48
Undecided	10.0 (7.5, 13.1)	108

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**Table 2.** Model coefficients representing difference in indicator between households who self-reported that it is harder to access food during the pandemic and those who report no change/easier; and those who decreased spending during the pandemic and those who did not. Adjusted models for households control for household ethnicity, household size, education level of mother and the head of household, and district. Adjusted models for mothers include additionally mother's age. Adjusted models for children include additionally child's age and sex. FCS = food consumption score; CSI = coping strategy index; DDS = dietary diversity score. Lower values for FCS and DDS and higher values of CSI indicate greater food insecurity.

	Model coefficients				
	Harder to access food during the pandemic		Decreased expenditures during the pandemic		Population mean (95% CI)
	Crude difference (95% CI)	Adjusted difference (95% CI)	Crude difference (95% CI)	Adjusted difference (95% CI)	
FCS	-3.36 (-5.42, -1.29)*	-2.74 (-4.92, -0.55)*	-6.53 (-8.23, -4.79)*	-5.24 (-7.05, -3.42)*	
CSI	0.07 (-0.86, 0.99)	0.36 (-0.65, 1.37)	0.83 (-0.07, 1.74)	1.32 (0.40, 2.24)*	3.6 (3.1, 4.1)
DDS (child)	-0.21 (0.41, -0.01)*	-0.20 (-0.41, 0.01)	-0.20 (-0.38, -0.02)*	-0.10 (-0.29, 0.09)	4.14 (4.04, 4.24)
DDS (mother)	-0.15 (-0.40, 0.01)	-0.10 (-0.33, 0.12)	-0.08 (-0.28, 0.12)	0.07 (-0.13, 0.26)	5.38 (5.26, 5.51)

\*represents statistical significance at  $p < 0.05$

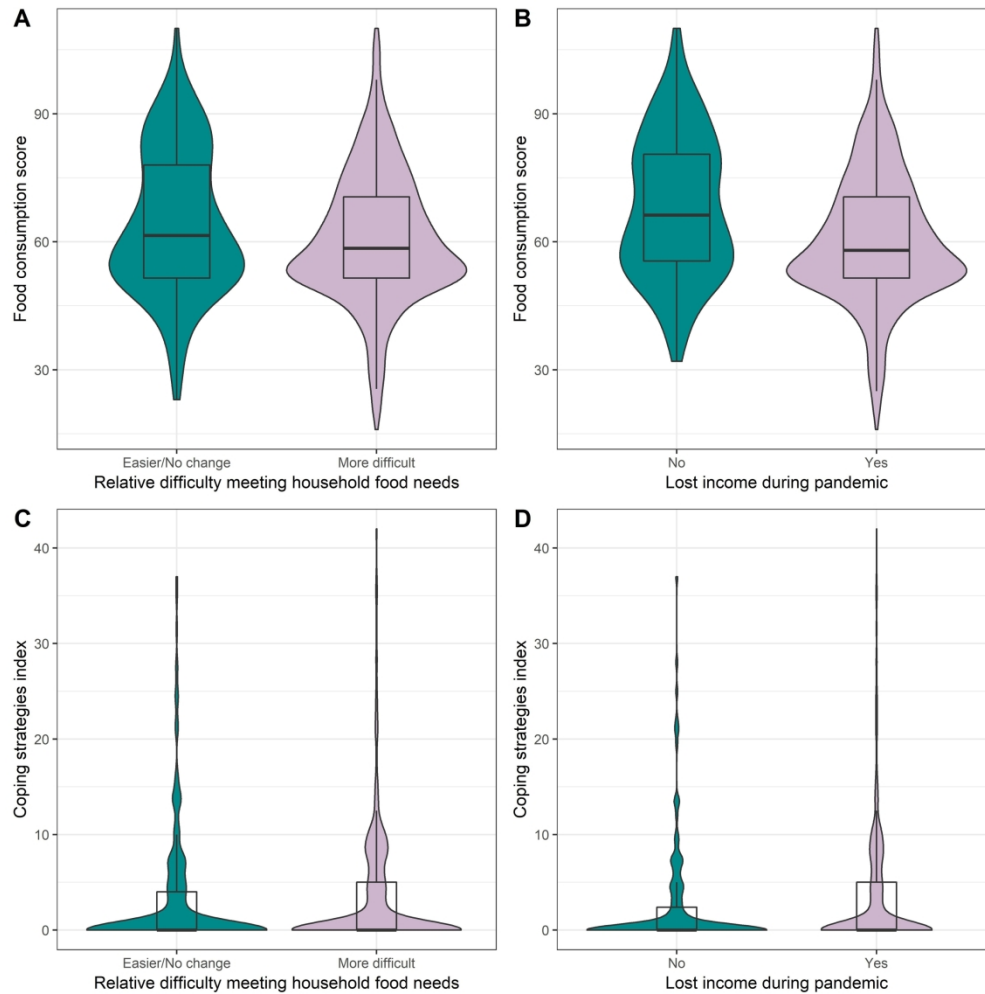


Figure 1. Violin plot showing distribution of two household food security measures, together with their median and interquartile range (IQR). Household food security was measured through food consumption score (FCS) (A, B) and coping strategies index (CSI) (C, D). Food insecurity is associated with low FCS and high CSI.

228x228mm (300 x 300 DPI)

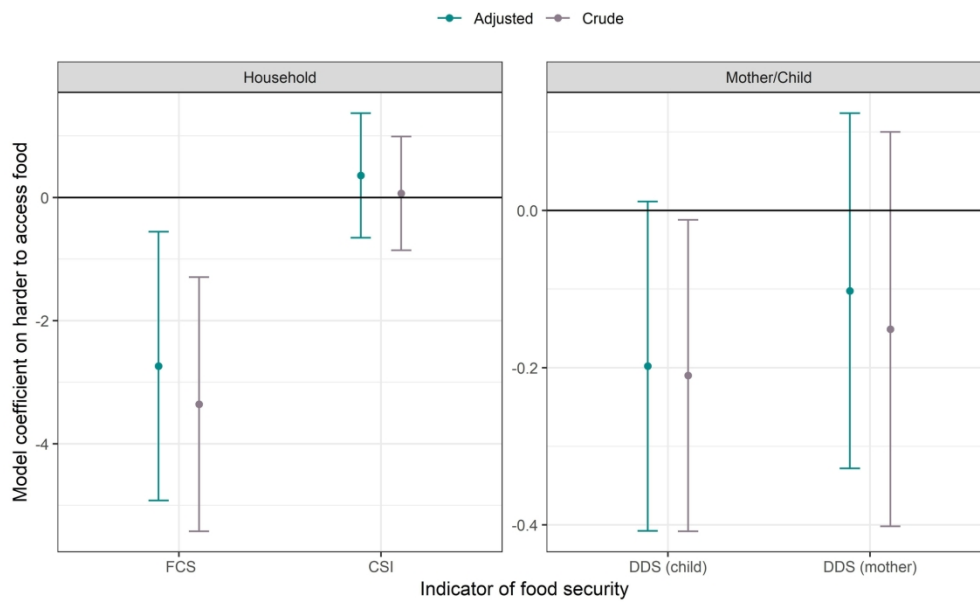


Figure 2. . The difference in mean of food security indicator among households who had a harder time meeting their food needs during the pandemic compared to those who did not. Vertical bars represent 95% confidence intervals. Adjusted models for households control for household ethnicity, household size, education level of mother and the head of household, and district. Adjusted models for mothers include additionally mother’s age. Adjusted models for children include additionally child’s age and sex. FCS = food consumption score; CSI = coping strategy index; DDS = dietary diversity score. Lower values for FCS and DDS and higher values of CSI indicate greater food insecurity.

203x127mm (300 x 300 DPI)



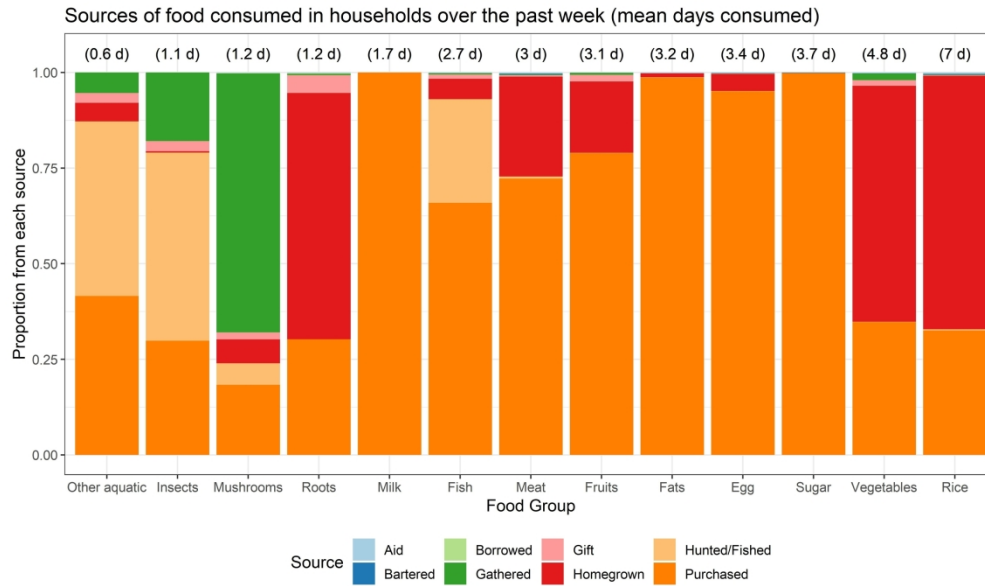


Figure 3. Proportional source of each food group consumed during the past week by households. Numbers in parenthesis above the bars indicates the mean number of days per week household consumed these food groups.

254x152mm (300 x 300 DPI)

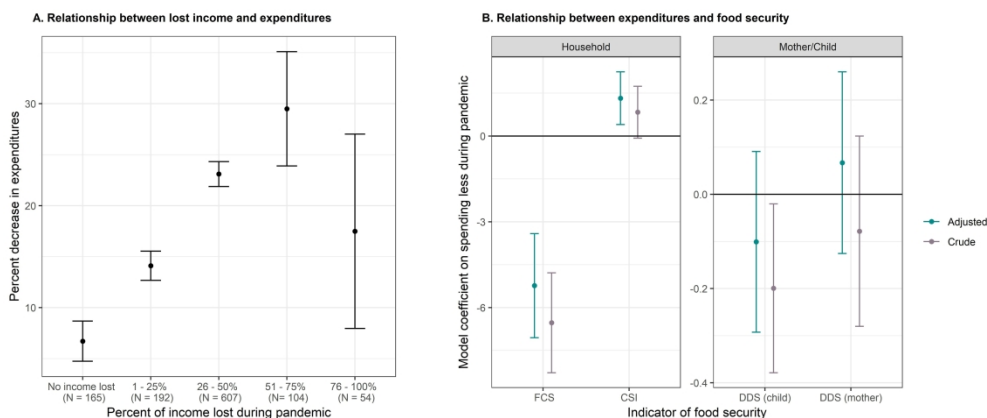


Figure 4. A) Mean decrease in expenditures reported, stratified by the percent reduction in household income. Vertical bars represent 95% confidence intervals. B) The difference in mean of food security indicator among households who reduced spending during the pandemic compared to those who did not. Vertical bars represent 95% confidence intervals. Adjusted models for households control for household ethnicity, household size, education level of mother and the head of household, and district. Adjusted models for mothers include additionally mother’s age. Adjusted models for children include additionally child’s age and sex. FCS = food consumption score; CSI = coping strategy index; DDS = dietary diversity score. Lower values for FCS and DDS and higher values of CSI indicate greater food insecurity.

304x127mm (300 x 300 DPI)

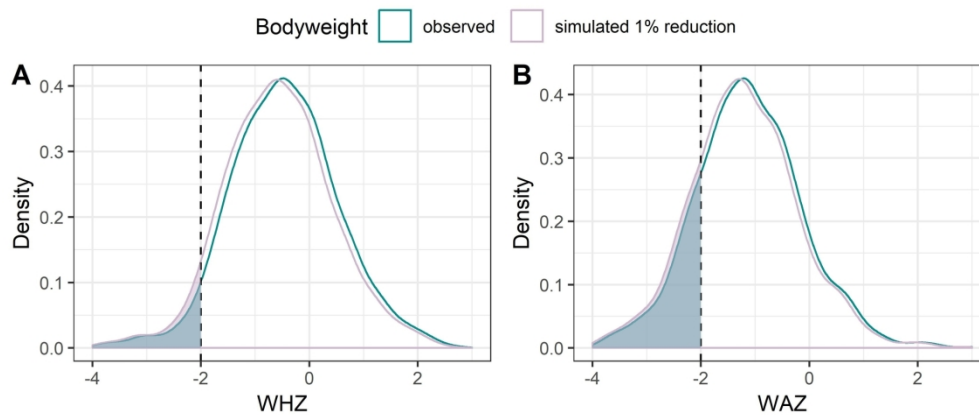


Figure 5. WHZ and WAZ curves among children under 5 under observed (cyan) conditions and under a simulated shock in which body weight reduces by 1% (pink). Area shaded to the left of -2 represents the proportion of children classified as wasted or underweight, respectively.

177x76mm (300 x 300 DPI)

## Supplemental Info for:

### Changes in household food security, access to health services, and income in northern Lao PDR during the COVID-19 pandemic: a cross-sectional survey

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Survey tool

## Endline Interview Questionnaire – 2020

### Health and Nutrition Assessment

#### Introductory Statement to the Interview

Good Morning/Good Afternoon.

My name is \_\_\_\_\_ and I am here on behalf of the Primary Health Care program. We are conducting a survey on the health and nutritional status of women and children. You have been selected by chance from the list of families with children under the age of five. Is this correct? The purpose of this interview is to obtain information about the health and nutrition status of you and your child. We are interested in interviewing mothers of children aged five or less. Are you the mother of the child? *(If no)*, Is the mother of the child at home? *(If yes, wait until she arrives, and re-explain purpose)*. Could you please spare some time (around 45 minutes) for the interview? The information you give will be confidential and will only be used to prepare a report of general findings – but will not include any names. You will not get any additional entitlements because of the interview. At any time during the survey, you are free to stop the survey, or choose not answer any question. If you are willing to participate in this survey, please indicate your oral consent by saying “yes” or “no”.

#### May I start now?

- Yes, permission is given ⇒ Go to 101 to begin the interview.
- No, permission is not given ⇒ Tell this result to your supervisor and move to the next household.

**Enumerators**– *If the respondent is not willing, do not ask any of the questions and move to the next household. If the household contains children under the age of 5, but the mother is not present, ask when it is a good time to return, and return at a later time. We only want to interview mothers of children under the age of 5.*

General Information				
No.	Item	Name		
101	District			
102	Village			
103	Date of interview	DD	MM	YYYY
		--	--	2016
104	Interviewer's Name/Number	--		

Household Demographic Information			
First, we would like to ask some questions about yourself and the people who live in this household.			
No.	Question	Response	Notes
201	How old are you?	Age (in completed years): __ __	
202	To what ethnic group does the head of this household belong?	1.....Lao Lom 2.....Hmong 3.....Khmu 4.....Mien 5.....Lue 6.....Akha 7.....Muser 98.....Other (Specify.....)	
203	What is your marital status?	1.....Married (monogamous) 2.....Married (polygamous) 3.....Not married, but living with a man 4.....Single 5.....Divorced or separated 6.....Widowed	

204	What is your relationship to the head of the household (HHH)?	1..... Head of household 2..... Wife of the HHH 3..... Daughter of the HHH 4.....Daughter in law of HHH 5.....Granddaughter of HHH 98...Other relation	1 → 206 2 → 206
205	Is the head of the household male or female?	0.....Female 1.....Male	<i>if 204 ≠ 1 or 2</i>
206	Have you ever attended school?	1.....Yes 0.....No	0 → 208
207	What is the highest level of school you completed?	1.....Preschool 2.....Primary 3.....Lower Secondary 4.....Upper secondary 5.....Post-secondary vocational, tertiary/ diploma 6.....Higher	<i>if 206 = 1</i>
208	Did the head of the household attend school?	1.....Yes 0.....No 99...Don't know	<i>if 204≠1</i> 1 → 209 0 → 210
209	What is the highest level of school completed by the head of the household?	1.....Preschool 2.....Primary 3.....Lower Secondary 4.....Upper secondary 5.....Post-secondary vocational, tertiary/ diploma 6.....Higher 99...Don't know	<i>if 208 = 1</i>
210	How many household members are aged 15 years or more?	_____	

	<i>Prompt to include self in this count</i>		
211	How many household members are below 15 years of age?	___ ___	
212	How many household members are below 5 years of age?	___ ___	Check: 212 ≤ 211
213	How many members are in your own family?	___ ___	

<b>Dietary Intake</b>			
Now we would like to ask some questions about the diet of yourself and one of your children. Enumerators, if there are more than one children under the age of five, randomly select one child. Ask the name of the child, and use that name for the rest of the interview.			
No.	Question	Response	Notes
400	When was this child born? <i>Probe: Using MCH book, house registration, other official document</i>	___ ___ ___	
401	How many months old is this child? <i>Probe: Using important holidays, dates, etc.</i>	___ ___ months	0-59 only!
402	Is the child selected (Child's name) your youngest child? <i>Probe: the last child of alive children?</i>	1.....Yes 0.....No	
403	Yesterday during the day or night, was your diet a typical diet? <i>Probe: She had special ceremonies or illnesses that led her to have less or much more than her typical eating.?</i>	1.....Yes 2.....No. I ate more. 3.....No. I ate less 99.....Do not know	
404	Yesterday during the day or night, did you eat more or less or same amount of food compared to your eating before this pregnancy?	1.....Increased amount 2.....Same amount 3.....Decreased amount 99.....Do not know	<i>if 226=1 (currently pregnant)</i>
405	Yesterday during the day or night, did you eat more or less or same amount of animal source foods compared to your eating before this pregnancy?	1.....Increased amount 2.....Same amount 3.....Decreased amount 99.....Do not know	<i>if 226=1 (currently pregnant)</i>



	<i>Probe: Using examples of animal food or product in their general contexts and comparing with her usual eating style</i>		
<b>406</b>	<p>I would like to ask you about foods that you may have had yesterday during the day or night. I am interested to know whether you had the item even if combined with other foods. Please include foods consumed outside of your home.</p> <p>YESTERDAY DURING THE DAY OR NIGHT, DID YOU DRINK/EAT (FOOD GROUP ITEMS)?</p> <p><i>Questions and filters (Circle the corresponding code and you can underline more than one answer)</i></p> <p>Always start with: 'YESTERDAY DID YOU EAT...'</p>		
<b>406a</b>	<p>Any offal items (excluding intestines)?</p> <p><i>Probe: such as liver, brain, lung, heart, gizzard, kidney, of any animal</i></p>	<p>1.....Yes 0.....No 99.....Do not know</p>	
<b>406b</b>	<p>The intestine of any animal?</p>	<p>1.....Yes 0.....No 99.....Do not know</p>	
<b>406c</b>	<p>Any kind of meat?</p> <p><i>Probe: such as any meat, such as beef (fresh or dry), buffalo, pork, goat, chicken, goose, duck, sausage, blood sausage, sour sausage</i></p>	<p>1.....Yes 0.....No 99.....Do not know</p>	
<b>406d</b>	<p>Any kind of eggs?</p> <p><i>Probe: 'such as?' eggs from chicken, duck, turtle or other animals</i></p>	<p>1.....Yes 0.....No 99.....Do not know</p>	
<b>406e</b>	<p>Any kind of fish or aquatic animals?</p> <p><i>Probe: 'such as?' fresh, fermented or dried fish, swamp eel, squid, shrimp (fresh or dry), crab, granulated ark, clam, snail, frog, water insects</i></p>	<p>1.....Yes 0.....No 99.....Do not know</p>	
<b>406f</b>	<p>Any kind of wild animals?</p> <p><i>Probe: 'such as?' lizard, rat, rabbit, wild bird, small birds</i></p>	<p>1.....Yes 0.....No 99.....Do not know</p>	

1 2 3 4 5 6 7	<b>406g</b>	Any kind of insects or grubs?  <i>Probe: 'such as?' silk worm pupa, cricket, weaver ant, ant egg, etc.</i>	1.....Yes 0.....No 99.....Do not know	
8 9 10 11 12 13	<b>406h</b>	Any kind of dairy products (not including coffee creamer)?  <i>Probe: 'such as?' cheese (butter), yogurt, or other milk products</i>	1.....Yes 0.....No 99.....Do not know	
14 15 16 17	<b>406i</b>	Other foods that came from an animal. Example: pork skin	1.....Yes 0.....No 99.....Do not know	
18 19 20 21 22 23	<b>406j</b>	Sticky rice (refined or unrefined), roasted rice, rice, pre-chewed rice, rice noodles, maize, noodles, thick porridge, or other foods made from grains?	1.....Yes 0.....No 99.....Do not know	
24 25 26 27 28 29	<b>406k</b>	White or purple coloured foods from roots such as white yams, purple yams, yam bean, cassava, white radish, white potato, or any other white or purple colored foods from roots.	1.....Yes 0.....No 99.....Do not know	
30 31 32 33	<b>406l</b>	Pulses/lentils/tofu/bean curd	1.....Yes 0.....No 99.....Do not know	
34 35 36 37	<b>406m</b>	Nuts or seeds (e.g. Sesame seeds, mung bean, ground bean, sun flower seed, cashew nuts etc.)	1.....Yes 0.....No 99.....Do not know	
38 39 40 41 42	<b>406n</b>	Any dark green leafy vegetables such as pak choi, swamp cabbage, morning glory, sweet potato leaves, Chinese kale	1.....Yes 0.....No 99.....Do not know	
43 44 45 46 47	<b>406o</b>	Ripe orange fleshed mangoes, ripe orange fleshed papayas, pumpkin, carrots, sweet potatoes that are yellow or orange inside?	1.....Yes 0.....No 99.....Do not know	
48 49 50	<b>406p</b>	Other vegetables	1.....Yes 0.....No 99.....Do not know	
51 52 53 54	<b>406q</b>	Other fruit	1.....Yes 0.....No 99.....Do not know	
55	Now, I would like to ask about feeding practices for your child selected.			

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5	<b>407</b>	Has (CHILD'S NAME) ever been breastfed?	1.....Yes 0.....No <i>if 401 &lt; 24</i> 0 → 409
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7	<b>408</b>	Was (CHILD'S NAME) breastfed yesterday, either during the day or the night?	1.....Yes 0.....No 99.....Do not know <i>if 401 &lt; 24</i> & 407 = 1
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11	<b>409</b>	Did (NAME) drink anything from a bottle with a nipple yesterday, during the day or night?	1.....Yes 0.....No 99.....Do not know <i>if 401 &lt; 24</i>
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13			
14	<b>410</b>	Did (NAME) drink or eat vitamin or mineral supplements yesterday, during the day or night?	1.....Yes 0.....No 99.....Do not know <i>if 401 &lt; 24</i>
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18	<b>411</b>	How long after birth did you first put (NAME) to the breast?  <i>If immediately, record 00. If less than 24 hours, record hours. If over 24 hours, record 25. If unknown, record 99.</i>	_____ hours  <i>if 401 &lt; 24</i> & 407 = 1
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27	<b>412</b>	Did (CHILD'S NAME) have any liquid other than breast milk, such as canned, powdered or fresh animal milk, infant formula, juice, thin porridge, or clear soup (Nam Keang) yesterday, during the day or night?	1.....Yes 0.....No 99.....Do not know <i>if 401 &lt; 24</i> 0 → 413 99 → 413
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35	<b>412a</b>	How many times did (CHILD'S NAME) receive milk other than breastmilk, such as canned, powdered or fresh animal milk, or infant formula?	_____ times 99.....Do not know <i>if</i> <i>401 = 6-23</i> & 412 = 1
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40	<b>413</b>	When do you think is the best time to start breastfeeding a child after giving birth?	<b>Enumerators: read off all answer choices and circle the best one</b>  1.....Within the first hour after giving birth 2.....Within the first six hours after giving birth 3.....Within the first twelve hours after giving birth 4.....Within one day after giving birth 99.....Do not know
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<b>414</b>	<p>I would like to ask you about foods that the selected child (CHILD'S NAME) may have had yesterday during the day or night. I am interested to know whether HE/SHE had the item even combined with other foods. Please include foods consumed outside of your home.</p> <p>YESTERDAY DURING THE DAY OR NIGHT, DID THE SELECTED CHILD (CHILD'S NAME) DRINK/EAT (FOOD GROUP ITEMS)?</p> <p>Always start with: 'YESTERDAY DID (NAME) EAT....'</p>	<i>if 401 ≥ 6</i>
<b>414a</b>	Commercially fortified baby food, e.g., cerelac	1.....Yes 0.....No 99.....Do not know
<b>414b</b>	Sticky rice (white or brown), roasted rice, rice, pre-chewed rice, rice noodles, maize, noodles, porridge, or other foods made from grains?	1.....Yes 0.....No 99.....Do not know
<b>414c</b>	Pumpkin, carrots or sweet potatoes that are yellow or orange inside?	1.....Yes 0.....No 99.....Do not know
<b>414d</b>	White or purple coloured foods from roots such as white yams, purple yams, yam bean, cassava, white radish, white potato, or any other white or purple colored foods from roots.	1.....Yes 0.....No 99.....Do not know
<b>414e</b>	Any dark green, leafy vegetables such as pak choi, swamp cabbage, morning glory, sweet potato leaves, Chinese kale?	1.....Yes 0.....No 99.....Do not know
<b>414f</b>	Ripe or orange-fleshed mangos, or papayas	1.....Yes 0.....No 99.....Do not know
<b>414g</b>	Any other fruits or vegetables	1.....Yes 0.....No 99.....Do not know
<b>414h</b>	Liver, brain, lung, heart, gizzard, kidney, intestine, or other organ of any animal	1.....Yes 0.....No 99.....Do not know
<b>414i</b>	Any meat, such as beef (fresh or dry), buffalo, pork, lamb, goat, chicken, goose, duck, sausage, blood sausage, sour sausage	1.....Yes 0.....No 99.....Do not know
<b>414j</b>	Eggs from chicken, duck, turtle or other animals	1.....Yes 0.....No

		99.....Do not know	
<b>414k</b>	Fresh, fermented or dried fish, swamp eel, squid, shrimp (fresh or dry), shellfish, crab, granulate ark, clam, snail	1.....Yes 0.....No 99.....Do not know	
<b>414l</b>	Any wild animals such as lizard, frog, rat, rabbit, wild bird, small bird	1.....Yes 0.....No 99.....Do not know	
<b>414m</b>	Insects or grubs such as silk worm pupa, cricket, weaver ant, any insect eggs, water insects	1.....Yes 0.....No 99.....Do not know	
<b>414n</b>	Any foods made from beans, Leucanea (bean), common pea, lentils, or nuts, including tofu?	1.....Yes 0.....No 99.....Do not know	
<b>414o</b>	Cheese, yogurt, or other food made from milk?	1.....Yes 0.....No 99.....Do not know	
<b>414p</b>	Any oil, pork fat, or butter or foods made with any of these	1.....Yes 0.....No 99.....Do not know	
<b>414q</b>	Any packaged foods such as packaged noodles, chocolates, sweets, candies, pastries, cakes, or biscuits	1.....Yes 0.....No 99.....Do not know	
<b>415</b>	How meals (solid or semi-solid food) did (CHILD'S NAME) eat yesterday?  <i>Enter 99 if unknown</i>	_____ times  99.....Do not know	<i>if 401 ≥ 6</i>
<b>416</b>	Did (CHILD'S NAME) eat any solid, semi-solid or soft foods (such as porridge, rice, pre-chewed rice, fruits, bread, meat, eggs, vegetables) yesterday?	1.....Yes 0.....No 99.....Do not know	<i>if 401 &lt; 6</i> <i>0 → 418</i> <i>99 → 418</i>
<b>417</b>	In the first three days after delivery or when you returned to work in the rice field, was ( <i>name</i> ) given anything to drink other than breast milk?	1.....Yes 0.....No 99.....Do not know	<i>if 401 &lt; 6</i> <i>&amp; 407 = 1</i>
Now, I understand eating pattern of you and your child. I would now like to ask more about eating practices of women who are breastfeeding.			
<b>418</b>	Yesterday during the day or night, did you eat more or less or same amount of food compared to your eating before this pregnancy?	1.....Increased amount 2.....Same amount 3.....Decreased amount 99.....Do not know	<i>if 401 &lt; 6</i> <i>&amp; 407 = 1</i>

	<i>Probe: Comparing with her usual eating style.</i>		
419	Yesterday during the day or night, did you eat more or less amount of animal source foods compared to your eating before this pregnancy?  <i>Probe: Using example of animal food or product in their general contexts and comparing with her usual eating style.</i>	1.....Increased amount 2.....Same amount 3.....Decreased amount 99.....Do not know	<i>if 401 &lt; 6 &amp; 407 = 1</i>

Household Food Security and Expenditures		
No.	Question	Response
I would like to ask you some questions about how much your household spends on health services and other things. <i>For all questions in this section report all values in local currency, whether paid in cash or in kind</i>		
501	In the last 4 weeks, how much did your household spend on:  Food, including such things as [rice], meat, fruits, vegetables, and cooking oils. Include the value of any food that was produced and consumed by the household, and exclude alcohol, tobacco and restaurant meals.	_____,000 kip
502	In the last 4 weeks, how much did your household spend on:  Housing, gas, electricity, water, telephone, and heating fuel	_____,000 kip
503	In the last 4 weeks, how much did your household spend on:  Education fees and supplies	_____,000 kip
504	In the last 4 weeks, how much did your household spend on:  Health care costs	_____,000 kip
505	In the last 4 weeks, how much did your household spend on:  All other goods and services not yet mentioned	_____,000 kip
506	In the last 4 weeks, how much did your household spend in total? (Should equal 501 + 502 + 503 + 504 + 505)	_____,000 kip
507	In the <b>past month</b> , how often have you used any of the methods when you did not have enough food or money to buy food?	
507a	Rely on less preferred, less expensive foods?	1.....1 day per week 2.....1-2 days a week

		3.....3-4 days a week 4.....5-6 days a week 5.....Daily 6.....Never/<1 time per week
507b	Borrow food or money from friends or relatives?	1.....1 day per week 2.....1-2 days a week 3.....3-4 days a week 4.....5-6 days a week 5.....Daily 6.....Never/<1 time per week
507c	Limit portions at mealtimes?	1.....1 day per week 2.....1-2 days a week 3.....3-4 days a week 4.....5-6 days a week 5.....Daily 6.....Never/<1 time per week
507d	Limit adult intake?	1.....1 day per week 2.....1-2 days a week 3.....3-4 days a week 4.....5-6 days a week 5.....Daily 6.....Never/<1 time per week
507e	Reduce number of meals per day?	1.....1 day per week 2.....1-2 days a week 3.....3-4 days a week 4.....5-6 days a week 5.....Daily 6.....Never/<1 time per week
Now I would like to ask you some questions about food that the household ate in the last 7 days		
	<p><b>508. How many days</b> in the past week (last 7 days) did your household eat the following foods? Number of days eaten (out of last 7 days)</p>	<p><b>509</b> What is the source of this food for each item mentioned? <i>if 508 &gt; 0</i> Food Source Code: 1. Home grown crop or livestock production 2 Purchased food 3 Gathered forest products 4 Hunting/fishing 5 Borrowed</p>

		6 Food aid 7 Exchanged/barter 8 Gift from family/relatives
A. Rice (sticky rice, white rice)		
B. Maize / Corn		
C. Cassava		
D. Other roots of tubers (potatoes, yam)		
E. Pulses/Lentils/Tofu/Bean Curd		
F. Vegetables (green leafy, carrot, pumpkin...)		
G. Bamboo shoots / mushrooms		
H. Fruits		
I. Fish, fish paste		
J. Other aquatic animals (crab, snail, shrimp...)		
K. Meat (beef, pork, chicken)		
L. Wild animals/Insects		
M. Eggs		
N. Milk		
O. Sugar		
P. Oil/Butter/Animal Fat		
<b>510</b>	How many hours in the past week did you spend gathering food from the forest?	<i>if any</i> 509 = 3
<b>511</b>	How many hours in the past week did you spend hunting?	<i>if any</i> 509 = 4
<b>512</b>	How many hours in the past week did you spend fishing?	<i>if any</i> 509 = 4
<b>513</b>	Compared to before the pandemic, is it easier or harder to meet your family's food needs?	1. Much easier 2. Somewhat easier 3. No change 4. Somewhat harder 5. Much harder 99. Don't know/no answer 1 → 514 2 → 514 3 → 514 99 → 514
<b>513a</b>	What is the reason it is harder to meet your food needs during the pandemic?  Select all that apply	1. Items are more expensive 2. Markets being closed 3. Foods not available 4. HH had lost income. <i>if 513 =</i> 4 or 5



		98. Others (specify) 99. Don't know/no answer	
<b>514</b>	Did you lose income due to the pandemic?	1. Yes 0. No 99. Don't know/no answer	0→515 99→515
<b>514a</b>	If yes, how much did you lose, as a proportion of your income? (give best guess)	1. 0-25% 2. 25-50% 3. 50-75% 4. 75-100%	<i>if 514=1</i>
<b>515</b>	Do you spend less money due to the pandemic?	1. Yes 0. No 99. Don't know/no answer	0→516 99→516
<b>515a</b>	If yes, how much did you spend less, as a proportion of your expenditure? (give best guess)	1. 0-25% 2. 25-50% 3. 50-75% 4. 75-100%	<i>if 515=1</i>
<b>516</b>	Is it more difficult to access health services now compared to before the pandemic?	1. Much easier 2. Somewhat easier 3. No change 4. Somewhat harder 5. Much harder	

<b>VI. Illness and Treatment</b>			
Now we would like to ask about any recent illnesses that the selected child (CHILD'S NAME) may have had.			
<b>No.</b>	<b>Question</b>	<b>Response</b>	
<b>601</b>	Did (CHILD'S NAME) have diarrhea in the past two weeks, where diarrhea is defined as three or more loose stools or one loose, bloody stool in a 24 hour period?	1.....Yes 0.....No 99.....Do not know	0→603 99→603
<b>602a</b>	Now I would like to know how much (CHILD'S NAME) was given to drink, including breast milk, during the diarrhea  Was he/she given less than usual to drink, about the same amount, or more than usual to drink?  <i>If less, probe: Was he/she given much less than usual to drink or somewhat less?</i>	1.....Much less 2.....Somewhat less 3.....About the same 4.....More 5.....Nothing to drink 99.....Do not know	<i>if 601 = 1</i>

<b>602b</b>	During the time (CHILD'S NAME) had diarrhea, was HE/SHE given either: a) A fluid made from a special packet called (ORALYTE/NAM THA LAY PHOUN)? b) Recommended homemade fluid such as coconut water or rice water with salt?	1.....Yes, Nam Tha Lay Phoun 2.....Yes, Recommended Homemade Fluid 3.....No 99.....Do not know	<i>if 601 = 1</i>
<b>602c</b>	When (CHILD'S NAME) had diarrhea, was he/she given less than usual to eat, about the same amount, or more than usual to eat?  <i>If less, probe: Was he/she given much less than usual to eat or somewhat less?</i>	1.....Much less 2.....Somewhat less 3.....About the same 4.....More 5.....Nothing to eat 99....Do not know	<i>if 601 = 1</i>
<b>603</b>	Has (CHILD'S NAME) been ill with a fever any time in the past two weeks?	1.....Yes 0.....No 99.....Do not know	
<b>604</b>	Has (CHILD'S NAME) had an illness with a cough at any time in the last two weeks?	1.....Yes 0.....No 99.....Do not know	0→605 99→605
<b>604a</b>	When (CHILD'S NAME) was sick with a cough, did he/she breathe faster than normal with short, rapid breaths or have difficulty breathing?	1.....Yes 0.....No 99.....Do not know	<i>if 604 = 1</i> 0→605 99→605
<b>604b</b>	Was the fast or difficult breathing due to a problem in the chest or to a blocked or runny nose?	1.....Chest only 2.....Nose only 3.....Both 99.....Do not know	<i>if 604a = 1</i>
<b>605</b>	At any time during the past two weeks, did you ( <i>mother</i> ) have diarrhea?	1.....Yes 0.....No 99.....Do not know	
<b>606</b>	At any time during the past two weeks, have you ( <i>mother</i> ) been ill with a fever?	1.....Yes 0.....No 99.....Do not know	
<b>607</b>	When (CHILD'S NAME) was sick, did you seek advice or treatment from any source?	1.....Yes 0.....No 99.....Do not know	<i>if 601, 603 or 604 = 1</i> 0→609 99→609
<b>608</b>	From where did you seek advice or treatment?	1...Government hospital 2.....Health centre	<i>if 607 = 1</i>

	<p><i>Probe: Anywhere else?</i></p> <p><i>(Multiple response)</i></p>	<p>3...Village health worker</p> <p>4.....Outreach team</p> <p>5...Lao Women Union worker</p> <p>6...Private hospital/clinic</p> <p>7.....Private physician</p> <p>8.....Private pharmacy</p> <p>9.....Mobile Clinic</p> <p>10.....Relative/friend</p> <p>11.....Shop</p> <p>12...Traditional healer</p> <p>98.....Other</p>	
<b>609</b>	<p>When (YOU) was sick, did you seek advice or treatment from any source?</p>	<p>1.....Yes</p> <p>0.....No</p> <p>99.....Do not know</p>	<p><i>if 605 or 606=1</i></p> <p>0 → 700</p> <p>99→ 700</p>
<b>610</b>	<p>From where did you seek advice or treatment?</p> <p><i>Probe: Anywhere else?</i></p> <p><i>(Multiple response)</i></p>	<p>1.....Government hospital</p> <p>2.....Health centre</p> <p>3.....Village health worker</p> <p>4.....Outreach team</p> <p>5.....Lao Women Union worker</p> <p>6.....Private hospital/clinic</p> <p>7.....Private physician</p> <p>8.....Private pharmacy</p> <p>9.....Mobile Clinic</p> <p>10.....Relative/friend</p> <p>11.....Shop</p> <p>12...Traditional healer</p> <p>98.....Other</p>	<p><i>if 609 = 1</i></p>

<b>VIII. Anthropometry</b>			
<b>No</b>	<b>Question</b>	<b>Response</b>	<b>Notes</b>
	<p>As part of this survey, we are measuring the growth of children 0-59 mo. Child growth is an important indicator of health. Poor growth is a serious health problem that usually results from poor nutrition, poor sanitation, or infection. This measurement will help us design programs to improve child health. We will share with you the measurements, but will not share the information with anyone else outside the survey team. Do you have any questions?</p>		

1	901	What is the age, in months, of (NAME)?	_____	Same as 401
2	902	What is the sex of (NAME)?	0.....Female 1.....Male	
3	903	<b>Enumerator:</b> Check for bilateral pitting edema	1.....Present 0.....Not present 99...Unsure 98....Not checked	1→906
4	904	Now I am going to weigh (NAME).  <b>Enumerator:</b> If the child is under 2 years old, weigh the mom by herself. The child should wear as few clothes as possible. If the child is wearing clothes, weigh the mom holding an extra pair of clothes (if an extra pair exists) similar to the weight of the clothes the child is wearing. Tare the scale. Then weigh the mom holding the child. Record the weight of the child.	_____ . _____ kg	if 903 = 0
5	905	<b>Enumerator:</b> was (NAME) undressed to the minimum?  (note...if child was dressed but mother held clothes, indicate 'no clothes')	0.....No clothes 1.....Few clothes 2.....Many clothes	
6	906	Now I am going to measure the arm of (NAME).  <b>Enumerator:</b> record the MUAC measurement, in cm	_____ . _____ cm	if 401 ≥ 6
7	907	Record the color of the MUAC tape	1.....Green 2.....Yellow 3.....Red	if 401 ≥ 6
8	908	Now I am going to measure the height of (NAME).  <b>Enumerator:</b> record the height measurement of the child, in cm. If the child is less than 23 months, measure the child lying down.	_____ . _____ cm	
9	909	How was the person actually measured? Lying down or standing up?	1.....Lying down 2.....Standing	
10	910	Now I am going to measure your arm.  <b>Enumerator:</b> record the MUAC measurement of the mother, in cm.	_____ . _____ cm	

**Closing Statement to the Interview**

The interview is complete. Thank you so much for your time and patience. Your help will allow us to work together to improve the health and nutrition of your child and community.

**Enumerators:** *indicating completeness:*

- Yes, interview is complete ⇒ Move to the next household
- No, interview was not complete ⇒ Tell this result to your supervisor and move to the next household.

For peer review only

Ethical approval

ສາທາລະນະລັດ ປະຊາທິປະໄຕ ປະຊາຊົນລາວ  
ສັນຕິພາບ ເອກະລາດ ປະຊາທິປະໄຕ ເອກະພາບ ວັດທະນາຖາວອນ



ກະຊວງສາທາລະນະສຸກ  
ມະຫາວິທະຍາໄລ ວິທະຍາສາດ ສຸຂະພາບ  
ຄະນະກຳມະການຈັນຍາທຳການຄົ້ນຄວ້າວິທະຍາສາດ  
ເບີໂທ: 021 240255

ເລກທີ 131-- /ຄຈສ  
ນະຄອນຫຼວງວຽງຈັນ, ວັນທີ 19 FEB 2021

**ໃບອະນຸມັດຈັນຍາທຳ**

ຊື່ໂຄງການ: ສຶກສາຜົນກະທົບຈາກການລະບາດຂອງພະຍາດໂຄວິດ ຕໍ່ກັບຄວາມປອດໄພ ແລະ ການບໍລິໂພກອາຫານ, ການເຂົ້າເຖິງການບໍລິການສາທາລະນະສຸກ ແລະ ການໃຊ້ຈ່າຍ ໃນແຕ່ລະຄອບຄົວ ຢູ່ທາງພາກເໜືອຂອງ ສປປ ລາວ (ບົດ Proposal version 2.1, ລົງວັນທີ 09 ກຸມພາ ປີ 2021).

ຊື່ຜູ້ຄົ້ນຄວ້າຫຼັກ: ປອ. ດຣ ເພັດສະຫວັນ ຈັນທະວິໄລ, ຮອງຫົວໜ້າພະແນກຄົ້ນຄວ້າວິທະຍາສາດ, ສະຖາບັນຄົ້ນຄວ້າ ແລະ ພັດທະນາການສຶກສາ.

ໄລຍະເວລາການອະນຸມັດ: 01 ປີ.

ຄະນະກຳມະການຈັນຍາທຳການຄົ້ນຄວ້າວິທະຍາສາດ ໄດ້ທຳການພິຈາລະນາໂຄງການຄົ້ນຄວ້າດັ່ງກ່າວ ແລະ ເຫັນວ່າ ການຄົ້ນຄວ້າດັ່ງກ່າວນີ້ຈະບໍ່ສົ່ງຜົນກະທົບທາງດ້ານສຳຮາກ ແລະ ຈິດໃຈຂອງຜູ້ທີ່ເຂົ້າຮ່ວມໃນການສຶກສາ ແລະ ບໍ່ແຕກຕ້ອງ ເຖິງບັນຫາຈັນຍາທຳຂອງການຄົ້ນຄວ້າ. ໂຄງການຄົ້ນຄວ້າດັ່ງກ່າວນີ້ຈະມີຜົນປະໂຫຍດອັນໃຫຍ່ຫຼວງ ໃນການປະກອບ ສ່ວນວຽກງານການສົ່ງເສີມສຸຂະພາບ ໂດຍທາງກົງ ແລະ ທາງອ້ອມ ຕໍ່ຜູ້ເຂົ້າຮ່ວມການສຶກສາ, ແລະ ເປັນຂໍ້ມູນພື້ນຖານ ທີ່ສຳຄັນໃນການຄົ້ນຄວ້າຕໍ່ໄປແກ່ ວົງການສາທາລະນະສຸກລາວ ແລະ ຂະແໜງການວິທະຍາສາດ ໃນອະນາຄົດ.

ດັ່ງນັ້ນ, ຄະນະກຳມະການຈັນຍາທຳການຄົ້ນຄວ້າຂອງ ມະຫາວິທະຍາໄລ ວິທະຍາສາດ ສຸຂະພາບ ຈຶ່ງຕົກລົງເຫັນ ດີອະນຸມັດດ້ານຈັນຍາທຳການຄົ້ນຄວ້າສຳລັບໂຄງການດັ່ງກ່າວນີ້. ຜູ້ເຮັດການຄົ້ນຄວ້າຫຼັກຕ້ອງຮັບປະກັນວ່າທີມງານຄົ້ນ ຄວ້າທັງໝົດໄດ້ຮັບຮູ້ ກ່ຽວກັບ ເງື່ອນໄຂຂອງການອະນຸມັດຈາກຄະນະກຳມະການຈັນຍາທຳການຄົ້ນຄວ້າ ຂອງ ມວສ ລວມທັງເອກະສານທີ່ຖືກອະນຸມັດ. ຜູ້ເຮັດການຄົ້ນຄວ້າຫຼັກຕ້ອງໄດ້ແຈ້ງໃຫ້ກອງເລຂາຂອງຄະນະກຳມະການຈັນຍາທຳ ຄົ້ນຄວ້າຮັບຊາບຖ້າມີ ການແກ້ໄຂເພີ່ມເຕີມ ຫຼື ການປ່ຽນແປງ ແລະ ຕ້ອງລາຍງານຄວາມຄືບໜ້າຂອງໂຄງການຄົ້ນຄວ້າ ຄືດັ່ງລຸ່ມນີ້:

- ກໍລະນີມີການປ່ຽນແປງໃດໆທີ່ມີຄວາມສຳຄັນຕໍ່ກັບໂຄງການ ແລະ ເຫດຜົນຂອງການປ່ຽນແປງນັ້ນ, ລວມທັງຂໍ້ບັງ ຊີທາງດ້ານຈັນຍາທຳ;
- ເກີດຜົນກະທົບທີ່ຮ້າຍແຮງຕໍ່ຜູ້ເຂົ້າຮ່ວມ ແລະ ການແກ້ໄຂຜົນກະທົບດັ່ງກ່າວ;
- ເກີດເຫດການທີ່ບໍ່ໄດ້ຄາດຄິດ ຫຼື ຄາດເດົາລ່ວງໜ້າ;
- ກໍລະນີຜູ້ເຮັດການຄົ້ນຄວ້າຫຼັກບໍ່ສາມາດສືບຕໍ່ເຮັດໜ້າທີ່ຂອງຕົນໄດ້ ຫຼື ມີການປ່ຽນແປງໃດໆທີ່ກ່ຽວຂ້ອງກັບບຸກ ຄົນໃນໂຄງການຄົ້ນຄວ້າດັ່ງກ່າວ;
- ກໍລະນີມີການຊີ້ປະກັນໄພຄຸ້ມຄອງຜູ້ເຂົ້າຮ່ວມການສຶກສາ ແລະ ການປະກັນໄພໝົດກຳນົດ;
- ເກີດຄວາມຊັກຊ້າໃນການເລີ່ມຕົ້ນໂຄງການເກີນກວ່າ 12 ເດືອນ; ແລະ
- ມີການຍຸຕິ ຫຼື ປິດໂຄງການຄົ້ນຄວ້າກ່ອນໂຄງການຈະສຳເລັດ.

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ເອກະສານທີ່ອະນຸມັດ

ເອກະສານທີ່ໄດ້ຮັບການທົບທວນຝ່າລະນາ ແລະ ອະນຸມັດຈາກ ຄະນະກຳມະການຈັນຍາທຳການຄົ້ນຄວ້າວິທະຍາສາດ

ເອກະສານປະກອບ	ສະບັບທີ (version)	ວັນທີ
ບົດສະເໜີໂຄງການຄົ້ນຄວ້າ	Version 2.1	09 ກຸມພາ ປີ 2021
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ປະທານ

ຄະນະກຳມະການຈັນຍາທຳຄົ້ນຄວ້າວິທະຍາສາດ



ດຣ.ນ. ຈັນຖະໜອມ ມະນີທິບ

STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

	Item No	Recommendation	Page No
<b>Title and abstract</b>	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	1
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2
<b>Introduction</b>			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3-7
Objectives	3	State specific objectives, including any prespecified hypotheses	7
<b>Methods</b>			
Study design	4	Present key elements of study design early in the paper	8
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	7-8
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	8
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	8-10
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	8-10
Bias	9	Describe any efforts to address potential sources of bias	8,11
Study size	10	Explain how the study size was arrived at	8
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	11
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	11
		(b) Describe any methods used to examine subgroups and interactions	N/A
		(c) Explain how missing data were addressed	12
		(d) If applicable, describe analytical methods taking account of sampling strategy	11
		(e) Describe any sensitivity analyses	N/A
<b>Results</b>			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	12
		(b) Give reasons for non-participation at each stage	12
		(c) Consider use of a flow diagram	-
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	12
		(b) Indicate number of participants with missing data for each variable of interest	12
Outcome data	15*	Report numbers of outcome events or summary measures	13-15; 26



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Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	13-15; 27
		(b) Report category boundaries when continuous variables were categorized	13-15
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	-
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	-
<b>Discussion</b>			
Key results	18	Summarise key results with reference to study objectives	17
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	21
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	18-20
Generalisability	21	Discuss the generalisability (external validity) of the study results	21
<b>Other information</b>			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	2

\*Give information separately for exposed and unexposed groups.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at [www.strobe-statement.org](http://www.strobe-statement.org).

# BMJ Open

## Changes in household food security, access to health services, and income in northern Lao PDR during the COVID-19 pandemic: a cross-sectional survey

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## Changes in household food security, access to health services, and income in northern Lao PDR during the COVID-19 pandemic: a cross-sectional survey

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**Keywords:** food security; dietary diversity; underweight; wasting; income; COVID-19; Lao PDR; malnutrition; local food production

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3 16 **Abstract**

4  
5 17 **Objectives:** We assessed the relative difficulty in meeting food needs during the COVID-19 pandemic  
6 18 compared to before; determined the relationship between pandemic-associated difficulties in food  
7 19 access and household, maternal and child food security; and identified resiliency-promoting strategies.

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9 20 **Design:** A cross-sectional survey of households undertaken in November 2020.

10  
11 21 **Setting:** Rural districts of Luang Prabang Province, Lao People's Democratic Republic

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13 22 **Participants:** Households (N=1,122) with children under five years.

14  
15 23 **Primary and secondary outcomes measured:** Survey respondents reported the relative ease of access of  
16 24 food and health care as well as changes in income and expenditures compared to before March 2020.  
17 25 We determined indicators of food security and source of foods consumed for households, women, and  
18 26 children, as well as prevalence of malnutrition in children under five.

19  
20 27 **Results:** Nearly four-fifths (78.5%) found it harder to meet household food needs during the pandemic.  
21 28 The most common reasons were increased food prices (51.2%), loss of income (45.3%), and decreased  
22 29 food availability (36.6%). Adjusting for demographics, households with increased difficulty meeting food  
23 30 needs had lower food consumption scores and child dietary diversity. Over 85% of households lost  
24 31 income during the pandemic. Decreased expenditures was associated with reliance on more extreme  
25 32 coping strategies to meet food needs. The households who experienced no change in meeting food  
26 33 needs produced a greater percentage of their food from homegrown methods (4.22% more, 95% CI:  
27 34 1.28, 7.15), than households who found it more difficult.

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29 35 **Conclusions:** Pandemic-associated shocks may have large effects on food insecurity. Action is needed to  
30 36 mitigate consequences of the pandemic on nutrition. Local food production and safety net programs  
31 37 that offset income losses may help.

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37 39 **List of abbreviations:**

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39 40 **LMICs:** low- and middle-income countries

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41 41 **FAO:** Food and agriculture organization

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43 42 **FCS:** food consumption score

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45 43 **CSI:** coping strategies index

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47 44 **DDS:** dietary diversity score

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49 45 **HAZ:** height-for-age Z-score

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51 46 **WAZ:** weight-for-age Z-score

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53 47 **WHZ:** weight-for-height Z-score

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## 50 **Strengths and limitations of this study**

- 51 • We characterize food security across all members of the household, including  
52 women and children, through a series of standardized measures, and describe the  
53 source of foods consumed, permitting identification of strategies to promote  
54 resilience in this population.
- 55 • We capture a large, representative sample of Luang Prabang Province, a  
56 marginalized population with high prevalence of ethnic minorities, for whom little  
57 data on nutrition was previously available.
- 58 • The results of this study may not be generalizable to other counties with varying  
59 economic profiles or rates of COVID-19, to urban communities, or to rural provinces  
60 with lower reliance on tourism.
- 61 • The analyses are cross-sectional, preventing establishment of causal relationships.
- 62 • Self-reported measures, including food consumption patterns and relative ability to  
63 meet food needs during the pandemic as compared to before, are subject to recall  
64 bias.

65

## 66 Introduction

67 Disruptions to food, economics, and health systems during the COVID-19 pandemic have increased the  
68 risk of malnutrition among low- and middle-income countries (LMICs) [1-4]. The food supply chain has  
69 faced challenges across multiple stages, including loss of labor for agricultural production and  
70 postharvest handling due to movement restrictions or illnesses; closure of processing and distributing  
71 facilities; disruptions in distribution networks under restricted trade policies; and changes in consumer  
72 demand and market access [5]. Such challenges have resulted in increases in food prices, with the Food  
73 and Agricultural Organization (FAO) reporting that wheat and rice prices increased by 8% and 25%,  
74 respectively, between March 2019 and April 2020 [6]. Economic disruptions, such as business closures  
75 and declines in tourism, have reduced country-specific gross national incomes in most LMICs [7]. The  
76 World Bank estimates that the pandemic pushed an additional 119 to 124 million people into extreme  
77 poverty in 2020 [8], and surveys across multiple LMICs reveal losses in income among the majority of  
78 households [8-12]. An estimated 118 to 161 million more individuals faced hunger in 2020 as compared  
79 to in 2019 [7]. This increase in the number of people undernourished was apparent in all subregions of  
80 Africa and Latin America, and most subregions of Asia, and was more than five times greater than the  
81 highest increase in undernourishment in the past two decades [7]. Compounding this effect, health  
82 services designed to catch and treat acute malnutrition may be disrupted in many LMICs. For instance,  
83 UNICEF estimates a reduction of 30% in the coverage of essential nutrition services in LMICs due to  
84 difficulties in mobility of both users and providers, interruption of non-COVID-19 services in  
85 communities, higher burdens on the health care workers, and limited personal protective equipment  
86 [13].

87 Increased food insecurity coupled with a decline in access to essential nutritional services is expected to  
88 lead to increases in the prevalence of childhood wasting, an acute form of malnutrition associated with  
89 elevated risk of mortality [14, 15]. One study estimates that there could be a 14.3% increase in the

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3 90 prevalence of moderate or severe wasting among children younger than five years in the 118 LMICs due  
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5 91 to COVID-19-related income losses [2]. By another projection, an increase in wasting of this order of  
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7 92 magnitude (10-50%), coupled with a decline in maternal and child health services by 9.8-15.9%, would  
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9 93 be associated with an increase of 9.8-44.7% in under-five deaths per month [16]. To prevent a global  
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11 94 malnutrition crisis, leaders from four United Nations agencies (UNHCR, UNICEF, FAO, WHO) have issued  
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13 95 an immediate call to action, recommending \$2.4 billion be directed to avoiding child malnutrition  
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15 96 through wasting treatment and prevention, vitamin A supplementation, and breastfeeding support [17].  
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17 97 Alongside these efforts, leaders have called for research that estimates the scale and reach of nutrition  
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19 98 challenges, including country-specific estimates of the effect of the pandemic on incomes, and the  
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21 99 ability to meet food needs and access health services.  
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26 100 Lao People's Democratic Republic (PDR) has one of the highest rates of malnutrition in southeast Asia,  
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28 101 with a national prevalence of stunting of 33%, underweight of 21% and wasting of 9% [18]. Lao PDR  
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30 102 experienced its first case of COVID-19 infection in March 2020 [19]. Shortly afterwards, the government  
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32 103 imposed a strict lockdown for six weeks, stopping human movement between districts, provinces, and  
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34 104 across the border. A total of six cases were identified between March and April 2020. Beginning in May  
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36 105 2020, restrictions on within-country movement eased along with adherence to protective measures  
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38 106 (e.g., mask wearing and social distancing), but borders were closed to everyone except those who  
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40 107 entered the country via special mission flights, who underwent strict quarantine and testing in  
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42 108 government authorised facility [20]. Between March 2020 and February 2021, only 45 cases had been  
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44 109 reported in Lao PDR, mainly among individuals returning to the country [21]. In April 2021, an outbreak  
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46 110 of COVID-19 occurred, with the first confirmed death in May of 2021 [21]. Cases peaked in December of  
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48 111 2021, and as of February, 2022, the country has had over 148,600 confirmed cases and 621 deaths [21].  
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53 112 While Lao PDR has reported fewer cases of COVID-19 than neighbouring countries [21], it may  
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55 113 experience substantial economic and food security effects of the pandemic. The FAO reports that food  
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3 114 prices in Lao PDR have increased by 7.1% between February 14, 2020 to January 30, 2021 [22]. At the  
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5 115 same time, the Ministry of Labour and Social Welfare reported a surge in unemployment from 2%  
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7 116 before the pandemic to 25% as of May 2020 [23]. Moreover, in a national assessment, UNICEF found  
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9 117 that between August 2019 and August 2020, there was a 10-24% decline in the coverage of maternal  
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11 118 health services, newborn services, routine vaccinations, screening for child wasting, and treatment of  
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13 119 child wasting [13]. The economic effects of the pandemic are expected to be felt most strongly in Luang  
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15 120 Prabang province, a popular tourist destination. In 2019, Luang Prabang received about 638,000  
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17 121 international visitors and 222,000 domestic tourists. In May 2020, 78% of Luang Prabang's tourism  
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19 122 enterprises were closed, and those that remained open did so largely at partial capacity [24]. This is  
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21 123 particularly concerning, as the Luang Prabang province bears a disproportionate burden of children who  
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23 124 are stunted (41.3%) or underweight (25%) [18]. The rural and mountainous provinces of Luang Prabang  
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25 125 are particularly vulnerable to undernutrition as poverty rates are high and they are often isolated, with  
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27 126 difficult access to markets, healthcare and other public services, and water infrastructure [25, 26]. There  
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29 127 is a high prevalence of minority ethnolinguistic groups, particularly Hmong and Khmu ethnicities, in  
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31 128 these regions and livelihoods are largely agriculturally based. Heavy reliance on rice with limited animal  
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33 129 protein contributes to nutritional deficiencies [27]. In this northern Lao PDR, newborns are commonly  
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35 130 fed masticated sticky rice after birth, and 97% of women report following culturally determined  
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37 131 restricted diets for one or more months postpartum, reducing consumption of all food groups, except  
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39 132 rice [28].  
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46 133 In rural provinces of Luang Prabang where documented COVID-19 transmission was low, we aimed to 1)  
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48 134 assess the relative difficulty in meeting food needs and accessing health care during the COVID-19  
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50 135 pandemic compared to before the pandemic; 2) compare self-reported difficulty in meeting food needs  
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52 136 to indicators of food security among women, children and the household; 3) identify strategies  
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54 137 associated with increased resiliency to food insecurity.  
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## 138 **Methods**

### 139 *Survey region and population*

140 We obtained data from a cross-sectional, household survey conducted in November 2020 from the Lao  
141 Provincial Health Department. Data were collected as part of the Lao Health Department's endline  
142 evaluation of the Primary Health Care Program to monitor and evaluate public health activities over a  
143 three-year period, starting in 2017. Data were collected from three districts - Nan, NamBak, and Pak Ou  
144 - in Luang Prabang Province.

### 145 *Sampling plan*

146 The target sample size was 1,200 households. The sample size was chosen to detect with 95%  
147 confidence and 80% power a change from 77.7% to 83% in the proportion of women delivering with a  
148 skilled birth attendant since the baseline survey in 2017, accounting for a design effect of 1.5 and a non-  
149 response rate of 5%. A household was considered eligible for selection if members have lived in the  
150 village for at least two years, if it contained a child under the age of five, and if an adult respondent  
151 provided verbal, informed consent to participate.

152 Household selection followed a multistage clustered sampling design that stratified by the three  
153 districts. In the first stage, 25 villages were selected using probability proportional to size sampling. In  
154 the second stage, 30 households per village were selected using simple random sampling from a list of  
155 eligible households prepared by the village head in collaboration with the village health volunteer. The  
156 health and diet of one child under the age of five per household was assessed, and anthropometric  
157 measurements taken. If there were more than one child under five years in the house, a third stage of  
158 sampling was used, in which one child was selected using simple random sampling.

### 159 *Household questionnaire*

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3 160 Household questionnaires were administered verbally by trained data collectors. Information of  
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5 161 household demographics, household food security, maternal and child diet, child anthropometrics, and  
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7 162 self-reported changes in food access, income, expenditures and access to health services during the  
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9 163 pandemic were collected. The survey was translated into Lao language, and back translated to ensure  
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11 164 correct translation. One enumerator per team was also fluent in the local languages of Khmu and  
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13 165 Hmong, in case the respondent did not speak Lao. A copy of the reduced survey tool is included in the  
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15 166 Supplemental Information.

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19 167 The endline survey used the same questionnaire as the baseline survey, which was adapted from global  
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21 168 standard reproductive, maternal, newborn and child health and nutrition surveys, and added questions  
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23 169 related to food security and access to health services during the pandemic. These additional questions  
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25 170 were adapted from a standardized questionnaire developed by Save the Children, International to  
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27 171 assess the impact of COVID-19 globally [29]. Respondents were asked if, compared to before the  
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29 172 pandemic, it was much harder, somewhat harder, easier, or the same to meet their family's food needs.  
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31 173 If harder, families were asked to list the reasons why. Similarly, respondents were asked if, compared to  
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33 174 before the pandemic, it was much harder, somewhat harder, easier, or the same to access health care.  
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35 175 Finally, families were asked if they lost income or reduced their expenditures during the pandemic, and  
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37 176 if so, asked to estimate by what percent.

#### 38 39 40 41 42 177 *Calculation of household food security and maternal and child dietary diversity*

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45 178 Household food security was assessed through two standard indicators: the food consumption score  
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47 179 and coping strategy index. The food consumption score (FCS) is a frequency weighted household dietary  
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49 180 diversity score calculated by multiplying the frequency of consumption of different food groups  
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51 181 consumed by a household during the 7 days before the survey by a weighting factor, and summing [30].  
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53 182 The food groups, and their respective weights include: main staples (2), pulses (3), vegetables (1), fruit  
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183 (1), meat and fish (4), dairy (4), sugar (0.5), and oils/butter (0.5). Lower values for FCS reflect greater  
184 food insecurity, as measured by households consuming nutritious foods with lower frequency and/or  
185 diversity.

186 The reduced Coping Strategies Index (CSI) was also used to compare household food security. CSI is  
187 calculated by multiplying the weekly frequency of five behaviors by the weight of the behavior and  
188 summing for all behaviors [31]. The five standard coping strategies and their severity weightings are:  
189 Eating less-preferred foods (1.0); Borrowing food/money from friends and relatives (2.0); Limiting  
190 portions at mealtime (1.0); Limiting adult intake (3.0), and reducing the number of meals per day (1.0).  
191 Higher values for CSI reflect greater food insecurity, as measured by engagement in more frequent  
192 and/or severe behaviors when they do not have enough food or money to buy food [31].

193 The CSI and FCS are significantly correlated with each other and other indicators of household food  
194 insecurity, including the household food insecurity and access scale, yet there is enough difference  
195 between indicators that prior work recommends use of multiple metrics to capture different aspects of  
196 food insecurity [32]. By capturing behavioral response, CSI has been shown to be a better indicator of  
197 future consumption than FCS, and thus a good measure of vulnerability to future shocks [33]. By  
198 capturing dietary diversity, FCS correlates well with caloric consumption and is commonly used by the  
199 World Food Programme and other major organizations as a key indicator in program monitoring. CSI is  
200 more likely to identify a household as food insecure, while FCS is more likely to miss households that are  
201 food insecure [32]. Both can be used as continuous values. CSI has no universal thresholds associated  
202 with it for creating categorical indicators, although prior study from Ethiopia proposed to categorize  
203 scores below 3 as indicative of acceptable food security [32]. FCS has universal thresholds established,  
204 with scores above 35 indicative of acceptable food security; yet, prior study demonstrates that a  
205 sizeable proportion of households with an FCS  $\geq 35$  classify as food insecure according to caloric intake  
206 [34].

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2  
3 207 In addition, we calculated an individual dietary diversity score (DDS) for women and children aged 6-59  
4  
5 208 months [35]. DDS for children aged 24-59 months is calculated by summing the total number of food  
6  
7 209 groups consumed in the previous 24 hours, where the food groups are defined as: grains, roots and  
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9  
10 210 white tubers; legumes and nuts; dairy products; meat; eggs; vitamin A-containing fruits and vegetables  
11  
12 211 (i.e., dark-green, leafy vegetables, fruits that are orange on the inside); other fruits and vegetables. The  
13  
14 212 child must consume at least four of the seven food groups to meet their minimum acceptable dietary  
15  
16 213 diversity [35]. For children aged 6-23 months, breastmilk is added as an eighth food group and the child  
17  
18 214 must consume five out of eight food groups to meet minimum acceptable dietary diversity.  
19  
20  
21  
22 215 DDS for women is tallied by adding up the number of food groups consumed out of the following ten  
23  
24 216 groups: grains, roots, and white tubers; legumes; nuts and seeds; dairy products; meat; eggs; dark, leafy  
25  
26 217 greens and vegetables; other vitamin-A-rich fruits and vegetables; other vegetables; other fruits. The  
27  
28 218 woman must consume at least five of the ten food groups to meet her minimum dietary diversity [35].  
29  
30  
31 219 Women who reported having an abnormal diet (i.e., ate much more or much less than normal) in the  
32  
33 220 past 24 hours were excluded from analysis.

### 221 *Anthropometric analysis*

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39 222 Weight and height of children were recorded to the nearest 0.01 kg and 0.1 cm, respectively. Weight-  
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41 223 for-age (WAZ), height-for-age (HAZ), and weight-for-height (WHZ) Z-scores were determined using 2006  
42  
43 224 WHO Growth Standards [36]. A child was considered stunted, wasted, or underweight if they had a  
44  
45 225 WAZ, WHZ, or WAZ score below -2SD, respectively.

### 226 *Statistical analysis*

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51 227 Data were analyzed in R version 3.5 [37]. Survey weights were calculated using the inverse probability of  
52  
53 228 selection for a child (for child outcome) or a household (for household or maternal outcomes). We used  
54  
55 229 the 'survey' package in R to calculate means and percentages accounting for survey weights, and

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3 230 standard errors used to calculate 95% confidence intervals were determined accounting for clustering  
4  
5 231 [38]. Univariate and multivariate associations between food security indicators and pandemic-  
6  
7 232 associated changes in income, expenditures, and ability to meet food needs were assessed using  
8  
9 233 generalized linear models, accounting for survey weights, and using cluster robust standard errors to  
10  
11 234 adjust for clustering at the village level. A directed-acyclic-graph (DAG) was used to identify the set of  
12  
13 235 minimally sufficient covariates to adjust for to block confounding pathways between the exposure and  
14  
15 236 the outcome (Figure S1). These covariates were associated with the exposure, causally associated with  
16  
17 237 the outcome, and not on the causal pathway between exposure and outcome. Selected covariates to  
18  
19 238 include were defined *a priori* as: household ethnicity, household size, education level of mother and the  
20  
21 239 head of household, and district. Adjusted models for maternal outcomes additionally included mother's  
22  
23 240 age, and models for children outcomes additionally included child's age and sex. Inclusion of all variables  
24  
25 241 within this set of minimally sufficient covariates minimized model AIC as compared to inclusion of only a  
26  
27 242 subset of these covariates. Because we did not capture income prior to the pandemic, which may act as  
28  
29 243 a confounder, we examined the sensitivity of model coefficients to inclusion of total expenditures and  
30  
31 244 the percent of expenditures spent on food. These variables may be associated with initial income, but  
32  
33 245 are not included in primary analyses as they may lie on the causal pathway between exposures and  
34  
35 246 outcome. Finally, we conducted stratified analyses to examine whether associations between food  
36  
37 247 security and relative ability to meet food needs during compared to before the pandemic was modified  
38  
39 248 by the most commonly reported reasons for increased difficulty (items more expensive, markets closed,  
40  
41 249 less food available in markets, and lost income).

## 250 *Ethics*

251 Data were collected by the Lao Provincial Health Department as part of routine, non-research public  
252 health activities. We obtained data from the Lao Provincial Health Department. Ethical clearance for

253 secondary data analysis was obtained from the Research Ethics Committee in the University of Health  
254 Sciences within the Lao Ministry of Health and Committee for the Protection of Human Subjects within  
255 University of California, Berkeley (protocol ID: 2021-05-14365). A copy of the ethical approval is included  
256 in the Supplemental Information.

### 257 *Patient and Public Involvement*

258 Community members were involved in the conduct of this research. During the survey, community  
259 volunteers assisted in locating other community members for participation in the survey. Results,  
260 including village health profiles, were shared with provincial and district health department leadership  
261 and the head of the Maternal Child Health Department. Monthly village health days were held  
262 throughout the project period to convey information and results to community members, verbally and  
263 with handmade posters.

### 264 **Results**

265 Interviews were completed for 1,122 households, corresponding to a 93.5% response rate. Reasons for  
266 non-response included empty house (53.8%), parent not at home (38.5%) and inaccessible house (5.1%).  
267 The most common ethnicities of those interviewed were Khmu (463, 41.3%), Lao Lom (340, 30.3%), and  
268 Hmong (281, 25.0%). Undernutrition among children under five years in the study region was high, with  
269 the survey-weighted prevalence of wasting at 4.5% (95% CI: 3.5, 5.8), underweight at 18.2% (95% CI:  
270 15.9, 20.7%), and stunting at 32.9% (95% CI: 29.6, 36.4%).

### 271 *Food security*

272 Nearly four-fifths (78.5%) of the study population reported that it was harder to meet their family's food  
273 needs during the pandemic, as compared to before (Table 1). A weighted 60.9% (95% CI: 57.6, 64.1%) of  
274 individuals reported that it was somewhat harder to meet food needs, while 17.6% (95% CI: 15.4, 20.0%)

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2  
3 275 reported that it was much harder. Among the 874 individuals who found it harder to meet food needs,  
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5 276 the most common reason reported was that foods were more expensive (51.2%), followed by household  
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7 277 losing income (45.3%), food not available at markets (36.6%), and markets being closed (36.5%). The  
8  
9 278 median monthly expenditure among households was US\$133. Households spent, on average, 40% of  
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11 279 their income on food, which was increased from 30% in 2017.

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15 280 The mean food consumption score was 60.9 (95% CI: 59.7, 62.3) (Table 2). Households consumed rice  
16  
17 281 daily and meat and vegetables an average of 3.0 and 4.8 days per week, respectively. On average,  
18  
19 282 children consumed 4.21 (95% CI: 3.95, 4.18) food groups in the day prior to the survey, corresponding to  
20  
21 283 62.5% (95% CI: 59.1, 65.8) of children that met the minimum DDS requirement. Women consumed an  
22  
23 284 average of 5.38 (95% CI: 5.25, 5.51) food groups, corresponding to 67.7% (95% CI: 64.4, 70.9) meeting  
24  
25 285 her minimum DDS. Compared to 2017, households in 2020 demonstrated significantly ( $p < 0.05$ ) lower  
26  
27 286 dietary diversity and higher coping strategies. In 2017, 76% of women and 69% of children met their  
28  
29 287 minimum dietary diversity score, and the average CSI for households was 0.7 points lower. The largest  
30  
31 288 change in household food consumption between 2017 and 2020, was in meat consumption; in 2017,  
32  
33 289 households ate meat an average of 6 days per week. Household consumption of vegetables (5.3 vs. 4.8)  
34  
35 290 was also lower in 2020 compared to 2017, while consumption of rice remained the same. While women  
36  
37 291 and children consumed less meat in 2020 than in 2017, the difference was not as large as observed  
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39 292 among other household members, and both women and children increased egg consumption (Figures  
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41 293 S2 and S3).

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47 294 The distribution of both household food security indicators differed by whether or not households found  
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49 295 it harder to access food during the pandemic (Figure 1). Among households who found it harder to meet  
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51 296 their food needs during the pandemic, there was greater density of lower FCS (indicating worse food  
52  
53 297 security) and higher CSI (indicating worse food security) compared to those who experienced no change.  
54  
55 298 These relationships between household FCS and access to food during the pandemic were also seen in



299 multivariate regression analyses (Table 2; Figure 2). Adjusting for ethnicity of the household, size of the  
300 household, district, and education level of the mother and head of household, we estimated that the  
301 average food consumption score among households who found it harder to meet their food needs was  
302 2.74 points lower (95% CI: 0.55, 4.92) than the average food consumption score among households who  
303 experienced no change (Figure 2). This is roughly equivalent to consuming vegetables nearly three fewer  
304 times per week, or consuming rice one less time per week. The household coping strategies index  
305 among households who had a harder time meeting their food needs was higher, indicating lower food  
306 security, but not significantly so. Dietary diversity scores for women and children were lower among  
307 households who had more difficulty meeting their food needs during the pandemic, but not significantly  
308 so in adjusted analyses. Sensitivity analyses including total expenditures and percent of expenditures  
309 spent on food as covariates found similar model coefficients (Table S1), although dietary diversity score  
310 for children met the criteria for statistically significant at the 95% confidence level. For all outcomes,  
311 households who reported that increased food prices were a major reason for increased difficulty  
312 meeting food needs were associated with the greatest deteriorations in food security or diversity,  
313 compared to households who reported food availability and market closures as the reason for their  
314 difficulty.

315 We did not find any difference in WAZ or WHZ scores among children from households who self-  
316 reported greater difficulty meeting their food needs compared to those from household who reported  
317 no change in ability to meet food needs.

318  
319 **Figure 1.** Violin plot showing distribution of two household food security measures, together with their  
320 median and interquartile range (IQR). Household food security was measured through food

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3 321 consumption score (FCS) (A, B) and coping strategies index (CSI) (C, D). Food insecurity is associated with  
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5 322 low FCS and high CSI.  
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11 324 **Figure 2.** The difference in mean of food security indicator among households who had a harder time  
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13 325 meeting their food needs during the pandemic compared to those who did not. Vertical bars represent  
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15 326 95% confidence intervals. Adjusted models for households control for household ethnicity, household  
16  
17 327 size, education level of mother and the head of household, and district. Adjusted models for mothers  
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19 328 include additionally mother's age. Adjusted models for children include additionally child's age and sex.  
20  
21 329 FCS = food consumption score; CSI = coping strategy index; DDS = dietary diversity score. Lower values  
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23 330 for FCS and DDS and higher values of CSI indicate greater food insecurity.  
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### 28 331 *Resiliency to food insecurity*

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31 332 We estimated the percentage of a household's food sources in the past week that was self-produced  
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33 333 (e.g., farmed, fished, hunted, gathered). On average, families met 42% of their food needs through self-  
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35 334 production (interquartile range: 27%, 57%). Commonly self-produced foods included: insects, aquatic  
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37 335 animals other than fish, mushrooms, and roots (Figure 3). Over half of households also self-produced  
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39 336 rice and vegetables, and about one quarter self-produced fish, meat, and fruits. We found that  
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41 337 households who derived a greater proportion of their food needs through homegrown methods were  
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43 338 more resilient than families who purchased their foods. Adjusting for ethnicity of the household, size of  
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45 339 the household, district, and education level of the mother and head of household, we estimated that the  
46  
47 340 average percentage of food obtained from homegrown methods was 4.22% (95% CI: 1.28, 7.15%) lower  
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49 341 among households who found it harder to meet their food needs compared to household who  
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51 342 experienced no change. On average, respondents spent 9.6 hours per week fishing, gathering or hunting  
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343 food. Persons who found it harder to meet their food needs during the pandemic also spent fewer hours  
344 per week fishing, gathering, or hunting, though the results were not significant.

345 **Figure 3.** Proportional source of each food group consumed during the past week by households.

346 Numbers in parenthesis above the bars indicates the mean number of days per week household  
347 consumed these food groups.

### 348 *Income and expenditures*

349 Over 85% of the study population reported losing income during the pandemic, with the majority of  
350 respondents (54.4%, 95% CI: 51.3, 57.4%) reporting losing between 25-50% of their income. Households  
351 who reported declines in income were more likely to reduce spending, with the greater the reduction in  
352 income corresponding to greater reductions in household expenditures (Figure 4a). A weighted 23.3%  
353 reported reducing household expenditures by 1-25%, while 35.7% reported reducing expenditures by  
354 25-50%. The distribution of both household food security indicators also differed by whether or not  
355 households lost income during the pandemic (Figure 1).

356 Households who reduced expenditures during the pandemic had significantly decreased food security in  
357 adjusted analyses, as measured by the FCS and the CSI, and significantly decreased food security in  
358 univariate analyses as measured by the FCS and child's DDS (Figure 4b, Table 2). In adjusted analyses,  
359 families who reported spending less during the pandemic had a household FCS that was 5.23 (95% CI:  
360 3.41, 7.05) units lower, and a CSI that was 0.83 (95% CI: -0.07, 1.74) units higher than families who did  
361 not reduce spending. Dietary diversity scores for children were lower among households who had more  
362 difficulty meeting their food needs during the pandemic, but not significantly so in adjusted analyses.  
363 Including total expenditures and percent of expenditures spent on food as covariates in multivariable  
364 models did not change these conclusions (Table S1).

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3 365 We did not find any difference in WAZ or WHZ scores among children from households who lost income  
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5 366 or reduced spending compared to those who did not lose income or reduce spending.  
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11 368 **Figure 4.** A) Mean decrease in expenditures reported, stratified by the percent reduction in household  
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13 369 income. Vertical bars represent 95% confidence intervals. B) The difference in mean of food security  
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15 370 indicator among households who reduced spending during the pandemic compared to those who did  
16  
17 371 not. Vertical bars represent 95% confidence intervals. Adjusted models for households control for  
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19 372 household ethnicity, household size, education level of mother and the head of household, and district.  
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21 373 Adjusted models for mothers include additionally mother's age. Adjusted models for children include  
22  
23 374 additionally child's age and sex. FCS = food consumption score; CSI = coping strategy index; DDS =  
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25 375 dietary diversity score. Lower values for FCS and DDS and higher values of CSI indicate greater food  
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27 376 insecurity.

### 32 377 *Access to health care*

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35 378 A weighted 37.4% (95% CI: 34.6, 40.2%) of individuals reported that it was somewhat harder to access  
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37 379 healthcare compared to before the pandemic, while 4.8% (95% CI: 3.7, 6.1%) reported that it was much  
38  
39 380 harder (Table 1). We identified 123 (11%) women and 557 (50%) children who had experienced fever,  
40  
41 381 diarrhea, cough and/or respiratory infection in the two weeks prior to the survey. Among both women  
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43 382 and children with illness in the past two weeks, >60% had fever (see Figures S4-S5 for Venn diagrams).  
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45 383 Of these, a weighted 69.7% (95% CI: 66.3, 73.0%) of children and 81.2% (95% CI: 73.3, 87.2) of women  
46  
47 384 sought care from a health facility. We found no association between healthcare seeking behavior, either  
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49 385 for stratified by condition or in aggregate, and relative ability to access health care during versus before  
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51 386 the pandemic.  
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### 56 387 **Discussion**

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3 388 In a rural setting in Lao PDR with low documented COVID-19 transmission and high dependence on  
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5 389 tourism, we found prevalent loss of income and increased difficulty in meeting household food needs  
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7 390 following the start of the COVID-19 pandemic and a national border closure. In our household survey,  
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9 391 we found that nearly four-fifths of the study population reported that it was harder to meet their  
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11 392 family's food needs during the pandemic, with the most common reason being increases in food prices;  
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13 393 indeed, families reported that the proportion of their household expenditure on food had doubled since  
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15 394 baseline in 2017. At the same time, we found that over 85% of the study population reported losing  
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17 395 income during the pandemic, with over half of respondents reported losing between 25-50% of their  
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19 396 income. Respondents who reported losses in income and and/or reported greater challenges meeting  
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21 397 their food needs had small, but significant declines in household food security, as measured by the food  
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23 398 consumption score (which correlates best with caloric intake) and coping strategies index (which  
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25 399 correlates best with vulnerability to shocks). Nevertheless, the small differences in food security  
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27 400 indicators suggests that people in this population may have been able largely able to protect their  
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29 401 consumption without heavy reliance on negative coping strategies, despite some deterioration.  
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31 402 Decreased expenditures as a result of the pandemic was more strongly associated with reductions in  
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33 403 household food security, as measured by both the FCS and the CSI, as compared to greater difficulty in  
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35 404 food access. Moreover, of the reasons for challenges meeting food needs reported by the community,  
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37 405 increased food prices were most strongly associated with lower FCS, higher CSI, and lower DDS in  
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39 406 women and children. Self-production of food via farming, hunting, fishing, or gathering is common in  
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41 407 this population, accounting for 42% of food consumed. Our study found that individuals who derived a  
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43 408 greater proportion of the food from self-produced means were more resilient to pandemic-associated  
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45 409 shocks.  
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47 410 Our results support a growing body of empirical data that suggests wide scale difficulty in meeting food  
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49 411 needs and pervasive loss in income associated with the pandemic. In Kenya, surveys administered  
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3 412 before and after the COVID-19 lockdown found that 52% of the population changed their dietary habits,  
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5 413 most commonly via reductions in meat, dairy, and bread [11]. Nearly all (95%) of respondents reported  
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7 414 loss of income during the pandemic, with 88% finding that the resulting income was insufficient to meet  
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9 415 food needs. Over one third also attributed changes in food consumption to lower food availability, with  
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11 416 households obtaining food from markets more likely to change food consumption patterns than those  
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13 417 obtaining food from farming and livestock [11]. An interrupted time series analysis in Bangladesh found  
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15 418 that median incomes fell from US\$212 to \$59 during a two-month stay at home order, while the  
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17 419 proportion of families living on less than \$1.90 per day rose from 0.2% to 47.3% [39]. In that study, the  
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19 420 proportion of households classified as moderately or severely food insecure rose from 5.6% and 2.7%,  
20  
21 421 respectively, to 36.5% and 15.3% [39]. While global surveys indicate loss of income across all counties,  
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23 422 the proportion of participants financially impacted by the pandemic is estimated to be three times  
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25 423 higher in LMICs than in high income countries [40]. Longitudinal survey data from Ethiopia, Malawi,  
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27 424 Nigeria and Uganda find that 77% of the population live in households that have lost income during the  
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29 425 pandemic [9]. In a Save the Children global survey, 85% of families living in Asia reported income loss,  
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31 426 with a strong negative association between income loss and dietary diversity [29]. To our knowledge, no  
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33 427 study has yet to be published from Lao PDR, but an unpublished household survey in Phongsaly  
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35 428 Province, another rural province, found that 46% of households reduced their expenditures, and 24%  
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37 429 took out loans to buy food (personal communication).

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39 430 Randomized control trials demonstrate that improved access to proper nutrition can improve WAZ and  
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41 431 WHZ Z-scores [41-43]. In many LMICs, including Lao PDR, the density of Z-scores is clustered around the  
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43 432 dichotomous classification threshold of -2SD, so even small changes to body weight can translate into  
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45 433 meaningful changes in the proportion of children classified as underweight or wasted [44]. While LMICs  
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47 434 have seen progress in reducing prevalence of wasting and underweight, yearly reductions in Lao PDR  
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49 435 and other LMICs may be smaller than a percentage point [18, 45, 46], suggesting that even small effects

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3 436 of COVID-19 on bodyweight could undo years of progress. At the same time, we did not observe a  
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5 437 difference in the WAZ or WHZ scores between children whose household reported greater difficulty  
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7 438 meeting food needs and those who did not, nor did we see a difference in maternal or child dietary  
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9 439 diversity score between these groups in multivariate analyses. This may suggest that households in our  
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11 440 study population prioritized maternal and child consumption patterns even as families struggled to meet  
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13 441 food needs. We find that while household meat consumption was strongly reduced between 2020 and  
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15 442 2017, meat consumption of women and children was reduced only slightly, and more than offset by  
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17 443 increases in egg consumption. All villages in the study population have been receiving interventions  
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19 444 focused on sustainable behavioral change for maternal and child nutrition, so individuals in the  
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21 445 population may have been more likely to prioritize the nutrition of these vulnerable populations.  
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23 446 Indeed, eggs were promoted as part of behavioral change communication as an alternative and cheap  
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25 447 source of protein when meat was too expensive or not available.  
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31 448 Our study suggests possible interventions that might mitigate the effect of the pandemic on food  
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33 449 security. We found that households who were more likely to experience no change in meeting food  
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35 450 needs during the pandemic derived a greater proportion of their food needs through homegrown  
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37 451 methods (as opposed to purchasing foods) as compared to households who found it more difficult to  
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39 452 meet their food needs. Reducing reliance on food supply from other places or countries is recognized by  
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41 453 others to be a means of reducing the impact of the COVID-19 pandemic on food insecurity. Farm-  
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43 454 system-for-nutrition approaches have been suggested as one solution, in which location-specific farm  
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45 455 systems integrate arable farming, horticulture, backyard farming, and animal farming in order to  
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47 456 increase household access to nutritious foods while conserving natural resources [47]. The FAO  
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49 457 advocate for improving the resilience of local food systems by facilitating access to locally produced  
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51 458 food, shortening the supply chain by promoting direct purchase from local producers, and promoting  
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53 459 urban or backyard gardens that also offer financial and environmental co-benefits [48]. Because our  
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3 460 study design could not establish trends in homegrown food production prior to the pandemic, we are  
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5 461 unable to determine if households in our population increased homegrown food production or time  
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7 462 spent fishing, gathering, or hunting as a response to the pandemic, although we found slightly higher  
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10 463 prevalence of homegrown food production (48%) and time spent collecting food (12.0 hours) in 2017 as  
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12 464 compared to 2020. Globally, reliance on homegrown food production may have increased as a response  
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14 465 to lockdown measures [7] and helped stabilize food consumption patterns amidst market uncertainty  
15  
16 466 [11]. Yet, increased reliance on gathering or growing food may represent a source of unpaid labor that  
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18 467 could be devoted to other activities [49]. Care must be taken that local food grown solutions minimize  
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20 468 contributions to the burden of time poverty, or are enacted along with interventions that offset time  
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22 469 poverty [50].  
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26 470 Our study also identified that loss of income and higher food prices are among the most important  
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28 471 reason households are less able to meet their food needs. As such, social safety net programs may be  
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30 472 particularly suited to addressing the challenge of food insecurity [51-53]. A randomized control trial in  
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32 473 Colombia in March 2020, at the start of a national quarantine, found that 90% of families randomized to  
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34 474 an arm that received cash transfers of \$19 every 5-9 weeks spent the cash on food, which helped to  
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36 475 offset the effects of the pandemic on food insecurity in the treatment arm [54]. Other randomized  
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38 476 control trials demonstrate reductions of severe food insecurity among those who received a cash  
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40 477 transfer or a direct food transfer by nearly 25% [55, 56]. Systematic review and meta-analysis of 74  
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42 478 studies found that children from households who received cash transfers had reduced stunting by 2.5%  
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44 479 and improved consumption of animal foods by 4.5% [57].  
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49 480 This study has limitations. First, the results of this survey may not be generalizable to other countries,  
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51 481 particularly those with higher COVID-19 incidence and greater restrictions on within-country movement.  
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53 482 At the time of the survey (November 2020), fewer than 50 cases had been reported in Lao PDR, and  
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55 483 health systems were not experiencing the same overwhelming of capacity as in many other countries  
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3 484 [58]. Additionally, while initial control measures limited local movement, these restrictions were largely  
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5 485 relaxed by May 2020, seven months prior to the survey, with the main intervention remaining being  
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7 486 strict border closure. We expect, therefore, that compared to other LMICs, the effects of food security  
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9  
10 487 and access to health care found in this study may be smaller than would be seen in other countries. At  
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12 488 the same time, however, the effects of the pandemic on food security and income and expenditures  
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14 489 may be seen more strongly in Luang Prabang as compared to other provinces within Lao PDR. As the  
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16 490 province is home to the UNESCO World Heritage City of Luang Prabang, Luang Prabang province  
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18 491 receives a greater proportion of its income from tourism as compared to other provinces [24]. Indeed,  
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20 492 our survey found a greater proportion of household reduced expenditures (64%) compared to another,  
21  
22 493 unpublished, survey in a different rural province, where 46% of households reduced expenditures  
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24 494 (personal communication). As mentioned, households in the study population had been receiving  
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26 495 educational messaging regarding the importance of maternal and child malnutrition, so may have  
27  
28 496 prioritized meeting the needs of mothers and children even as their struggled to meet the families' food  
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30 497 needs. Thus it is possible that other areas may have seen more dramatic declines in maternal and child  
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32 498 nutrition. Moreover, the results of the survey may not be generalizable to larger, more urban areas.  
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34 499 Similarly, the relationships with FCS may not be generalizable to other areas with different dietary  
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36 500 patterns. The mean FCS in our study was 60.9, well above the generic cut off of  $\geq 35$  for an acceptable  
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38 501 score. We do not emphasize these thresholds in our study, as they have been shown to badly misclassify  
39  
40 502 food insecurity in some contexts. For instance, in El Salvador, only 0.2% of households fell below the FCS  
41  
42 503 threshold for food insecurity, while 19% had low caloric consumption [34]. Such may occur in this  
43  
44 504 context as well, as while diversity of foods consumed was low, staples and meat/fish/insects were  
45  
46 505 among the more commonly consumed food groups, and these food groups are given large weights in  
47  
48 506 calculating the weighted mean. Finally, while we do not find associations between seeking care during  
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3 507 illness and self-reported changes in access to healthcare, it is possible that individuals reduced routine  
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5 508 wellness visits, which we do not assess in our survey.  
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8 509 Another limitation of our study relates to recall bias. Because control measures were first implemented  
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10 510 in March 2020, and we implemented this survey in November 2020, there could be substantial recall  
11  
12 511 bias, as participants are asked to compare ability to meet food needs, ability to access health care, and  
13  
14 512 income and expenditures to a time period that extended 8 months prior up until the current time. The  
15  
16 513 ideal observational research design would be to compare our estimates of food security and  
17  
18 514 malnutrition to repeated estimates taken longitudinally, leading up to just prior to the pandemic. While  
19  
20 515 we lack data from just before the pandemic, we have data from household surveys in the region  
21  
22 516 collected in 2017. Estimates of food insecurity and the prevalence of children underweight and wasted  
23  
24 517 from 2020 are higher than estimates from 2017, while estimates of dietary diversity from 2020 are  
25  
26 518 lower than estimates from 2017. However, because changes in indicators between 2017 and 2020  
27  
28 519 cannot be attributed to the effects of the pandemic alone, we do not emphasize 2017 data here.  
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33 520 Roughly 3.5% of visited households were empty, which may represent a form of selection bias that may  
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35 521 underrepresent adverse consequences of the pandemic if the empty households moved out of a need to  
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37 522 avoid lockdown or preserve livelihoods. However, as was observed in 2017, many households within this  
38  
39 523 population will leave for days at a time to attend to work in rice fields, which is expected to be the  
40  
41 524 predominant reason for non-response. Finally, while we examine loss of income, we did not collect  
42  
43 525 information on income prior to the pandemic nor occupation or occupational status of household  
44  
45 526 members. While we control for education in multivariate models, which may in part control for some  
46  
47 527 variation due to income or occupational type, residual confounding may remain. Future work might seek  
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49 528 to examine whether how loss of occupation affects food security via lost income, and what types of  
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51 529 work are most susceptible to loss.  
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**530 Conclusion**

531 Lao PDR's early efforts to control the spread of COVID-19 have been successful, with fewer documented  
532 cases to date relative to neighboring countries. Nevertheless, the effect of the pandemic on food  
533 security on livelihoods in LMICs may be severe, and subsequent waves of cases, and associated  
534 lockdown measures, in 2021 and 2022 demonstrates that the threat of continued food security remains  
535 present. Increasing self-sufficiency through local food production, and/or supporting incomes via social  
536 safety nets such as cash transfer programs, may mitigate some of these effects. As control measures to  
537 curb the transmission of COVID-19 continue, and as outbreaks occur intermittently with concomitant  
538 restrictions on movement, further study may be useful to understand what coping strategies people are  
539 using so that government and agencies can support the resilience of households in the long term.

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546 continued partnership.

**547 Contributorship statement**

548 PC, HC, and JRH conceptualized the research. PC and HC assisted in data collection. PC and JRH analyzed  
549 the data. HC and JRH wrote the manuscript. AV and KK lead the Save the Children health program in  
550 Luang Prabang and the Vientiane country office, respectively. All authors edited and read the  
551 manuscript.

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2  
3 552 **Competing interests**  
4  
5

6 553 HC, AV and KK, were or are currently employees of Save the Children, International. Save the Children  
7  
8 554 supports a government led Primary Health Care Program in Luang Prabang which includes nutritional  
9  
10  
11 555 interventions.  
12  
13

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15

16  
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18  
19 558 Pharmaceutical Company Limited Global CSR Partnership.  
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23 559 **Data sharing statement**  
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26 560 Data is owned by the Luang Prabang Provincial Health Department and permission has been granted for  
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28 561 its use.  
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705 **Table 1.** Self-reported effects of the pandemic on household access to food, health care, and income.

	<b>Weighted percentage (95% Confidence interval)</b>	<b>N</b>
<b>Relative ability to meet family's food needs now compared to before the pandemic (N = 1120)</b>		
Easier	0.83 (0.38, 1.82)	8
No change	20.7 (18.3, 23.3)	238
Somewhat harder	60.9 (57.6, 64.1)	698
Much harder	17.6 (15.4, 20.0)	176
<b>Reasons it is harder to meet food needs during the pandemic (N = 874)</b>		
Items more expensive	51.2 (46.4, 56.0)	415
Household lost income	45.3 (40.9, 49.9)	465
Less food is available	36.6 (33.1, 40.2)	561
Markets are closed	36.5 (32.3, 41.0)	555
<b>Proportion of household income lost during the pandemic (N = 1122)</b>		
No income lost	14.4 (12.3, 16.6)	165
1-25%	17.5 (14.6, 20.7)	192
26-50%	54.4 (51.3, 57.4)	607
51-75%	9.2 (1.7, 11.2)	104
76-100%	4.6 (3.5, 6.1)	54
<b>Percent reduction in household expenditures during the pandemic (N = 1122)</b>		
No reduction	36.3 (33.2, 39.6)	415
1-25%	23.2 (19.4, 27.4)	257
26-50%	35.7 (32.9, 38.6)	400
51-75%	3.9 (2.9, 5.3)	41
76-100%	0.89 (0.44, 1.8)	9
<b>Relative ability to access health care now compared to before the pandemic (N = 1121)</b>		
Easier	0.40 (0.15, 1.09)	8
No change	47.0 (44.0, 50.0)	544
Somewhat harder	37.4 (34.6, 40.2)	413
Much harder	4.8 (3.7, 6.1)	48
Undecided	10.0 (7.5, 13.1)	108

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**Table 2.** Model coefficients representing difference in indicator between households who self-reported that it is harder to access food during the pandemic and those who report no change/easier; and those who decreased spending during the pandemic and those who did not. Adjusted models for households control for household ethnicity, household size, education level of mother and the head of household, and district. Adjusted models for mothers include additionally mother’s age. Adjusted models for children include additionally child’s age and sex. FCS = food consumption score; CSI = coping strategy index; DDS = dietary diversity score. Lower values for FCS and DDS and higher values of CSI indicate greater food insecurity.

	Model coefficients				Population mean (95% CI)
	Harder to access food during the pandemic		Decreased expenditures during the pandemic		
	Crude difference (95% CI)	Adjusted difference (95% CI)	Crude difference (95% CI)	Adjusted difference (95% CI)	
FCS	-3.36 (-5.42, -1.29)*	-2.74 (-4.92, -0.55)*	-6.53 (-8.23, -4.79)*	-5.24 (-7.05, -3.42)*	60.9 (59.7, 62.3)
CSI	0.07 (-0.86, 0.99)	0.36 (-0.65, 1.37)	0.83 (-0.07, 1.74)	1.32 (0.40, 2.29)*	3.6 (3.1, 4.1)
DDS (child)	-0.21 (0.41, -0.01)*	-0.21 (-0.43, 0.01)	-0.20 (-0.38, -0.02)*	-0.11 (-0.31, 0.08)	4.14 (4.04, 4.24)
DDS (mother)	-0.15 (-0.40, 0.01)	-0.10 (-0.34, 0.15)	-0.08 (-0.28, 0.12)	0.06 (-0.14, 0.25)	5.38 (5.26, 5.51)

\*represents statistical significance at p<0.05

Peer review only

## Supplemental Info for:

### Changes in household food security, access to health services, and income in northern Lao PDR during the COVID-19 pandemic: a cross-sectional survey

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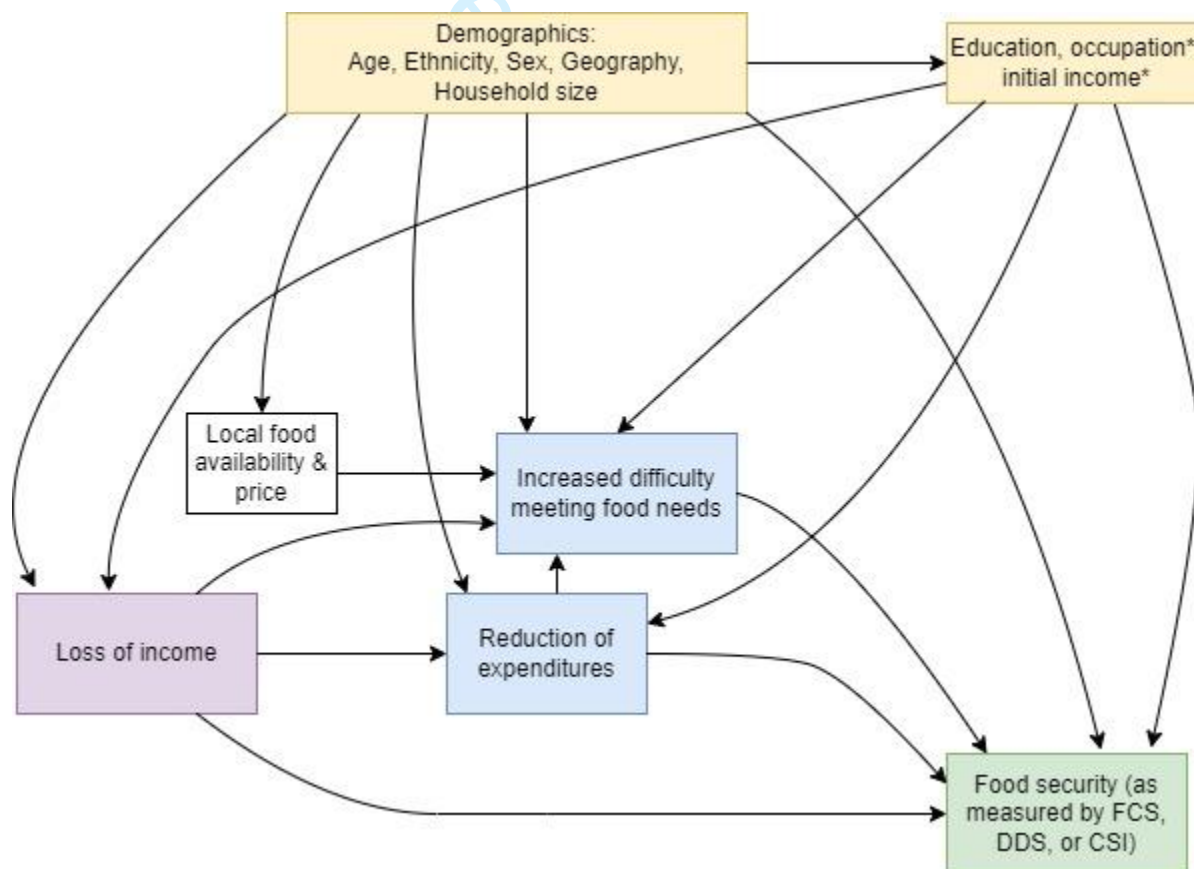
\*Corresponding author: Jennifer R. Head, MPH

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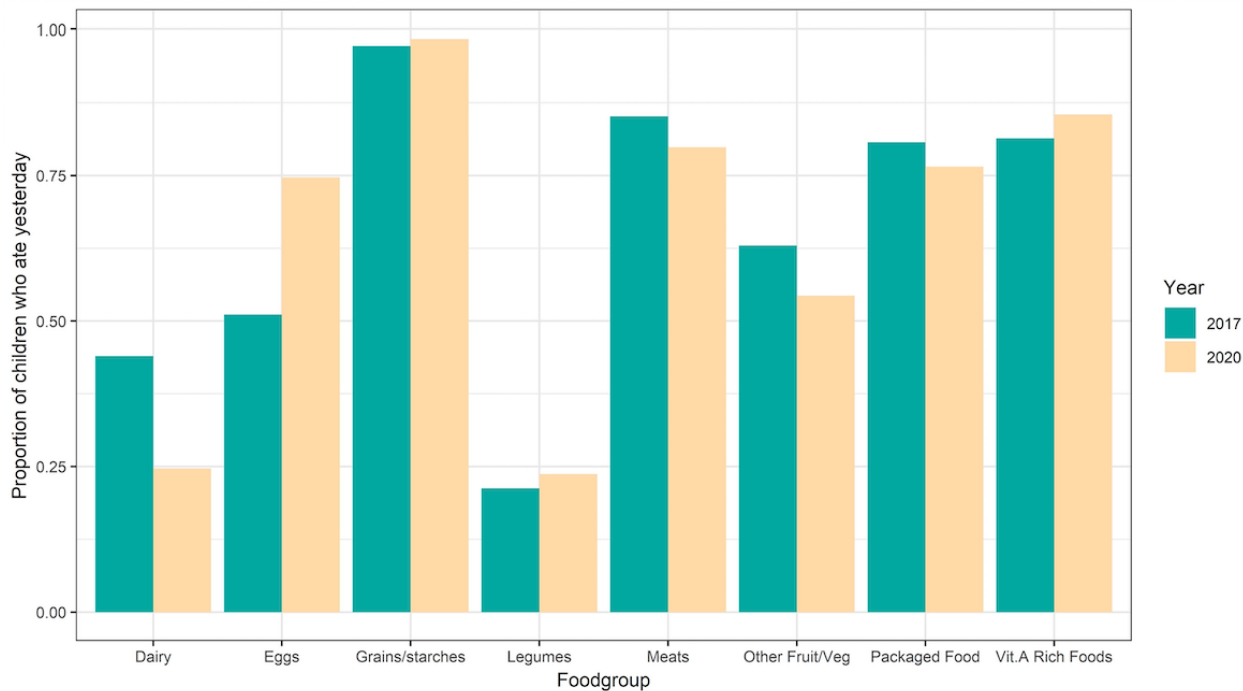
**Table S1.** Multivariate model results adding additional covariates to the model. Coefficients represent the difference in indicator between households who self-reported that it is harder to access food during the pandemic and those who report no change/easier; and those who decreased spending during the pandemic and those who did not. Adjusted models for households control for household ethnicity, household size, education level of mother and the head of household, district, **total expenditures**, and **percent of expenditures spent on food**. Adjusted models for mothers include additionally mother's age. Adjusted models for children include additionally child's age and sex. FCS = food consumption score; CSI = coping strategy index; DDS = dietary diversity score. Lower values for FCS and DDS and higher values of CSI indicate greater food insecurity.

	Model coefficients (95% CI)	
	Harder to access food during the pandemic	Decreased expenditures during the pandemic
FCS	-2.76 (-5.03, -0.50)*	-5.10 (-6.94, -3.27)*
CSI	0.23 (-0.81, 1.27)	1.46 (0.52, 2.41)*
DDS (child)	-0.23 (-0.45, -0.01)*	-0.10 (-0.30, 0.10)
DDS (mother)	-0.11 (-0.35, 0.14)	0.06 (-0.14, 0.25)

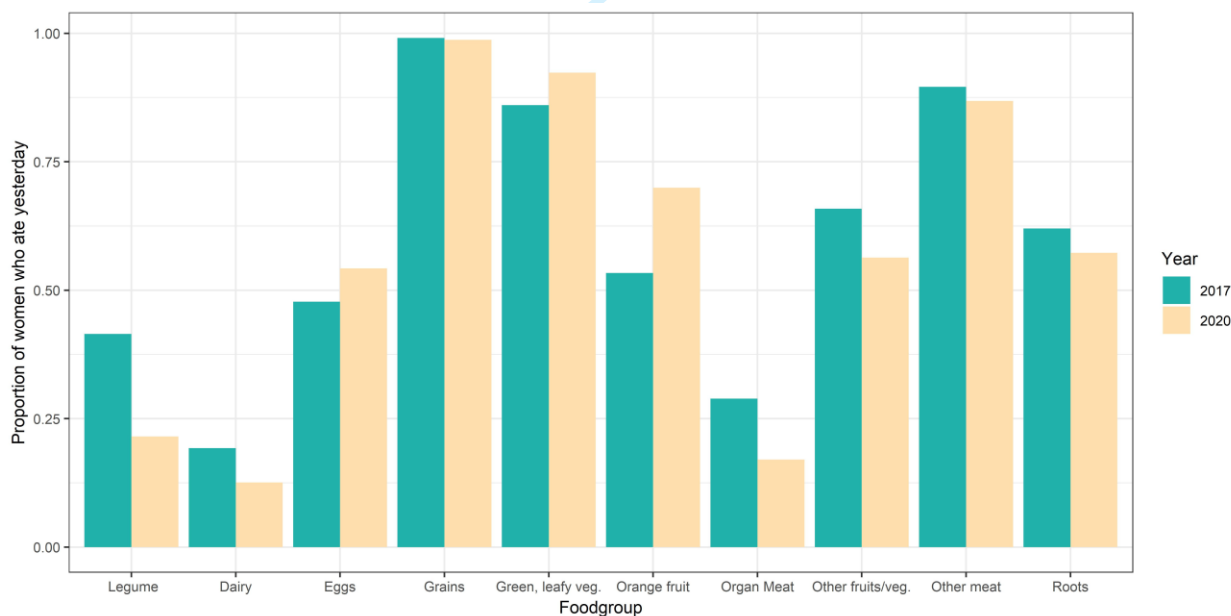
\*represents statistical significance at  $p < 0.05$



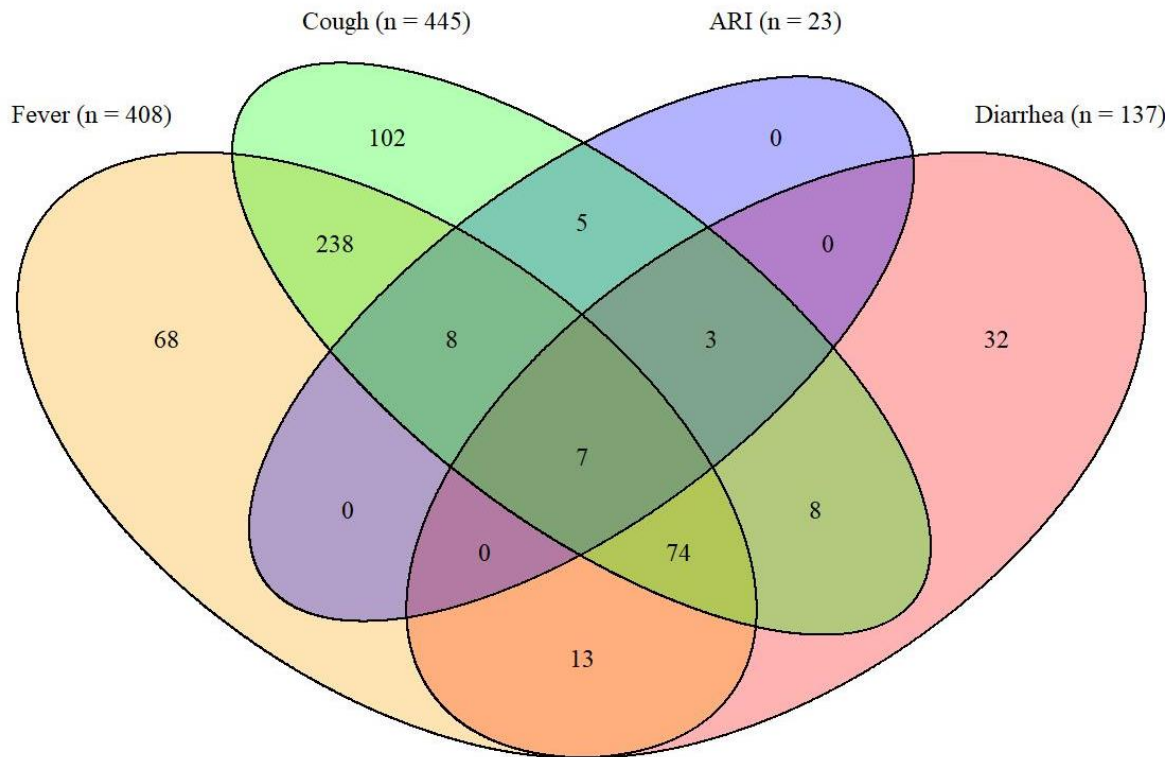
**Figure S1.** Directed acyclic graph (DAG) indicating the minimum set of covariates (yellow) to remove backdoor pathways between exposures (blue) and outcomes (green). White boxes are unmeasured upstream influences. Covariates indicated with an asterisk (\*) are unmeasured. FCS = Food Consumption Score; DDS = Dietary Diversity Score; CSI = Coping Strategies Index.



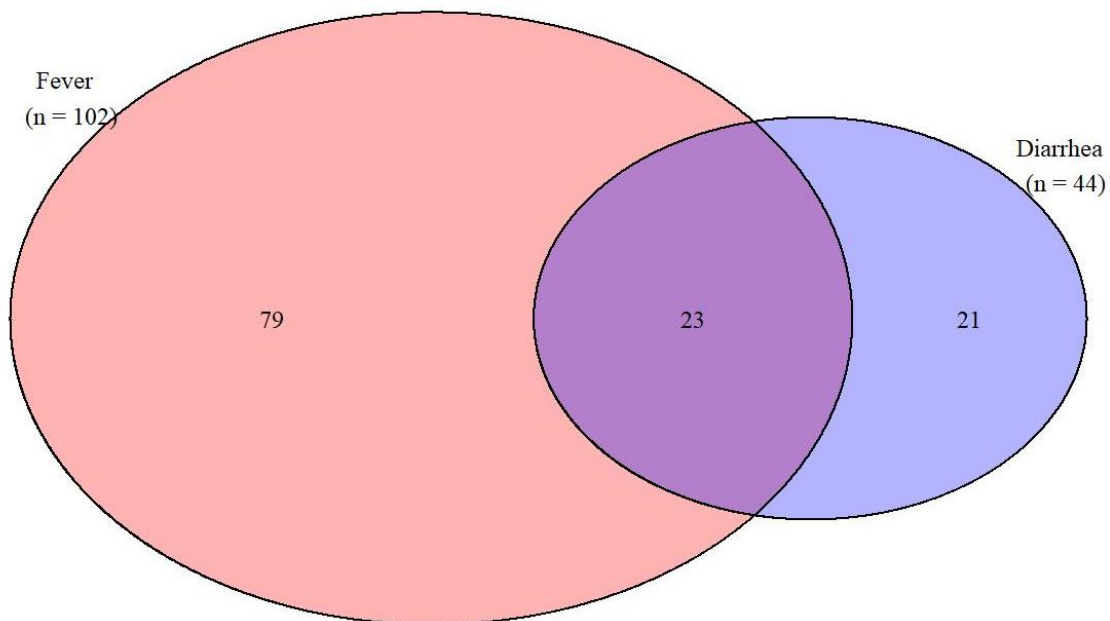
**Figure S2.** Prevalence of food group consumption in children 6-59 months, past 24 hours



**Figure S3.** Prevalence of food group consumption in mothers of children <59 months, past 24 hours



**Figure S4.** Venn diagram showing distribution of symptoms among the 557 children with fever, cough, ARI, or diarrhea in the past two weeks.



**Figure S5.** Venn diagram showing distribution of symptoms among the 123 mothers with fever or diarrhea in the past two weeks.

# Survey tool

## Endline Interview Questionnaire – 2020

### Health and Nutrition Assessment

Introductory Statement to the Interview
<p>Good Morning/Good Afternoon.</p> <p>My name is _____ and I am here on behalf of the Primary Health Care program. We are conducting a survey on the health and nutritional status of women and children. You have been selected by chance from the list of families with children under the age of five. Is this correct? The purpose of this interview is to obtain information about the health and nutrition status of you and your child. We are interested in interviewing mothers of children aged five or less. Are you the mother of the child? <i>(If no), Is the mother of the child at home? (If yes, wait until she arrives, and re-explain purpose).</i> Could you please spare some time (around 45 minutes) for the interview? The information you give will be confidential and will only be used to prepare a report of general findings – but will not include any names. You will not get any additional entitlements because of the interview. At any time during the survey, you are free to stop the survey, or choose not answer any question. If you are willing to participate in this survey, please indicate your oral consent by saying “yes” or “no”.</p>
<p><b>May I start now?</b></p> <p><input type="checkbox"/> Yes, permission is given ⇒ Go to 101 to begin the interview.</p> <p><input type="checkbox"/> No, permission is not given ⇒ Tell this result to your supervisor and move to the next household.</p>
<p><b>Enumerators</b>– <i>If the respondent is not willing, do not ask any of the questions and move to the next household. If the household contains children under the age of 5, but the mother is not present, ask when it is a good time to return, and return at a later time. We only want to interview mothers of children under the age of 5.</i></p>

General Information				
No.	Item	Name		
101	District			
102	Village			
103	Date of interview	DD	MM	YYYY
		--	--	2016
104	Interviewer's Name/Number	--		

Household Demographic Information			
First, we would like to ask some questions about yourself and the people who live in this household.			
No.	Question	Response	Notes
201	How old are you?	Age (in completed years): __ __	
202	To what ethnic group does the head of this household belong?	1.....Lao Lom 2.....Hmong 3.....Khmu 4.....Mien 5.....Lue 6.....Akha 7.....Muser 98.....Other (Specify.....)	
203	What is your marital status?	1.....Married (monogamous) 2.....Married (polygamous) 3.....Not married, but living with a man 4.....Single 5.....Divorced or separated 6.....Widowed	

204	What is your relationship to the head of the household (HHH)?	1..... Head of household 2..... Wife of the HHH 3..... Daughter of the HHH 4.....Daughter in law of HHH 5.....Granddaughter of HHH 98...Other relation	1 → 206 2 → 206
205	Is the head of the household male or female?	0.....Female 1.....Male	<i>if 204 ≠ 1 or 2</i>
206	Have you ever attended school?	1.....Yes 0.....No	0 → 208
207	What is the highest level of school you completed?	1.....Preschool 2.....Primary 3.....Lower Secondary 4.....Upper secondary 5.....Post-secondary vocational, tertiary/ diploma 6.....Higher	<i>if 206 = 1</i>
208	Did the head of the household attend school?	1.....Yes 0.....No 99....Don't know	<i>if 204≠1</i> 1 → 209 0 → 210
209	What is the highest level of school completed by the head of the household?	1.....Preschool 2.....Primary 3.....Lower Secondary 4.....Upper secondary 5.....Post-secondary vocational, tertiary/ diploma 6.....Higher 99...Don't know	<i>if 208 = 1</i>
210	How many household members are aged 15 years or more?	_____	



	<i>Prompt to include self in this count</i>		
211	How many household members are below 15 years of age?	___ ___	
212	How many household members are below 5 years of age?	___ ___	Check: 212 ≤ 211
213	How many members are in your own family?	___ ___	

<b>Dietary Intake</b>			
Now we would like to ask some questions about the diet of yourself and one of your children. Enumerators, if there are more than one children under the age of five, randomly select one child. Ask the name of the child, and use that name for the rest of the interview.			
No.	Question	Response	Notes
400	When was this child born? <i>Probe: Using MCH book, house registration, other official document</i>	___ ___ ___	
401	How many months old is this child? <i>Probe: Using important holidays, dates, etc.</i>	___ ___ months	0-59 only!
402	Is the child selected (Child's name) your youngest child? <i>Probe: the last child of alive children?</i>	1.....Yes 0.....No	
403	Yesterday during the day or night, was your diet a typical diet? <i>Probe: She had special ceremonies or illnesses that led her to have less or much more than her typical eating.?</i>	1.....Yes 2.....No. I ate more. 3.....No. I ate less 99.....Do not know	
404	Yesterday during the day or night, did you eat more or less or same amount of food compared to your eating before this pregnancy?	1.....Increased amount 2.....Same amount 3.....Decreased amount 99.....Do not know	<i>if 226=1 (currently pregnant)</i>
405	Yesterday during the day or night, did you eat more or less or same amount of animal source foods compared to your eating before this pregnancy?	1.....Increased amount 2.....Same amount 3.....Decreased amount 99.....Do not know	<i>if 226=1 (currently pregnant)</i>

	<i>Probe: Using examples of animal food or product in their general contexts and comparing with her usual eating style</i>		
<b>406</b>	<p>I would like to ask you about foods that you may have had yesterday during the day or night. I am interested to know whether you had the item even if combined with other foods. Please include foods consumed outside of your home.</p> <p>YESTERDAY DURING THE DAY OR NIGHT, DID YOU DRINK/EAT (FOOD GROUP ITEMS)?</p> <p><i>Questions and filters (Circle the corresponding code and you can underline more than one answer)</i></p> <p>Always start with: 'YESTERDAY DID YOU EAT...'</p>		
<b>406a</b>	<p>Any offal items (excluding intestines)?</p> <p><i>Probe: such as liver, brain, lung, heart, gizzard, kidney, of any animal</i></p>	<p>1.....Yes 0.....No 99.....Do not know</p>	
<b>406b</b>	<p>The intestine of any animal?</p>	<p>1.....Yes 0.....No 99.....Do not know</p>	
<b>406c</b>	<p>Any kind of meat?</p> <p><i>Probe: such as any meat, such as beef (fresh or dry), buffalo, pork, goat, chicken, goose, duck, sausage, blood sausage, sour sausage</i></p>	<p>1.....Yes 0.....No 99.....Do not know</p>	
<b>406d</b>	<p>Any kind of eggs?</p> <p><i>Probe: 'such as?' eggs from chicken, duck, turtle or other animals</i></p>	<p>1.....Yes 0.....No 99.....Do not know</p>	
<b>406e</b>	<p>Any kind of fish or aquatic animals?</p> <p><i>Probe: 'such as?' fresh, fermented or dried fish, swamp eel, squid, shrimp (fresh or dry), crab, granulated ark, clam, snail, frog, water insects</i></p>	<p>1.....Yes 0.....No 99.....Do not know</p>	
<b>406f</b>	<p>Any kind of wild animals?</p> <p><i>Probe: 'such as?' lizard, rat, rabbit, wild bird, small birds</i></p>	<p>1.....Yes 0.....No 99.....Do not know</p>	

1 2 3 4 5 6 7	<b>406g</b>	Any kind of insects or grubs?  <i>Probe: 'such as?' silk worm pupa, cricket, weaver ant, ant egg, etc.</i>	1.....Yes 0.....No 99.....Do not know	
8 9 10 11 12 13	<b>406h</b>	Any kind of dairy products (not including coffee creamer)?  <i>Probe: 'such as?' cheese (butter), yogurt, or other milk products</i>	1.....Yes 0.....No 99.....Do not know	
14 15 16 17	<b>406i</b>	Other foods that came from an animal. Example: pork skin	1.....Yes 0.....No 99.....Do not know	
18 19 20 21 22 23	<b>406j</b>	Sticky rice (refined or unrefined), roasted rice, rice, pre-chewed rice, rice noodles, maize, noodles, thick porridge, or other foods made from grains?	1.....Yes 0.....No 99.....Do not know	
24 25 26 27 28 29	<b>406k</b>	White or purple coloured foods from roots such as white yams, purple yams, yam bean, cassava, white radish, white potato, or any other white or purple colored foods from roots.	1.....Yes 0.....No 99.....Do not know	
30 31 32 33	<b>406l</b>	Pulses/lentils/tofu/bean curd	1.....Yes 0.....No 99.....Do not know	
34 35 36 37	<b>406m</b>	Nuts or seeds (e.g. Sesame seeds, mung bean, ground bean, sun flower seed, cashew nuts etc.)	1.....Yes 0.....No 99.....Do not know	
38 39 40 41 42	<b>406n</b>	Any dark green leafy vegetables such as pak choi, swamp cabbage, morning glory, sweet potato leaves, Chinese kale	1.....Yes 0.....No 99.....Do not know	
43 44 45 46 47	<b>406o</b>	Ripe orange fleshed mangoes, ripe orange fleshed papayas, pumpkin, carrots, sweet potatoes that are yellow or orange inside?	1.....Yes 0.....No 99.....Do not know	
48 49 50	<b>406p</b>	Other vegetables	1.....Yes 0.....No 99.....Do not know	
51 52 53 54	<b>406q</b>	Other fruit	1.....Yes 0.....No 99.....Do not know	
55 56 57 58 59 60	Now, I would like to ask about feeding practices for your child selected.			

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5	<b>407</b>	Has (CHILD'S NAME) ever been breastfed?	1.....Yes 0.....No <i>if 401 &lt; 24</i> 0 → 409
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7	<b>408</b>	Was (CHILD'S NAME) breastfed yesterday, either during the day or the night?	1.....Yes 0.....No 99.....Do not know <i>if 401 &lt; 24</i> & 407 = 1
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11	<b>409</b>	Did (NAME) drink anything from a bottle with a nipple yesterday, during the day or night?	1.....Yes 0.....No 99.....Do not know <i>if 401 &lt; 24</i>
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14	<b>410</b>	Did (NAME) drink or eat vitamin or mineral supplements yesterday, during the day or night?	1.....Yes 0.....No 99.....Do not know <i>if 401 &lt; 24</i>
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18	<b>411</b>	How long after birth did you first put (NAME) to the breast?  <i>If immediately, record 00. If less than 24 hours, record hours. If over 24 hours, record 25. If unknown, record 99.</i>	_____ hours  <i>if 401 &lt; 24</i> & 407 = 1
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27	<b>412</b>	Did (CHILD'S NAME) have any liquid other than breast milk, such as canned, powdered or fresh animal milk, infant formula, juice, thin porridge, or clear soup (Nam Keang) yesterday, during the day or night?	1.....Yes 0.....No 99.....Do not know <i>if 401 &lt; 24</i> 0 → 413 99 → 413
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35	<b>412a</b>	How many times did (CHILD'S NAME) receive milk other than breastmilk, such as canned, powdered or fresh animal milk, or infant formula?	_____ times 99.....Do not know <i>if</i> <i>401 = 6-23</i> & 412 = 1
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40	<b>413</b>	When do you think is the best time to start breastfeeding a child after giving birth?	<b>Enumerators: read off all answer choices and circle the best one</b>  1.....Within the first hour after giving birth 2.....Within the first six hours after giving birth 3.....Within the first twelve hours after giving birth 4.....Within one day after giving birth 99.....Do not know
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<b>414</b>	<p>I would like to ask you about foods that the selected child (CHILD'S NAME) may have had yesterday during the day or night. I am interested to know whether HE/SHE had the item even combined with other foods. Please include foods consumed outside of your home.</p> <p>YESTERDAY DURING THE DAY OR NIGHT, DID THE SELECTED CHILD (CHILD'S NAME) DRINK/EAT (FOOD GROUP ITEMS)?</p> <p>Always start with: 'YESTERDAY DID (NAME) EAT....'</p>	<i>if 401 ≥ 6</i>
<b>414a</b>	Commercially fortified baby food, e.g., cerelac	1.....Yes 0.....No 99.....Do not know
<b>414b</b>	Sticky rice (white or brown), roasted rice, rice, pre-chewed rice, rice noodles, maize, noodles, porridge, or other foods made from grains?	1.....Yes 0.....No 99.....Do not know
<b>414c</b>	Pumpkin, carrots or sweet potatoes that are yellow or orange inside?	1.....Yes 0.....No 99.....Do not know
<b>414d</b>	White or purple coloured foods from roots such as white yams, purple yams, yam bean, cassava, white radish, white potato, or any other white or purple colored foods from roots.	1.....Yes 0.....No 99.....Do not know
<b>414e</b>	Any dark green, leafy vegetables such as pak choi, swamp cabbage, morning glory, sweet potato leaves, Chinese kale?	1.....Yes 0.....No 99.....Do not know
<b>414f</b>	Ripe or orange-fleshed mangos, or papayas	1.....Yes 0.....No 99.....Do not know
<b>414g</b>	Any other fruits or vegetables	1.....Yes 0.....No 99.....Do not know
<b>414h</b>	Liver, brain, lung, heart, gizzard, kidney, intestine, or other organ of any animal	1.....Yes 0.....No 99.....Do not know
<b>414i</b>	Any meat, such as beef (fresh or dry), buffalo, pork, lamb, goat, chicken, goose, duck, sausage, blood sausage, sour sausage	1.....Yes 0.....No 99.....Do not know
<b>414j</b>	Eggs from chicken, duck, turtle or other animals	1.....Yes 0.....No

		99.....Do not know	
<b>414k</b>	Fresh, fermented or dried fish, swamp eel, squid, shrimp (fresh or dry), shellfish, crab, granulate ark, clam, snail	1.....Yes 0.....No 99.....Do not know	
<b>414l</b>	Any wild animals such as lizard, frog, rat, rabbit, wild bird, small bird	1.....Yes 0.....No 99.....Do not know	
<b>414m</b>	Insects or grubs such as silk worm pupa, cricket, weaver ant, any insect eggs, water insects	1.....Yes 0.....No 99.....Do not know	
<b>414n</b>	Any foods made from beans, Leucanea (bean), common pea, lentils, or nuts, including tofu?	1.....Yes 0.....No 99.....Do not know	
<b>414o</b>	Cheese, yogurt, or other food made from milk?	1.....Yes 0.....No 99.....Do not know	
<b>414p</b>	Any oil, pork fat, or butter or foods made with any of these	1.....Yes 0.....No 99.....Do not know	
<b>414q</b>	Any packaged foods such as packaged noodles, chocolates, sweets, candies, pastries, cakes, or biscuits	1.....Yes 0.....No 99.....Do not know	
<b>415</b>	How meals (solid or semi-solid food) did (CHILD'S NAME) eat yesterday?  <i>Enter 99 if unknown</i>	_____ times  99.....Do not know	<i>if 401 ≥ 6</i>
<b>416</b>	Did (CHILD'S NAME) eat any solid, semi-solid or soft foods (such as porridge, rice, pre-chewed rice, fruits, bread, meat, eggs, vegetables) yesterday?	1.....Yes 0.....No 99.....Do not know	<i>if 401 &lt; 6</i> <i>0 → 418</i> <i>99 → 418</i>
<b>417</b>	In the first three days after delivery or when you returned to work in the rice field, was (name) given anything to drink other than breast milk?	1.....Yes 0.....No 99.....Do not know	<i>if 401 &lt; 6</i> <i>&amp; 407 = 1</i>
Now, I understand eating pattern of you and your child. I would now like to ask more about eating practices of women who are breastfeeding.			
<b>418</b>	Yesterday during the day or night, did you eat more or less or same amount of food compared to your eating before this pregnancy?	1.....Increased amount 2.....Same amount 3.....Decreased amount 99.....Do not know	<i>if 401 &lt; 6</i> <i>&amp; 407 = 1</i>

	<i>Probe: Comparing with her usual eating style.</i>		
<b>419</b>	<p>Yesterday during the day or night, did you eat more or less amount of animal source foods compared to your eating before this pregnancy?</p> <p><i>Probe: Using example of animal food or product in their general contexts and comparing with her usual eating style.</i></p>	<p>1.....Increased amount 2.....Same amount 3.....Decreased amount 99.....Do not know</p>	<p><i>if 401 &lt; 6 &amp; 407 = 1</i></p>

Household Food Security and Expenditures		
No.	Question	Response
<p>I would like to ask you some questions about how much your household spends on health services and other things.</p> <p><i>For all questions in this section report all values in local currency, whether paid in cash or in kind</i></p>		
<b>501</b>	In the last 4 weeks, how much did your household spend on:  Food, including such things as [rice], meat, fruits, vegetables, and cooking oils. Include the value of any food that was produced and consumed by the household, and exclude alcohol, tobacco and restaurant meals.	_____,000 kip
<b>502</b>	In the last 4 weeks, how much did your household spend on:  Housing, gas, electricity, water, telephone, and heating fuel	_____,000 kip
<b>503</b>	In the last 4 weeks, how much did your household spend on:  Education fees and supplies	_____,000 kip
<b>504</b>	In the last 4 weeks, how much did your household spend on:  Health care costs	_____,000 kip
<b>505</b>	In the last 4 weeks, how much did your household spend on:  All other goods and services not yet mentioned	_____,000 kip
<b>506</b>	In the last 4 weeks, how much did your household spend in total? (Should equal 501 + 502 + 503 + 504 + 505)	_____,000 kip
<b>507</b>	In the <b>past month</b> , how often have you used any of the methods when you did not have enough food or money to buy food?	
<b>507a</b>	Rely on less preferred, less expensive foods?	<p>1.....1 day per week 2.....1-2 days a week</p>

		3.....3-4 days a week 4.....5-6 days a week 5.....Daily 6.....Never/<1 time per week
<b>507b</b>	Borrow food or money from friends or relatives?	1.....1 day per week 2.....1-2 days a week 3.....3-4 days a week 4.....5-6 days a week 5.....Daily 6.....Never/<1 time per week
<b>507c</b>	Limit portions at mealtimes?	1.....1 day per week 2.....1-2 days a week 3.....3-4 days a week 4.....5-6 days a week 5.....Daily 6.....Never/<1 time per week
<b>507d</b>	Limit adult intake?	1.....1 day per week 2.....1-2 days a week 3.....3-4 days a week 4.....5-6 days a week 5.....Daily 6.....Never/<1 time per week
<b>507e</b>	Reduce number of meals per day?	1.....1 day per week 2.....1-2 days a week 3.....3-4 days a week 4.....5-6 days a week 5.....Daily 6.....Never/<1 time per week
Now I would like to ask you some questions about food that the household ate in the last 7 days		
	<b>508.</b> How many <b>days</b> in the past week (last 7 days) did your household eat the following foods? Number of days eaten (out of last 7 days)	<b>509</b> What is the source of this food for each item mentioned? <i>if 508 &gt; 0</i> Food Source Code: 1. Home grown crop or livestock production 2 Purchased food 3 Gathered forest products 4 Hunting/fishing 5 Borrowed



		6 Food aid 7 Exchanged/barter 8 Gift from family/relatives
A. Rice (sticky rice, white rice)		
B. Maize / Corn		
C. Cassava		
D. Other roots of tubers (potatoes, yam)		
E. Pulses/Lentils/Tofu/Bean Curd		
F. Vegetables (green leafy, carrot, pumpkin...)		
G. Bamboo shoots / mushrooms		
H. Fruits		
I. Fish, fish paste		
J. Other aquatic animals (crab, snail, shrimp...)		
K. Meat (beef, pork, chicken)		
L. Wild animals/Insects		
M. Eggs		
N. Milk		
O. Sugar		
P. Oil/Butter/Animal Fat		
<b>510</b>	How many hours in the past week did you spend gathering food from the forest?	<i>if any</i> 509 = 3
<b>511</b>	How many hours in the past week did you spend hunting?	<i>if any</i> 509 = 4
<b>512</b>	How many hours in the past week did you spend fishing?	<i>if any</i> 509 = 4
<b>513</b>	Compared to before the pandemic, is it easier or harder to meet your family's food needs?	1. Much easier 2. Somewhat easier 3. No change 4. Somewhat harder 5. Much harder 99. Don't know/no answer 1 → 514 2 → 514 3 → 514 99 → 514
<b>513a</b>	What is the reason it is harder to meet your food needs during the pandemic?  Select all that apply	1. Items are more expensive 2. Markets being closed 3. Foods not available 4. HH had lost income. <i>if 513 =</i> 4 or 5

		98. Others (specify) 99. Don't know/no answer	
<b>514</b>	Did you lose income due to the pandemic?	1. Yes 0. No 99. Don't know/no answer	0→515 99→515
<b>514a</b>	If yes, how much did you lose, as a proportion of your income? (give best guess)	1. 0-25% 2. 25-50% 3. 50-75% 4. 75-100%	<i>if 514=1</i>
<b>515</b>	Do you spend less money due to the pandemic?	1. Yes 0. No 99. Don't know/no answer	0→516 99→516
<b>515a</b>	If yes, how much did you spend less, as a proportion of your expenditure? (give best guess)	1. 0-25% 2. 25-50% 3. 50-75% 4. 75-100%	<i>if 515=1</i>
<b>516</b>	Is it more difficult to access health services now compared to before the pandemic?	1. Much easier 2. Somewhat easier 3. No change 4. Somewhat harder 5. Much harder	

<b>VI. Illness and Treatment</b>			
Now we would like to ask about any recent illnesses that the selected child (CHILD'S NAME) may have had.			
<b>No.</b>	<b>Question</b>	<b>Response</b>	
<b>601</b>	Did (CHILD'S NAME) have diarrhea in the past two weeks, where diarrhea is defined as three or more loose stools or one loose, bloody stool in a 24 hour period?	1.....Yes 0.....No 99.....Do not know	0→603 99→603
<b>602a</b>	Now I would like to know how much (CHILD'S NAME) was given to drink, including breast milk, during the diarrhea  Was he/she given less than usual to drink, about the same amount, or more than usual to drink?  <i>If less, probe: Was he/she given much less than usual to drink or somewhat less?</i>	1.....Much less 2.....Somewhat less 3.....About the same 4.....More 5.....Nothing to drink 99.....Do not know	<i>if 601 = 1</i>

1 2 3 4 5 6 7 8 9 10 11	<b>602b</b>	During the time (CHILD'S NAME) had diarrhea, was HE/SHE given either: a) A fluid made from a special packet called (ORALYTE/NAM THA LAY PHOUN)? b) Recommended homemade fluid such as coconut water or rice water with salt?	1.....Yes, Nam Tha Lay Phoun 2.....Yes, Recommended Homemade Fluid 3.....No 99.....Do not know	<i>if 601 = 1</i>
12 13 14 15 16 17 18 19 20	<b>602c</b>	When (CHILD'S NAME) had diarrhea, was he/she given less than usual to eat, about the same amount, or more than usual to eat?  <i>If less, probe: Was he/she given much less than usual to eat or somewhat less?</i>	1.....Much less 2.....Somewhat less 3.....About the same 4.....More 5.....Nothing to eat 99....Do not know	<i>if 601 = 1</i>
21 22 23	<b>603</b>	Has (CHILD'S NAME) been ill with a fever any time in the past two weeks?	1.....Yes 0.....No 99.....Do not know	
24 25 26 27	<b>604</b>	Has (CHILD'S NAME) had an illness with a cough at any time in the last two weeks?	1.....Yes 0.....No 99.....Do not know	0→605 99→605
28 29 30 31 32 33	<b>604a</b>	When (CHILD'S NAME) was sick with a cough, did he/she breathe faster than normal with short, rapid breaths or have difficulty breathing?	1.....Yes 0.....No 99.....Do not know	<i>if 604 = 1</i> 0→605 99→605
34 35 36 37 38	<b>604b</b>	Was the fast or difficult breathing due to a problem in the chest or to a blocked or runny nose?	1.....Chest only 2.....Nose only 3.....Both 99.....Do not know	<i>if 604a = 1</i>
39 40 41 42	<b>605</b>	At any time during the past two weeks, did you ( <i>mother</i> ) have diarrhea?	1.....Yes 0.....No 99.....Do not know	
43 44 45 46 47 48 49 50 51 52	<b>606</b>	At any time during the past two weeks, have you ( <i>mother</i> ) been ill with a fever?	1.....Yes 0.....No 99.....Do not know	
53 54 55 56 57 58 59 60	<b>607</b>	When (CHILD'S NAME) was sick, did you seek advice or treatment from any source?	1.....Yes 0.....No 99.....Do not know	<i>if 601, 603 or 604 = 1</i> 0→609 99→609
	<b>608</b>	From where did you seek advice or treatment?	1...Government hospital 2.....Health centre	<i>if 607 = 1</i>

	<p><i>Probe: Anywhere else?</i></p> <p><i>(Multiple response)</i></p>	<p>3...Village health worker</p> <p>4.....Outreach team</p> <p>5...Lao Women Union worker</p> <p>6...Private hospital/clinic</p> <p>7.....Private physician</p> <p>8.....Private pharmacy</p> <p>9.....Mobile Clinic</p> <p>10.....Relative/friend</p> <p>11.....Shop</p> <p>12...Traditional healer</p> <p>98.....Other</p>	
<b>609</b>	<p>When (YOU) was sick, did you seek advice or treatment from any source?</p>	<p>1.....Yes</p> <p>0.....No</p> <p>99.....Do not know</p>	<p><i>if 605 or 606=1</i></p> <p>0 → 700</p> <p>99→ 700</p>
<b>610</b>	<p>From where did you seek advice or treatment?</p> <p><i>Probe: Anywhere else?</i></p> <p><i>(Multiple response)</i></p>	<p>1.....Government hospital</p> <p>2.....Health centre</p> <p>3.....Village health worker</p> <p>4.....Outreach team</p> <p>5.....Lao Women Union worker</p> <p>6.....Private hospital/clinic</p> <p>7.....Private physician</p> <p>8.....Private pharmacy</p> <p>9.....Mobile Clinic</p> <p>10.....Relative/friend</p> <p>11.....Shop</p> <p>12...Traditional healer</p> <p>98.....Other</p>	<p><i>if 609 = 1</i></p>

VIII. Anthropometry			
No	Question	Response	Notes
	<p>As part of this survey, we are measuring the growth of children 0-59 mo. Child growth is an important indicator of health. Poor growth is a serious health problem that usually results from poor nutrition, poor sanitation, or infection. This measurement will help us design programs to improve child health. We will share with you the measurements, but will not share the information with anyone else outside the survey team. Do you have any questions?</p>		

1 2 3 4 5	901	What is the age, in months, of (NAME)?	_____	Same as 401
6 7	902	What is the sex of (NAME)?	0.....Female 1.....Male	
8 9 10 11 12	903	<b>Enumerator:</b> Check for bilateral pitting edema	1.....Present 0.....Not present 99...Unsure 98....Not checked	1→906
13 14 15 16 17 18 19 20 21 22 23 24	904	Now I am going to weigh (NAME).  <b>Enumerator:</b> If the child is under 2 years old, weigh the mom by herself. The child should wear as few clothes as possible. If the child is wearing clothes, weigh the mom holding an extra pair of clothes (if an extra pair exists) similar to the weight of the clothes the child is wearing. Tare the scale. Then weigh the mom holding the child. Record the weight of the child.	_____ . _____ kg	if 903 = 0
25 26 27 28 29 30 31	905	<b>Enumerator:</b> was (NAME) undressed to the minimum?  (note...if child was dressed but mother held clothes, indicate 'no clothes')	0.....No clothes 1.....Few clothes 2.....Many clothes	
32 33 34 35 36	906	Now I am going to measure the arm of (NAME).  <b>Enumerator:</b> record the MUAC measurement, in cm	_____ . _____ cm	if 401 ≥ 6
37 38 39	907	Record the color of the MUAC tape	1.....Green 2.....Yellow 3.....Red	if 401 ≥ 6
40 41 42 43 44 45 46 47	908	Now I am going to measure the height of (NAME).  <b>Enumerator:</b> record the height measurement of the child, in cm. If the child is less than 23 months, measure the child lying down.	_____ . _____ cm	
48 49	909	How was the person actually measured? Lying down or standing up?	1.....Lying down 2.....Standing	
50 51 52 53 54 55 56 57 58 59 60	910	Now I am going to measure your arm.  <b>Enumerator:</b> record the MUAC measurement of the mother, in cm.	_____ . _____ cm	

**Closing Statement to the Interview**

The interview is complete. Thank you so much for your time and patience. Your help will allow us to work together to improve the health and nutrition of your child and community.

**Enumerators:** *indicating completeness:*

- Yes, interview is complete ⇒ Move to the next household
- No, interview was not complete ⇒ Tell this result to your supervisor and move to the next household.

For peer review only

Ethical approval

ສາທາລະນະລັດ ປະຊາທິປະໄຕ ປະຊາຊົນລາວ  
ສັນຕິພາບ ເອກະລາດ ປະຊາທິປະໄຕ ເອກະພາບ ວັດທະນາຖາວອນ



ກະຊວງສາທາລະນະສຸກ  
ມະຫາວິທະຍາໄລ ວິທະຍາສາດ ສຸຂະພາບ  
ຄະນະກຳມະການຈັນຍາທຳການຄົ້ນຄວ້າວິທະຍາສາດ  
ເບີໂທ: 021 240255

ເລກທີ 131-- /ຄຈສ  
ນະຄອນຫຼວງວຽງຈັນ, ວັນທີ 19 FEB 2021

**ໃບອະນຸມັດຈັນຍາທຳ**

ຊື່ໂຄງການ: ສຶກສາຜົນກະທົບຈາກການລະບາດຂອງພະຍາດໂຄວິດ ຕໍ່ກັບຄວາມປອດໄພ ແລະ ການບໍລິໂພກອາຫານ, ການເຂົ້າເຖິງການບໍລິການສາທາລະນະສຸກ ແລະ ການໃຊ້ຈ່າຍ ໃນແຕ່ລະຄອບຄົວ ຢູ່ທາງພາກເໜືອຂອງ ສປປ ລາວ (ບົດ Proposal version 2.1, ລົງວັນທີ 09 ກຸມພາ ປີ 2021).

ຊື່ຜູ້ຄົ້ນຄວ້າຫຼັກ: ປອ. ດຣ ເມັດສະຫວັນ ຈັນທະວິໄລ, ຮອງຫົວໜ້າພະແນກຄົ້ນຄວ້າວິທະຍາສາດ, ສະຖາບັນຄົ້ນຄວ້າ ແລະ ພັດທະນາການສຶກສາ.

ໄລຍະເວລາການອະນຸມັດ: 01 ປີ.

ຄະນະກຳມະການຈັນຍາທຳການຄົ້ນຄວ້າວິທະຍາສາດ ໄດ້ທຳການພິຈາລະນາໂຄງການຄົ້ນຄວ້າດັ່ງກ່າວ ແລະ ເຫັນວ່າ ການຄົ້ນຄວ້າດັ່ງກ່າວນີ້ຈະບໍ່ສົ່ງຜົນກະທົບທາງດ້ານສຳຮາກ ແລະ ຈິດໃຈຂອງຜູ້ທີ່ເຂົ້າຮ່ວມໃນການສຶກສາ ແລະ ບໍ່ແຕະຕ້ອງ ເຖິງບັນຫາຈັນຍາທຳຂອງການຄົ້ນຄວ້າ. ໂຄງການຄົ້ນຄວ້າດັ່ງກ່າວນີ້ຈະມີຜົນປະໂຫຍດອັນໃຫຍ່ຫຼວງ ໃນການປະກອບ ສ່ວນວຽກງານການສົ່ງເສີມສຸຂະພາບ ໂດຍທາງກົງ ແລະ ທາງອ້ອມ ຕໍ່ຜູ້ເຂົ້າຮ່ວມການສຶກສາ, ແລະ ເປັນຂໍ້ມູນພື້ນຖານ ທີ່ສຳຄັນໃນການຄົ້ນຄວ້າຕໍ່ໄປແກ່ ວົງການສາທາລະນະສຸກລາວ ແລະ ຂະແໜງການວິທະຍາສາດ ໃນອະນາຄົດ.

ດັ່ງນັ້ນ, ຄະນະກຳມະການຈັນຍາທຳການຄົ້ນຄວ້າຂອງ ມະຫາວິທະຍາໄລ ວິທະຍາສາດ ສຸຂະພາບ ຈຶ່ງຕົກລົງເຫັນ ດີອະນຸມັດດ້ານຈັນຍາທຳການຄົ້ນຄວ້າສຳລັບໂຄງການດັ່ງກ່າວນີ້. ຜູ້ເຮັດການຄົ້ນຄວ້າຫຼັກຕ້ອງຮັບປະກັນວ່າທີມງານຄົ້ນ ຄວ້າທັງໝົດໄດ້ຮັບຮູ້ ກ່ຽວກັບ ເງື່ອນໄຂຂອງການອະນຸມັດຈາກຄະນະກຳມະການຈັນຍາທຳການຄົ້ນຄວ້າ ຂອງ ມວສ ລວມທັງເອກະສານທີ່ຖືກອະນຸມັດ. ຜູ້ເຮັດການຄົ້ນຄວ້າຫຼັກຕ້ອງໄດ້ແຈ້ງໃຫ້ກອງເລຂາຂອງຄະນະກຳມະການຈັນຍາທຳ ຄົ້ນຄວ້າຮັບຊາບຖ້າມີ ການແກ້ໄຂເພີ່ມເຕີມ ຫຼື ການປ່ຽນແປງ ແລະ ຕ້ອງລາຍງານຄວາມຄືບໜ້າຂອງໂຄງການຄົ້ນຄວ້າ ຄືດັ່ງລຸ່ມນີ້:

- ກໍລະນີມີການປ່ຽນແປງໃດໆທີ່ມີຄວາມສຳຄັນຕໍ່ກັບໂຄງການ ແລະ ເຫດຜົນຂອງການປ່ຽນແປງນັ້ນ, ລວມທັງຂໍ້ບົ່ງ ຊີທາງດ້ານຈັນຍາທຳ;
- ເກີດຜົນກະທົບທີ່ຮ້າຍແຮງຕໍ່ຜູ້ເຂົ້າຮ່ວມ ແລະ ການແກ້ໄຂຜົນກະທົບດັ່ງກ່າວ;
- ເກີດເຫດການທີ່ບໍ່ໄດ້ຄາດຄິດ ຫຼື ຄາດເດົາລ່ວງໜ້າ;
- ກໍລະນີຜູ້ເຮັດການຄົ້ນຄວ້າຫຼັກບໍ່ສາມາດສືບຕໍ່ເຮັດໜ້າທີ່ຂອງຕົນໄດ້ ຫຼື ມີການປ່ຽນແປງໃດໆທີ່ກ່ຽວຂ້ອງກັບບຸກ ຄົນໃນໂຄງການຄົ້ນຄວ້າດັ່ງກ່າວ;
- ກໍລະນີມີການຊີ້ປະກັນໄພຄຸ້ມຄອງຜູ້ເຂົ້າຮ່ວມການສຶກສາ ແລະ ການປະກັນໄພໝົດກຳນົດ;
- ເກີດຄວາມຊັກຊ້າໃນການເລີ່ມຕົ້ນໂຄງການເກີນກວ່າ 12 ເດືອນ; ແລະ
- ມີການຍຸຕິ ຫຼື ປິດໂຄງການຄົ້ນຄວ້າກ່ອນໂຄງການຈະສຳເລັດ.

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ເອກະສານທີ່ອະນຸມັດ

ເອກະສານທີ່ໄດ້ຮັບການທົບທວນຝ່າຍລະນາ ແລະ ອະນຸມັດຈາກ ຄະນະສຳມະການຈັນຍາທຳການຄົ້ນຄວ້າວິທະຍາສາດ

ເອກະສານປະກອບ	ສະບັບທີ (version)	ວັນທີ
ບົດສະເໜີໂຄງການຄົ້ນຄວ້າ	Version 2.1	09 ກຸມພາ ປີ 2021
ເຄື່ອງມືເກັບຂໍ້ມູນ (ແບບຟອມສອບຖາມ ແລະ ອື່ນໆ)	Version 1.3	09 ກຸມພາ ປີ 2021

ປະທານ

ຄະນະສຳມະການຈັນຍາທຳຄົ້ນຄວ້າວິທະຍາສາດ



ດຣ.ນ. ຈັນຖະໜອມ ມະນີທິບ



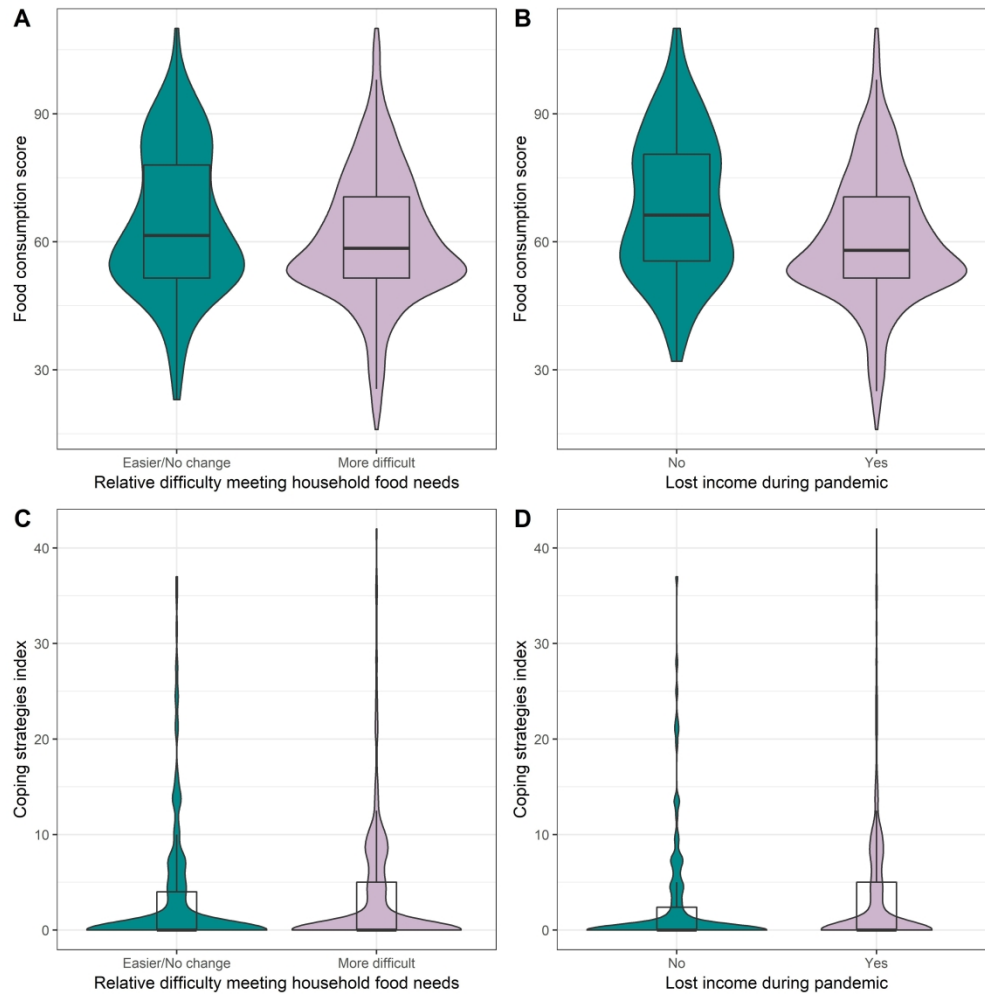


Figure 1. Violin plot showing distribution of two household food security measures, together with their median and interquartile range (IQR). Household food security was measured through food consumption score (FCS) (A, B) and coping strategies index (CSI) (C, D). Food insecurity is associated with low FCS and high CSI.

228x228mm (600 x 600 DPI)

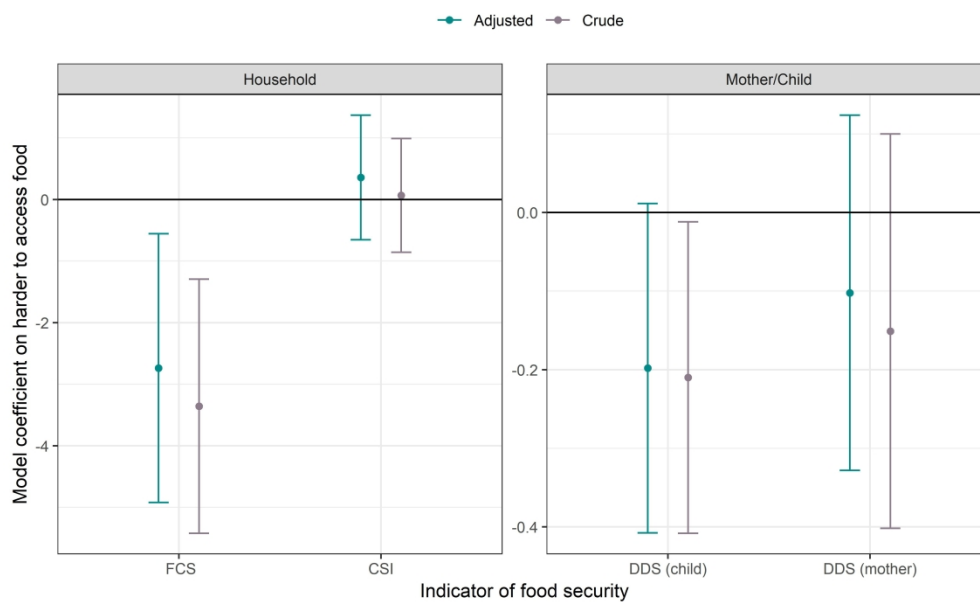


Figure 2. . The difference in mean of food security indicator among households who had a harder time meeting their food needs during the pandemic compared to those who did not. Vertical bars represent 95% confidence intervals. Adjusted models for households control for household ethnicity, household size, education level of mother and the head of household, and district. Adjusted models for mothers include additionally mother’s age. Adjusted models for children include additionally child’s age and sex. FCS = food consumption score; CSI = coping strategy index; DDS = dietary diversity score. Lower values for FCS and DDS and higher values of CSI indicate greater food insecurity.

203x127mm (600 x 600 DPI)

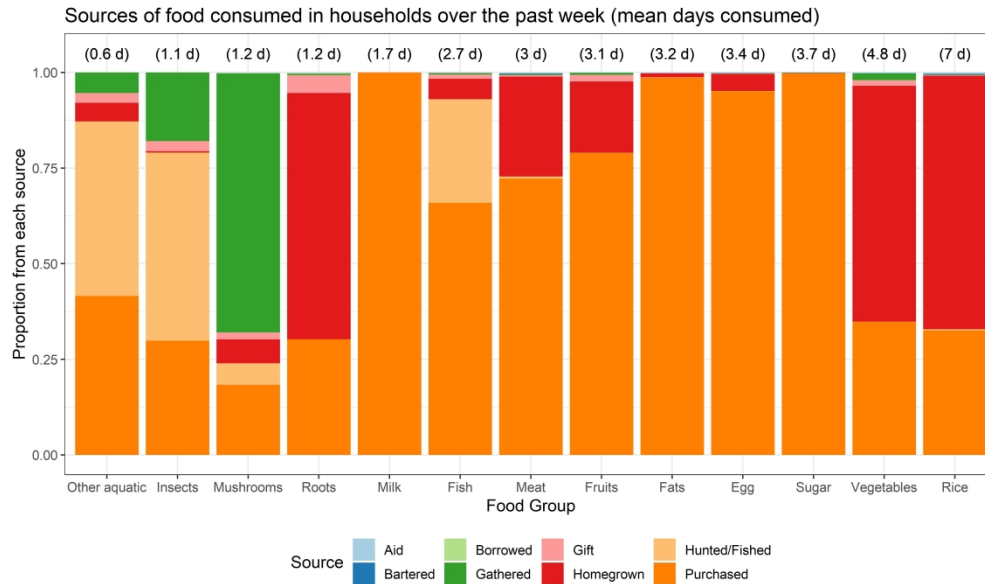


Figure 3. Proportional source of each food group consumed during the past week by households. Numbers in parenthesis above the bars indicates the mean number of days per week household consumed these food groups.

254x152mm (600 x 600 DPI)

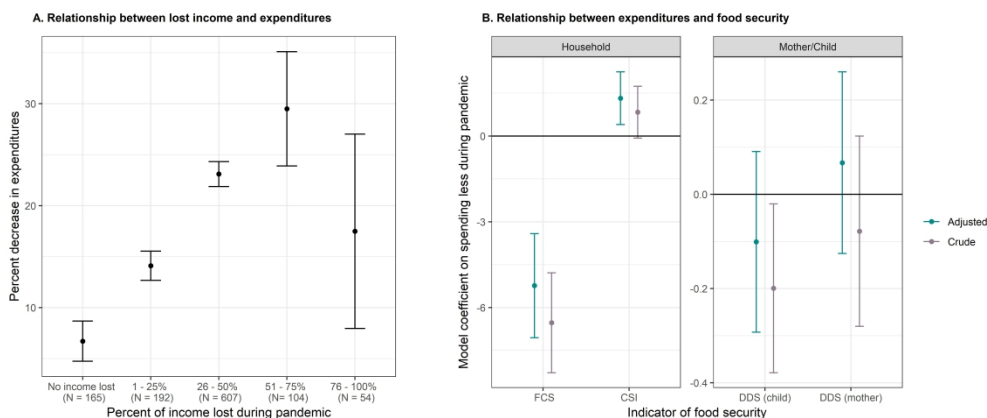


Figure 4. A) Mean decrease in expenditures reported, stratified by the percent reduction in household income. Vertical bars represent 95% confidence intervals. B) The difference in mean of food security indicator among households who reduced spending during the pandemic compared to those who did not. Vertical bars represent 95% confidence intervals. Adjusted models for households control for household ethnicity, household size, education level of mother and the head of household, and district. Adjusted models for mothers include additionally mother’s age. Adjusted models for children include additionally child’s age and sex. FCS = food consumption score; CSI = coping strategy index; DDS = dietary diversity score. Lower values for FCS and DDS and higher values of CSI indicate greater food insecurity.

304x127mm (600 x 600 DPI)

STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

	Item No	Recommendation	Page No
<b>Title and abstract</b>	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	1
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2
<b>Introduction</b>			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3-7
Objectives	3	State specific objectives, including any prespecified hypotheses	7
<b>Methods</b>			
Study design	4	Present key elements of study design early in the paper	8
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	7-8
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	8
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	8-10
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	8-10
Bias	9	Describe any efforts to address potential sources of bias	8,11
Study size	10	Explain how the study size was arrived at	8
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	11
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	11
		(b) Describe any methods used to examine subgroups and interactions	N/A
		(c) Explain how missing data were addressed	12
		(d) If applicable, describe analytical methods taking account of sampling strategy	11
		(e) Describe any sensitivity analyses	N/A
<b>Results</b>			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	12
		(b) Give reasons for non-participation at each stage	12
		(c) Consider use of a flow diagram	-
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	12
		(b) Indicate number of participants with missing data for each variable of interest	12
Outcome data	15*	Report numbers of outcome events or summary measures	13-15; 26

1			
2	Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included
3			13-
4			15; 27
5			
6			(b) Report category boundaries when continuous variables were categorized
7			13-15
8			
9			(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period
10			-
11	Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses
12			-
13			
14	<b>Discussion</b>		
15	Key results	18	Summarise key results with reference to study objectives
16			17
17	Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias
18			21
19			
20	Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
21			18-20
22			
23	Generalisability	21	Discuss the generalisability (external validity) of the study results
24			21
25			
26	<b>Other information</b>		
27	Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based
28			2
29			
30			

\*Give information separately for exposed and unexposed groups.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at [www.strobe-statement.org](http://www.strobe-statement.org).

# BMJ Open

## Changes in household food security, access to health services, and income in northern Lao PDR during the COVID-19 pandemic: a cross-sectional survey

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Article Type:	Original research
Date Submitted by the Author:	26-Apr-2022
Complete List of Authors:	Head, Jennifer; University of California Berkeley, Department of Epidemiology Chanthavilay, Phetsavanh; University of Health Sciences Catton, Helen; Save the Children International Vongsitthi, Ammaline; Save the Children International Khamphouxay, Kelley; Save the Children International Simphaly, Niphone; Provincial Health Department
<b>Primary Subject Heading</b>:	Global health
Secondary Subject Heading:	Global health, Nutrition and metabolism, Paediatrics
Keywords:	COVID-19, EPIDEMIOLOGY, Public health < INFECTIOUS DISEASES, NUTRITION & DIETETICS

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## Changes in household food security, access to health services, and income in northern Lao PDR during the COVID-19 pandemic: a cross-sectional survey

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**Keywords:** food security; dietary diversity; underweight; wasting; income; COVID-19; Lao PDR; malnutrition; local food production

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3 16 **Abstract**

4  
5 17 **Objectives:** We assessed the relative difficulty in meeting food needs during the COVID-19 pandemic  
6 18 compared to before; determined the relationship between pandemic-associated difficulties in food  
7 19 access and household, maternal and child food security; and identified resiliency-promoting strategies.

8  
9 20 **Design:** A cross-sectional survey of households undertaken in November 2020.

10  
11 21 **Setting:** Rural districts of Luang Prabang Province, Lao People's Democratic Republic

12  
13 22 **Participants:** Households (N=1,122) with children under five years.

14  
15 23 **Primary and secondary outcomes measured:** Survey respondents reported the relative ease of access of  
16 24 food and health care as well as changes in income and expenditures compared to before March 2020.  
17 25 We determined indicators of food security and source of foods consumed for households, women, and  
18 26 children, as well as prevalence of malnutrition in children under five.

19  
20 27 **Results:** Nearly four-fifths (78.5%) found it harder to meet household food needs during the pandemic.  
21 28 The most common reasons were increased food prices (51.2%), loss of income (45.3%), and decreased  
22 29 food availability (36.6%). Adjusting for demographics, households with increased difficulty meeting food  
23 30 needs had lower food consumption scores and child dietary diversity. Over 85% of households lost  
24 31 income during the pandemic. Decreased expenditures was associated with reliance on more extreme  
25 32 coping strategies to meet food needs. The households who experienced no change in meeting food  
26 33 needs produced a greater percentage of their food from homegrown methods (4.22% more, 95% CI:  
27 34 1.28, 7.15), than households who found it more difficult.

28  
29 35 **Conclusions:** Pandemic-associated shocks may have large effects on food insecurity. Action is needed to  
30 36 mitigate consequences of the pandemic on nutrition. Local food production and safety net programs  
31 37 that offset income losses may help.

32  
33 38  
34 39 **List of abbreviations:**

35  
36 40 **LMICs:** low- and middle-income countries

37  
38 41 **FAO:** Food and agriculture organization

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40 42 **FCS:** food consumption score

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42 43 **CSI:** coping strategies index

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44 44 **DDS:** dietary diversity score

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46 45 **HAZ:** height-for-age Z-score

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48 46 **WAZ:** weight-for-age Z-score

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50 47 **WHZ:** weight-for-height Z-score

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## 50 **Strengths and limitations of this study**

- 51 • We characterize food security across all members of the household, including  
52 women and children, through a series of standardized measures, and describe the  
53 source of foods consumed, permitting identification of strategies to promote  
54 resilience in this population.
- 55 • We capture a large, representative sample of Luang Prabang Province, a  
56 marginalized population with high prevalence of ethnic minorities, for whom little  
57 data on nutrition was previously available.
- 58 • The results of this study may not be generalizable to other counties with varying  
59 economic profiles or rates of COVID-19, to urban communities, or to rural provinces  
60 with lower reliance on tourism.
- 61 • The analyses are cross-sectional, preventing establishment of causal relationships.
- 62 • Self-reported measures, including food consumption patterns and relative ability to  
63 meet food needs during the pandemic as compared to before, are subject to recall  
64 bias.

65

## 66 Introduction

67 Disruptions to food, economics, and health systems during the COVID-19 pandemic have increased the  
68 risk of malnutrition among low- and middle-income countries (LMICs) [1-4]. The food supply chain has  
69 faced challenges across multiple stages, including loss of labor for agricultural production and  
70 postharvest handling due to movement restrictions or illnesses; closure of processing and distributing  
71 facilities; disruptions in distribution networks under restricted trade policies; and changes in consumer  
72 demand and market access [5]. Such challenges have resulted in increases in food prices, with the Food  
73 and Agricultural Organization (FAO) reporting that wheat and rice prices increased by 8% and 25%,  
74 respectively, between March 2019 and April 2020 [6]. Economic disruptions, such as business closures  
75 and declines in tourism, have reduced country-specific gross national incomes in most LMICs [7]. The  
76 World Bank estimates that the pandemic pushed an additional 119 to 124 million people into extreme  
77 poverty in 2020 [8], and surveys across multiple LMICs reveal losses in income among the majority of  
78 households [8-12]. An estimated 118 to 161 million more individuals faced hunger in 2020 as compared  
79 to in 2019 [7]. This increase in the number of people undernourished was apparent in all subregions of  
80 Africa and Latin America, and most subregions of Asia, and was more than five times greater than the  
81 highest increase in undernourishment in the past two decades [7]. Compounding this effect, health  
82 services designed to catch and treat acute malnutrition may be disrupted in many LMICs. For instance,  
83 UNICEF estimates a reduction of 30% in the coverage of essential nutrition services in LMICs due to  
84 difficulties in mobility of both users and providers, interruption of non-COVID-19 services in  
85 communities, higher burdens on the health care workers, and limited personal protective equipment  
86 [13].

87 Increased food insecurity coupled with a decline in access to essential nutritional services is expected to  
88 lead to increases in the prevalence of childhood wasting, an acute form of malnutrition associated with  
89 elevated risk of mortality [14, 15]. One study estimates that there could be a 14.3% increase in the

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2  
3 90 prevalence of moderate or severe wasting among children younger than five years in the 118 LMICs due  
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5 91 to COVID-19-related income losses [2]. By another projection, an increase in wasting of this order of  
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7 92 magnitude (10-50%), coupled with a decline in maternal and child health services by 9.8-15.9%, would  
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9 93 be associated with an increase of 9.8-44.7% in under-five deaths per month [16]. To prevent a global  
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11 94 malnutrition crisis, leaders from four United Nations agencies (UNHCR, UNICEF, FAO, WHO) have issued  
12  
13 95 an immediate call to action, recommending \$2.4 billion be directed to avoiding child malnutrition  
14  
15 96 through wasting treatment and prevention, vitamin A supplementation, and breastfeeding support [17].  
16  
17 97 Alongside these efforts, leaders have called for research that estimates the scale and reach of nutrition  
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19 98 challenges, including country-specific estimates of the effect of the pandemic on incomes, and the  
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21 99 ability to meet food needs and access health services.  
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26 100 Lao People's Democratic Republic (PDR) has one of the highest rates of malnutrition in southeast Asia,  
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28 101 with a national prevalence of stunting of 33%, underweight of 21% and wasting of 9% [18]. Lao PDR  
29  
30 102 experienced its first case of COVID-19 infection in March 2020 [19]. Shortly afterwards, the government  
31  
32 103 imposed a strict lockdown for six weeks, stopping human movement between districts, provinces, and  
33  
34 104 across the border. A total of six cases were identified between March and April 2020. Beginning in May  
35  
36 105 2020, restrictions on within-country movement eased along with adherence to protective measures  
37  
38 106 (e.g., mask wearing and social distancing), but borders were closed to everyone except those who  
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40 107 entered the country via special mission flights, who underwent strict quarantine and testing in  
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42 108 government authorised facility [20]. Between March 2020 and February 2021, only 45 cases had been  
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44 109 reported in Lao PDR, mainly among individuals returning to the country [21]. In April 2021, an outbreak  
45  
46 110 of COVID-19 occurred, with the first confirmed death in May of 2021 [21]. Cases peaked in December of  
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48 111 2021, and as of February, 2022, the country has had over 148,600 confirmed cases and 621 deaths [21].  
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53 112 While Lao PDR has reported fewer cases of COVID-19 than neighbouring countries [21], it may  
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55 113 experience substantial economic and food security effects of the pandemic. The FAO reports that food  
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3 114 prices in Lao PDR have increased by 7.1% between February 14, 2020 to January 30, 2021 [22]. At the  
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5 115 same time, the Ministry of Labour and Social Welfare reported a surge in unemployment from 2%  
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7 116 before the pandemic to 25% as of May 2020 [23]. Moreover, in a national assessment, UNICEF found  
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9 117 that between August 2019 and August 2020, there was a 10-24% decline in the coverage of maternal  
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11 118 health services, newborn services, routine vaccinations, screening for child wasting, and treatment of  
12  
13 119 child wasting [13]. The economic effects of the pandemic are expected to be felt most strongly in Luang  
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15 120 Prabang province, a popular tourist destination. In 2019, Luang Prabang received about 638,000  
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17 121 international visitors and 222,000 domestic tourists. In May 2020, 78% of Luang Prabang's tourism  
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19 122 enterprises were closed, and those that remained open did so largely at partial capacity [24]. This is  
20  
21 123 particularly concerning, as the Luang Prabang province bears a disproportionate burden of children who  
22  
23 124 are stunted (41.3%) or underweight (25%) [18]. The rural and mountainous provinces of Luang Prabang  
24  
25 125 are particularly vulnerable to undernutrition as poverty rates are high and they are often isolated, with  
26  
27 126 difficult access to markets, healthcare and other public services, and water infrastructure [25, 26]. There  
28  
29 127 is a high prevalence of minority ethnolinguistic groups, particularly Hmong and Khmu ethnicities, in  
30  
31 128 these regions and livelihoods are largely agriculturally based. Heavy reliance on rice with limited animal  
32  
33 129 protein contributes to nutritional deficiencies [27]. In this northern Lao PDR, newborns are commonly  
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35 130 fed masticated sticky rice after birth, and 97% of women report following culturally determined  
36  
37 131 restricted diets for one or more months postpartum, reducing consumption of all food groups, except  
38  
39 132 rice [28].

40  
41 133 In rural provinces of Luang Prabang where documented COVID-19 transmission was low, we aimed to 1)  
42  
43 134 assess the relative difficulty in meeting food needs and accessing health care during the COVID-19  
44  
45 135 pandemic compared to before the pandemic; 2) compare self-reported difficulty in meeting food needs  
46  
47 136 to indicators of food security among women, children and the household; 3) identify strategies  
48  
49 137 associated with increased resiliency to food insecurity.

## 138 **Methods**

### 139 *Survey region and population*

140 We obtained data from a cross-sectional, household survey conducted in November 2020 from the Lao  
141 Provincial Health Department. Data were collected as part of the Lao Health Department's endline  
142 evaluation of the Primary Health Care Program to monitor and evaluate public health activities over a  
143 three-year period, starting in 2017. Data were collected from three districts - Nan, NamBak, and Pak Ou  
144 - in Luang Prabang Province.

### 145 *Sampling plan*

146 The target sample size was 1,200 households. The sample size was chosen to detect with 95%  
147 confidence and 80% power a change from 77.7% to 83% in the proportion of women delivering with a  
148 skilled birth attendant since the baseline survey in 2017, accounting for a design effect of 1.5 and a non-  
149 response rate of 5%. A household was considered eligible for selection if members have lived in the  
150 village for at least two years, if it contained a child under the age of five, and if an adult respondent  
151 provided verbal, informed consent to participate.

152 Household selection followed a multistage clustered sampling design that stratified by the three  
153 districts. In the first stage, 25 villages were selected using probability proportional to size sampling. In  
154 the second stage, 30 households per village were selected using simple random sampling from a list of  
155 eligible households prepared by the village head in collaboration with the village health volunteer. The  
156 health and diet of one child under the age of five per household was assessed, and anthropometric  
157 measurements taken. If there were more than one child under five years in the house, a third stage of  
158 sampling was used, in which one child was selected using simple random sampling.

### 159 *Household questionnaire*

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2  
3 160 Household questionnaires were administered verbally by trained data collectors. Information of  
4  
5 161 household demographics, household food security, maternal and child diet, child anthropometrics, and  
6  
7 162 self-reported changes in food access, income, expenditures and access to health services during the  
8  
9 163 pandemic were collected. The survey was translated into Lao language, and back translated to ensure  
10  
11 164 correct translation. One enumerator per team was also fluent in the local languages of Khmu and  
12  
13 165 Hmong, in case the respondent did not speak Lao. A copy of the reduced survey tool is included in the  
14  
15 166 Supplemental Information.

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18  
19 167 The endline survey used the same questionnaire as the baseline survey, which was adapted from global  
20  
21 168 standard reproductive, maternal, newborn and child health and nutrition surveys, and added questions  
22  
23 169 related to food security and access to health services during the pandemic. These additional questions  
24  
25 170 were adapted from a standardized questionnaire developed by Save the Children, International to  
26  
27 171 assess the impact of COVID-19 globally [29]. Respondents were asked if, compared to before the  
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29 172 pandemic, it was much harder, somewhat harder, easier, or the same to meet their family's food needs.  
30  
31 173 If harder, families were asked to list the reasons why. Similarly, respondents were asked if, compared to  
32  
33 174 before the pandemic, it was much harder, somewhat harder, easier, or the same to access health care.  
34  
35 175 Finally, families were asked if they lost income or reduced their expenditures during the pandemic, and  
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37 176 if so, asked to estimate by what percent.

#### 38 39 40 41 42 177 *Calculation of household food security and maternal and child dietary diversity*

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44  
45 178 Household food security was assessed through two standard indicators: the food consumption score  
46  
47 179 and coping strategy index. The food consumption score (FCS) is a frequency weighted household dietary  
48  
49 180 diversity score calculated by multiplying the frequency of consumption of different food groups  
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51 181 consumed by a household during the 7 days before the survey by a weighting factor, and summing [30].  
52  
53 182 The food groups, and their respective weights include: main staples (2), pulses (3), vegetables (1), fruit  
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183 (1), meat and fish (4), dairy (4), sugar (0.5), and oils/butter (0.5). Lower values for FCS reflect greater  
184 food insecurity, as measured by households consuming nutritious foods with lower frequency and/or  
185 diversity.

186 The reduced Coping Strategies Index (CSI) was also used to compare household food security. CSI is  
187 calculated by multiplying the weekly frequency of five behaviors by the weight of the behavior and  
188 summing for all behaviors [31]. The five standard coping strategies and their severity weightings are:  
189 Eating less-preferred foods (1.0); Borrowing food/money from friends and relatives (2.0); Limiting  
190 portions at mealtime (1.0); Limiting adult intake (3.0), and reducing the number of meals per day (1.0).  
191 Higher values for CSI reflect greater food insecurity, as measured by engagement in more frequent  
192 and/or severe behaviors when they do not have enough food or money to buy food [31].

193 The CSI and FCS are significantly correlated with each other and other indicators of household food  
194 insecurity, including the household food insecurity and access scale, yet there is enough difference  
195 between indicators that prior work recommends use of multiple metrics to capture different aspects of  
196 food insecurity [32]. By capturing behavioral response, CSI has been shown to be a better indicator of  
197 future consumption than FCS, and thus a good measure of vulnerability to future shocks [33]. By  
198 capturing dietary diversity, FCS correlates well with caloric consumption and is commonly used by the  
199 World Food Programme and other major organizations as a key indicator in program monitoring. CSI is  
200 more likely to identify a household as food insecure, while FCS is more likely to miss households that are  
201 food insecure [32]. Both can be used as continuous values. CSI has no universal thresholds associated  
202 with it for creating categorical indicators, although prior study from Ethiopia proposed to categorize  
203 scores below 3 as indicative of acceptable food security [32]. FCS has universal thresholds established,  
204 with scores above 35 indicative of acceptable food security; yet, prior study demonstrates that a  
205 sizeable proportion of households with an FCS  $\geq 35$  classify as food insecure according to caloric intake  
206 [34].

207 In addition, we calculated an individual dietary diversity score (DDS) for women and children aged 6-59  
208 months [35]. DDS for children aged 24-59 months is calculated by summing the total number of food  
209 groups consumed in the previous 24 hours, where the food groups are defined as: grains, roots and  
210 white tubers; legumes and nuts; dairy products; meat; eggs; vitamin A-containing fruits and vegetables  
211 (i.e., dark-green, leafy vegetables, fruits that are orange on the inside); other fruits and vegetables. The  
212 child must consume at least four of the seven food groups to meet their minimum acceptable dietary  
213 diversity [35]. For children aged 6-23 months, breastmilk is added as an eighth food group and the child  
214 must consume five out of eight food groups to meet minimum acceptable dietary diversity.

215 DDS for women is tallied by adding up the number of food groups consumed out of the following ten  
216 groups: grains, roots, and white tubers; legumes; nuts and seeds; dairy products; meat; eggs; dark, leafy  
217 greens and vegetables; other vitamin-A-rich fruits and vegetables; other vegetables; other fruits. The  
218 woman must consume at least five of the ten food groups to meet her minimum dietary diversity [35].  
219 Women who reported having an abnormal diet (i.e., ate much more or much less than normal) in the  
220 past 24 hours were excluded from analysis.

### 221 *Anthropometric analysis*

222 Weight and height of children were recorded to the nearest 0.01 kg and 0.1 cm, respectively. Weight-  
223 for-age (WAZ), height-for-age (HAZ), and weight-for-height (WHZ) Z-scores were determined using 2006  
224 WHO Growth Standards [36]. A child was considered stunted, wasted, or underweight if they had a  
225 WAZ, WHZ, or WAZ score below -2SD, respectively.

### 226 *Statistical analysis*

227 Data were analyzed in R version 3.5 [37]. Survey weights were calculated using the inverse probability of  
228 selection for a child (for child outcome) or a household (for household or maternal outcomes). We used  
229 the 'survey' package in R to calculate means and percentages accounting for survey weights, and

230 standard errors used to calculate 95% confidence intervals were determined accounting for clustering  
231 [38]. Univariate and multivariate associations between food security indicators and pandemic-  
232 associated changes in income, expenditures, and ability to meet food needs were assessed using  
233 generalized linear models, accounting for survey weights, and using cluster robust standard errors to  
234 adjust for clustering at the village level. A directed-acyclic-graph (DAG) was used to identify the set of  
235 minimally sufficient covariates to adjust for to block confounding pathways between the exposure and  
236 the outcome (Figure S1). These covariates were associated with the exposure, causally associated with  
237 the outcome, and not on the causal pathway between exposure and outcome. Selected covariates to  
238 include were defined *a priori* as: household ethnicity, household size, education level of mother and the  
239 head of household, and district. Adjusted models for maternal outcomes additionally included mother's  
240 age, and models for children outcomes additionally included child's age and sex. Inclusion of all variables  
241 within this set of minimally sufficient covariates minimized model AIC as compared to inclusion of only a  
242 subset of these covariates. Because we did not capture income prior to the pandemic, which may act as  
243 a confounder, we examined the sensitivity of model coefficients to inclusion of total expenditures and  
244 the percent of expenditures spent on food. These variables may be associated with initial income, but  
245 are not included in primary analyses as they may lie on the causal pathway between exposures and  
246 outcome. Finally, we conducted stratified analyses to examine whether associations between food  
247 security and relative ability to meet food needs during compared to before the pandemic was modified  
248 by the most commonly reported reasons for increased difficulty (items more expensive, markets closed,  
249 less food available in markets, and lost income).

## 250 *Ethics*

251 Data were collected by the Lao Provincial Health Department as part of routine, non-research public  
252 health activities. We obtained data from the Lao Provincial Health Department. Ethical clearance for

253 secondary data analysis was obtained from the Research Ethics Committee in the University of Health  
254 Sciences within the Lao Ministry of Health and Committee for the Protection of Human Subjects within  
255 University of California, Berkeley (protocol ID: 2021-05-14365). A copy of the ethical approval is included  
256 in the Supplemental Information.

### 257 *Patient and Public Involvement*

258 Community members were involved in the conduct of this research. During the survey, community  
259 volunteers assisted in locating other community members for participation in the survey. Results,  
260 including village health profiles, were shared with provincial and district health department leadership  
261 and the head of the Maternal Child Health Department. Monthly village health days were held  
262 throughout the project period to convey information and results to community members, verbally and  
263 with handmade posters.

### 264 **Results**

265 Interviews were completed for 1,122 households, corresponding to a 93.5% response rate. Reasons for  
266 non-response included empty house (53.8%), parent not at home (38.5%) and inaccessible house (5.1%).  
267 The most common ethnicities of those interviewed were Khmu (463, 41.3%), Lao Lom (340, 30.3%), and  
268 Hmong (281, 25.0%). Undernutrition among children under five years in the study region was high, with  
269 the survey-weighted prevalence of wasting at 4.5% (95% CI: 3.5, 5.8), underweight at 18.2% (95% CI:  
270 15.9, 20.7%), and stunting at 32.9% (95% CI: 29.6, 36.4%).

### 271 *Food security*

272 Nearly four-fifths (78.5%) of the study population reported that it was harder to meet their family's food  
273 needs during the pandemic, as compared to before (Table 1). A weighted 60.9% (95% CI: 57.6, 64.1%) of  
274 individuals reported that it was somewhat harder to meet food needs, while 17.6% (95% CI: 15.4, 20.0%)

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3 275 reported that it was much harder. Among the 874 individuals who found it harder to meet food needs,  
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5 276 the most common reason reported was that foods were more expensive (51.2%), followed by household  
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7 277 losing income (45.3%), food not available at markets (36.6%), and markets being closed (36.5%). The  
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10 278 median monthly expenditure among households was US\$133. Households spent, on average, 40% of  
11  
12 279 their income on food, which was increased from 30% in 2017.

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14  
15 280 The mean food consumption score was 60.9 (95% CI: 59.7, 62.3) (Table 2). Households consumed rice  
16  
17 281 daily and meat and vegetables an average of 3.0 and 4.8 days per week, respectively. On average,  
18  
19 282 children consumed 4.21 (95% CI: 3.95, 4.18) food groups in the day prior to the survey, corresponding to  
20  
21 283 62.5% (95% CI: 59.1, 65.8) of children that met the minimum DDS requirement. Women consumed an  
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23 284 average of 5.38 (95% CI: 5.25, 5.51) food groups, corresponding to 67.7% (95% CI: 64.4, 70.9) meeting  
24  
25 285 her minimum DDS. Compared to 2017, households in 2020 demonstrated significantly ( $p < 0.05$ ) lower  
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27 286 dietary diversity and higher coping strategies. In 2017, 76% of women and 69% of children met their  
28  
29 287 minimum dietary diversity score, and the average CSI for households was 0.7 points lower. The largest  
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31 288 change in household food consumption between 2017 and 2020, was in meat consumption; in 2017,  
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33 289 households ate meat an average of 6 days per week. Household consumption of vegetables (5.3 vs. 4.8)  
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35 290 was also lower in 2020 compared to 2017, while consumption of rice remained the same. While women  
36  
37 291 and children consumed less meat in 2020 than in 2017, the difference was not as large as observed  
38  
39 292 among other household members, and both women and children increased egg consumption (Figures  
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41 293 S2 and S3).

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44 294 The distribution of both household food security indicators differed by whether or not households found  
45  
46 295 it harder to access food during the pandemic (Figure 1). Among households who found it harder to meet  
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48 296 their food needs during the pandemic, there was greater density of lower FCS (indicating worse food  
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50 297 security) and higher CSI (indicating worse food security) compared to those who experienced no change.  
51  
52 298 These relationships between household FCS and access to food during the pandemic were also seen in  
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299 multivariate regression analyses (Table 2; Figure 2). Adjusting for ethnicity of the household, size of the  
300 household, district, and education level of the mother and head of household, we estimated that the  
301 average food consumption score among households who found it harder to meet their food needs was  
302 2.74 points lower (95% CI: 0.55, 4.92) than the average food consumption score among households who  
303 experienced no change (Figure 2). This is roughly equivalent to consuming vegetables nearly three fewer  
304 times per week, or consuming rice one less time per week. The household coping strategies index  
305 among households who had a harder time meeting their food needs was higher, indicating lower food  
306 security, but not significantly so. Dietary diversity scores for women and children were lower among  
307 households who had more difficulty meeting their food needs during the pandemic, but not significantly  
308 so in adjusted analyses. Sensitivity analyses including total expenditures and percent of expenditures  
309 spent on food as covariates found similar model coefficients (Table S1), although dietary diversity score  
310 for children met the criteria for statistically significant at the 95% confidence level. For all outcomes,  
311 households who reported that increased food prices were a major reason for increased difficulty  
312 meeting food needs were associated with the greatest deteriorations in food security or diversity,  
313 compared to households who reported food availability and market closures as the reason for their  
314 difficulty.

315 We did not find any difference in WAZ or WHZ scores among children from households who self-  
316 reported greater difficulty meeting their food needs compared to those from household who reported  
317 no change in ability to meet food needs.

### 318 *Resiliency to food insecurity*

319 We estimated the percentage of a household's food sources in the past week that was self-produced  
320 (e.g., farmed, fished, hunted, gathered). On average, families met 42% of their food needs through self-  
321 production (interquartile range: 27%, 57%). Commonly self-produced foods included: insects, aquatic

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3 322 animals other than fish, mushrooms, and roots (Figure 3). Over half of households also self-produced  
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5 323 rice and vegetables, and about one quarter self-produced fish, meat, and fruits. We found that  
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7 324 households who derived a greater proportion of their food needs through homegrown methods were  
8  
9 325 more resilient than families who purchased their foods. Adjusting for ethnicity of the household, size of  
10  
11 326 the household, district, and education level of the mother and head of household, we estimated that the  
12  
13 327 average percentage of food obtained from homegrown methods was 4.22% (95% CI: 1.28, 7.15%) lower  
14  
15 328 among households who found it harder to meet their food needs compared to household who  
16  
17 329 experienced no change. On average, respondents spent 9.6 hours per week fishing, gathering or hunting  
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19 330 food. Persons who found it harder to meet their food needs during the pandemic also spent fewer hours  
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21 331 per week fishing, gathering, or hunting, though the results were not significant.  
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### 26 332 *Income and expenditures*

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29 333 Over 85% of the study population reported losing income during the pandemic, with the majority of  
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31 334 respondents (54.4%, 95% CI: 51.3, 57.4%) reporting losing between 25-50% of their income. Households  
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33 335 who reported declines in income were more likely to reduce spending, with the greater the reduction in  
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35 336 income corresponding to greater reductions in household expenditures (Figure 4a). A weighted 23.3%  
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37 337 reported reducing household expenditures by 1-25%, while 35.7% reported reducing expenditures by  
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39 338 25-50%. The distribution of both household food security indicators also differed by whether or not  
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41 339 households lost income during the pandemic (Figure 1).  
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45 340 Households who reduced expenditures during the pandemic had significantly decreased food security in  
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47 341 adjusted analyses, as measured by the FCS and the CSI, and significantly decreased food security in  
48  
49 342 univariate analyses as measured by the FCS and child's DDS (Figure 4b, Table 2). In adjusted analyses,  
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51 343 families who reported spending less during the pandemic had a household FCS that was 5.23 (95% CI:  
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53 344 3.41, 7.05) units lower, and a CSI that was 0.83 (95% CI: -0.07, 1.74) units higher than families who did  
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3 345 not reduce spending. Dietary diversity scores for children were lower among households who had more  
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5 346 difficulty meeting their food needs during the pandemic, but not significantly so in adjusted analyses.  
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7 347 Including total expenditures and percent of expenditures spent on food as covariates in multivariable  
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9 348 models did not change these conclusions (Table S1).

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13 349 We did not find any difference in WAZ or WHZ scores among children from households who lost income  
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15 350 or reduced spending compared to those who did not lose income or reduce spending.

### 16 17 18 351 *Access to health care*

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21 352 A weighted 37.4% (95% CI: 34.6, 40.2%) of individuals reported that it was somewhat harder to access  
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23 353 healthcare compared to before the pandemic, while 4.8% (95% CI: 3.7, 6.1%) reported that it was much  
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25 354 harder (Table 1). We identified 123 (11%) women and 557 (50%) children who had experienced fever,  
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27 355 diarrhea, cough and/or respiratory infection in the two weeks prior to the survey. Among both women  
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29 356 and children with illness in the past two weeks, >60% had fever (see Figures S4-S5 for Venn diagrams).  
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31 357 Of these, a weighted 69.7% (95% CI: 66.3, 73.0%) of children and 81.2% (95% CI: 73.3, 87.2) of women  
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33 358 sought care from a health facility. We found no association between healthcare seeking behavior, either  
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35 359 for stratified by condition or in aggregate, and relative ability to access health care during versus before  
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37 360 the pandemic.

### 38 39 40 41 361 **Discussion**

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44 362 In a rural setting in Lao PDR with low documented COVID-19 transmission and high dependence on  
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46 363 tourism, we found prevalent loss of income and increased difficulty in meeting household food needs  
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48 364 following the start of the COVID-19 pandemic and a national border closure. In our household survey,  
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50 365 we found that nearly four-fifths of the study population reported that it was harder to meet their  
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52 366 family's food needs during the pandemic, with the most common reason being increases in food prices;  
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54 367 indeed, families reported that the proportion of their household expenditure on food had doubled since  
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3 368 baseline in 2017. At the same time, we found that over 85% of the study population reported losing  
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5 369 income during the pandemic, with over half of respondents reported losing between 25-50% of their  
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7 370 income. Respondents who reported losses in income and and/or reported greater challenges meeting  
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10 371 their food needs had small, but significant declines in household food security, as measured by the food  
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12 372 consumption score (which correlates best with caloric intake) and coping strategies index (which  
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14 373 correlates best with vulnerability to shocks). Nevertheless, the small differences in food security  
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16 374 indicators suggests that people in this population may have been able largely able to protect their  
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18 375 consumption without heavy reliance on negative coping strategies, despite some deterioration.

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21 376 Decreased expenditures as a result of the pandemic was more strongly associated with reductions in  
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23 377 household food security, as measured by both the FCS and the CSI, as compared to greater difficulty in  
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25 378 food access. Moreover, of the reasons for challenges meeting food needs reported by the community,  
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28 379 increased food prices were most strongly associated with lower FCS, higher CSI, and lower DDS in  
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30 380 women and children. Self-production of food via farming, hunting, fishing, or gathering is common in  
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32 381 this population, accounting for 42% of food consumed. Our study found that individuals who derived a  
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34 382 greater proportion of the food from self-produced means were more resilient to pandemic-associated  
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36 383 shocks.

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39 384 Our results support a growing body of empirical data that suggests wide scale difficulty in meeting food  
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41 385 needs and pervasive loss in income associated with the pandemic. In Kenya, surveys administered  
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43 386 before and after the COVID-19 lockdown found that 52% of the population changed their dietary habits,  
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45 387 most commonly via reductions in meat, dairy, and bread [11]. Nearly all (95%) of respondents reported  
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47 388 loss of income during the pandemic, with 88% finding that the resulting income was insufficient to meet  
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49 389 food needs. Over one third also attributed changes in food consumption to lower food availability, with  
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51 390 households obtaining food from markets more likely to change food consumption patterns than those  
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53 391 obtaining food from farming and livestock [11]. An interrupted time series analysis in Bangladesh found

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3 392 that median incomes fell from US\$212 to \$59 during a two-month stay at home order, while the  
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5 393 proportion of families living on less than \$1.90 per day rose from 0.2% to 47.3% [39]. In that study, the  
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7 394 proportion of households classified as moderately or severely food insecure rose from 5.6% and 2.7%,  
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10 395 respectively, to 36.5% and 15.3% [39]. While global surveys indicate loss of income across all counties,  
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12 396 the proportion of participants financially impacted by the pandemic is estimated to be three times  
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14 397 higher in LMICs than in high income countries [40]. Longitudinal survey data from Ethiopia, Malawi,  
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16 398 Nigeria and Uganda find that 77% of the population live in households that have lost income during the  
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18 399 pandemic [9]. In a Save the Children global survey, 85% of families living in Asia reported income loss,  
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20 400 with a strong negative association between income loss and dietary diversity [29]. To our knowledge, no  
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22 401 study has yet to be published from Lao PDR, but an unpublished household survey in Phongsaly  
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24 402 Province, another rural province, found that 46% of households reduced their expenditures, and 24%  
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26 403 took out loans to buy food (personal communication).  
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30 404 Randomized control trials demonstrate that improved access to proper nutrition can improve WAZ and  
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32 405 WHZ Z-scores [41-43]. In many LMICs, including Lao PDR, the density of Z-scores is clustered around the  
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34 406 dichotomous classification threshold of -2SD, so even small changes to body weight can translate into  
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36 407 meaningful changes in the proportion of children classified as underweight or wasted [44]. While LMICs  
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38 408 have seen progress in reducing prevalence of wasting and underweight, yearly reductions in Lao PDR  
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40 409 and other LMICs may be smaller than a percentage point [18, 45, 46], suggesting that even small effects  
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42 410 of COVID-19 on bodyweight could undo years of progress. At the same time, we did not observe a  
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44 411 difference in the WAZ or WHZ scores between children whose household reported greater difficulty  
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46 412 meeting food needs and those who did not, nor did we see a difference in maternal or child dietary  
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48 413 diversity score between these groups in multivariate analyses. This may suggest that households in our  
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50 414 study population prioritized maternal and child consumption patterns even as families struggled to meet  
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52 415 food needs. We find that while household meat consumption was strongly reduced between 2020 and  
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3 416 2017, meat consumption of women and children was reduced only slightly. What is more, potential  
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5 417 declines in protein intake for women and children due to lower meat consumption was offset by  
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7 418 increases in egg consumption. All villages in the study population have been receiving interventions  
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9 419 focused on sustainable behavioral change for maternal and child nutrition, so individuals in the  
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11 420 population may have been more likely to prioritize the nutrition of these vulnerable populations.  
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13 421 Indeed, eggs were promoted as part of behavioral change communication as an alternative and cheap  
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15 422 source of protein when meat was too expensive or not available.  
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19 423 Our study suggests possible interventions that might mitigate the effect of the pandemic on food  
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21 424 security. We found that households who were more likely to experience no change in meeting food  
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23 425 needs during the pandemic derived a greater proportion of their food needs through homegrown  
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25 426 methods (as opposed to purchasing foods) as compared to households who found it more difficult to  
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27 427 meet their food needs. Reducing reliance on food supply from other places or countries is recognized by  
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29 428 others to be a means of reducing the impact of the COVID-19 pandemic on food insecurity. Farm-  
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31 429 system-for-nutrition approaches have been suggested as one solution, in which location-specific farm  
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33 430 systems integrate arable farming, horticulture, backyard farming, and animal farming in order to  
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35 431 increase household access to nutritious foods while conserving natural resources [47]. The FAO  
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37 432 advocate for improving the resilience of local food systems by facilitating access to locally produced  
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39 433 food, shortening the supply chain by promoting direct purchase from local producers, and promoting  
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41 434 urban or backyard gardens that also offer financial and environmental co-benefits [48]. Because our  
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43 435 study design could not establish trends in homegrown food production prior to the pandemic, we are  
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45 436 unable to determine if households in our population increased homegrown food production or time  
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47 437 spent fishing, gathering, or hunting as a response to the pandemic, although we found slightly higher  
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49 438 prevalence of homegrown food production (48%) and time spent collecting food (12.0 hours) in 2017 as  
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51 439 compared to 2020. Globally, reliance on homegrown food production may have increased as a response  
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3 440 to lockdown measures [7] and helped stabilize food consumption patterns amidst market uncertainty  
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5 441 [11]. Yet, increased reliance on gathering or growing food may represent a source of unpaid labor that  
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7 442 could be devoted to other activities [49]. Care must be taken that local food grown solutions minimize  
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9 443 contributions to the burden of time poverty, or are enacted along with interventions that offset time  
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11 444 poverty [50].  
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15 445 Our study also identified that loss of income and higher food prices are among the most important  
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17 446 reason households are less able to meet their food needs. As such, social safety net programs may be  
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19 447 particularly suited to addressing the challenge of food insecurity [51-53]. A randomized control trial in  
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21 448 Colombia in March 2020, at the start of a national quarantine, found that 90% of families randomized to  
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23 449 an arm that received cash transfers of \$19 every 5-9 weeks spent the cash on food, which helped to  
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25 450 offset the effects of the pandemic on food insecurity in the treatment arm [54]. Other randomized  
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27 451 control trials demonstrate reductions of severe food insecurity among those who received a cash  
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29 452 transfer or a direct food transfer by nearly 25% [55, 56]. Systematic review and meta-analysis of 74  
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31 453 studies found that children from households who received cash transfers had reduced stunting by 2.5%  
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33 454 and improved consumption of animal foods by 4.5% [57].  
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38 455 This study has limitations. First, the results of this survey may not be generalizable to other countries,  
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40 456 particularly those with higher COVID-19 incidence and greater restrictions on within-country movement.  
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42 457 At the time of the survey (November 2020), fewer than 50 cases had been reported in Lao PDR, and  
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44 458 health systems were not experiencing the same overwhelming of capacity as in many other countries  
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46 459 [58]. Additionally, while initial control measures limited local movement, these restrictions were largely  
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48 460 relaxed by May 2020, seven months prior to the survey, with the main intervention remaining being  
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50 461 strict border closure. We expect, therefore, that compared to other LMICs, the effects of food security  
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52 462 and access to health care found in this study may be smaller than would be seen in other countries. At  
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54 463 the same time, however, the effects of the pandemic on food security and income and expenditures  
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3 464 may be seen more strongly in Luang Prabang as compared to other provinces within Lao PDR. As the  
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5 465 province is home to the UNESCO World Heritage City of Luang Prabang, Luang Prabang province  
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7 466 receives a greater proportion of its income from tourism as compared to other provinces [24]. Indeed,  
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10 467 our survey found a greater proportion of household reduced expenditures (64%) compared to another,  
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12 468 unpublished, survey in a different rural province, where 46% of households reduced expenditures  
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14 469 (personal communication). As mentioned, households in the study population had been receiving  
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16 470 educational messaging regarding the importance of maternal and child malnutrition, so may have  
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18 471 prioritized meeting the needs of mothers and children even as their struggled to meet the families' food  
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20 472 needs. Thus it is possible that other areas may have seen more dramatic declines in maternal and child  
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22 473 nutrition. Moreover, the results of the survey may not be generalizable to larger, more urban areas.  
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24 474 Similarly, the relationships with FCS may not be generalizable to other areas with different dietary  
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26 475 patterns. The mean FCS in our study was 60.9, well above the generic cut off of  $\geq 35$  for an acceptable  
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28 476 score. We do not emphasize these thresholds in our study, as they have been shown to badly misclassify  
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30 477 food insecurity in some contexts. For instance, in El Salvador, only 0.2% of households fell below the FCS  
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32 478 threshold for food insecurity, while 19% had low caloric consumption [34]. Such may occur in this  
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34 479 context as well, as while diversity of foods consumed was low, staples and meat/fish/insects were  
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36 480 among the more commonly consumed food groups, and these food groups are given large weights in  
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38 481 calculating the weighted mean. Finally, while we do not find associations between seeking care during  
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40 482 illness and self-reported changes in access to healthcare, it is possible that individuals reduced routine  
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42 483 wellness visits, which we do not assess in our survey.

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44 484 Another limitation of our study relates to recall bias. Because control measures were first implemented  
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46 485 in March 2020, and we implemented this survey in November 2020, there could be substantial recall  
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48 486 bias, as participants are asked to compare ability to meet food needs, ability to access health care, and  
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50 487 income and expenditures to a time period that extended 8 months prior up until the current time. The  
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3 488 ideal observational research design would be to compare our estimates of food security and  
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5 489 malnutrition to repeated estimates taken longitudinally, leading up to just prior to the pandemic. While  
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7 490 we lack data from just before the pandemic, we have data from household surveys in the region  
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10 491 collected in 2017. Estimates of food insecurity and the prevalence of children underweight and wasted  
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12 492 from 2020 are higher than estimates from 2017, while estimates of dietary diversity from 2020 are  
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14 493 lower than estimates from 2017. However, because changes in indicators between 2017 and 2020  
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16 494 cannot be attributed to the effects of the pandemic alone, we do not emphasize 2017 data here.  
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19 495 Roughly 3.5% of visited households were empty, which may represent a form of selection bias that may  
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21 496 underrepresent adverse consequences of the pandemic if the empty households moved out of a need to  
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23 497 avoid lockdown or preserve livelihoods. However, as was observed in 2017, many households within this  
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25 498 population will leave for days at a time to attend to work in rice fields, which is expected to be the  
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27 499 predominant reason for non-response. Finally, while we examine loss of income, we did not collect  
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29 500 information on income prior to the pandemic nor occupation or occupational status of household  
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31 501 members. While we control for education in multivariate models, which may in part control for some  
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33 502 variation due to income or occupational type, residual confounding may remain. Future work might seek  
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35 503 to examine whether how loss of occupation affects food security via lost income, and what types of  
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37 504 work are most susceptible to loss.  
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## 42 505 **Conclusion**

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45 506 Lao PDR's early efforts to control the spread of COVID-19 have been successful, with fewer documented  
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47 507 cases to date relative to neighboring countries. Nevertheless, the effect of the pandemic on food  
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49 508 security on livelihoods in LMICs may be severe, and subsequent waves of cases, and associated  
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51 509 lockdown measures, in 2021 and 2022 demonstrates that the threat of continued food security remains  
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53 510 present. Increasing self-sufficiency through local food production, and/or supporting incomes via social  
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3 511 safety nets such as cash transfer programs, may mitigate some of these effects. As control measures to  
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5 512 curb the transmission of COVID-19 continue, and as outbreaks occur intermittently with concomitant  
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7 513 restrictions on movement, further study may be useful to understand what coping strategies people are  
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10 514 using so that government and agencies can support the resilience of households in the long term.  
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23  
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25  
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### 31 522 **Contributorship statement**

32  
33  
34 523 PC, HC, and JRH conceptualized the research. PC and HC assisted in data collection. PC and JRH analyzed  
35  
36 524 the data. HC and JRH wrote the manuscript. AV and KK lead the Save the Children health program in  
37  
38 525 Luang Prabang and the Vientiane country office, respectively. All authors edited and read the  
39  
40 526 manuscript.  
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### 45 527 **Competing interests**

46  
47  
48 528 HC, AV and KK, were or are currently employees of Save the Children, International. Save the Children  
49  
50 529 supports a government led Primary Health Care Program in Luang Prabang which includes nutritional  
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52 530 interventions.  
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7  
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11 534 **Data sharing statement**  
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15 535 Data is owned by the Luang Prabang Provincial Health Department and permission has been granted for

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17 536 its use.  
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3 679 **Figure 1.** Violin plot showing distribution of two household food security measures, together with their  
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5 680 median and interquartile range (IQR). Household food security was measured through food  
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7 681 consumption score (FCS) (A, B) and coping strategies index (CSI) (C, D). Food insecurity is associated with  
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9 682 low FCS and high CSI.

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13 683 **Figure 2.** The difference in mean of food security indicator among households who had a harder time  
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15 684 meeting their food needs during the pandemic compared to those who did not. Vertical bars represent  
16  
17 685 95% confidence intervals. Adjusted models for households control for household ethnicity, household  
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19 686 size, education level of mother and the head of household, and district. Adjusted models for mothers  
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21 687 include additionally mother's age. Adjusted models for children include additionally child's age and sex.  
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23 688 FCS = food consumption score; CSI = coping strategy index; DDS = dietary diversity score. Lower values  
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25 689 for FCS and DDS and higher values of CSI indicate greater food insecurity.

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29 690 **Figure 3.** Proportional source of each food group consumed during the past week by households.  
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31 691 Numbers in parenthesis above the bars indicates the mean number of days per week household  
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33 692 consumed these food groups.

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37 693 **Figure 4.** A) Mean decrease in expenditures reported, stratified by the percent reduction in household  
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39 694 income. Vertical bars represent 95% confidence intervals. B) The difference in mean of food security  
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41 695 indicator among households who reduced spending during the pandemic compared to those who did  
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43 696 not. Vertical bars represent 95% confidence intervals. Adjusted models for households control for  
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49 699 additionally child's age and sex. FCS = food consumption score; CSI = coping strategy index; DDS =  
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51 700 dietary diversity score. Lower values for FCS and DDS and higher values of CSI indicate greater food  
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53 701 insecurity.

702 **Table 1.** Self-reported effects of the pandemic on household access to food, health care, and income.

	<b>Weighted percentage (95% Confidence interval)</b>	<b>N</b>
<b>Relative ability to meet family's food needs now compared to before the pandemic (N = 1120)</b>		
Easier	0.83 (0.38, 1.82)	8
No change	20.7 (18.3, 23.3)	238
Somewhat harder	60.9 (57.6, 64.1)	698
Much harder	17.6 (15.4, 20.0)	176
<b>Reasons it is harder to meet food needs during the pandemic (N = 874)</b>		
Items more expensive	51.2 (46.4, 56.0)	415
Household lost income	45.3 (40.9, 49.9)	465
Less food is available	36.6 (33.1, 40.2)	561
Markets are closed	36.5 (32.3, 41.0)	555
<b>Proportion of household income lost during the pandemic (N = 1122)</b>		
No income lost	14.4 (12.3, 16.6)	165
1-25%	17.5 (14.6, 20.7)	192
26-50%	54.4 (51.3, 57.4)	607
51-75%	9.2 (1.7, 11.2)	104
76-100%	4.6 (3.5, 6.1)	54
<b>Percent reduction in household expenditures during the pandemic (N = 1122)</b>		
No reduction	36.3 (33.2, 39.6)	415
1-25%	23.2 (19.4, 27.4)	257
26-50%	35.7 (32.9, 38.6)	400
51-75%	3.9 (2.9, 5.3)	41
76-100%	0.89 (0.44, 1.8)	9
<b>Relative ability to access health care now compared to before the pandemic (N = 1121)</b>		
Easier	0.40 (0.15, 1.09)	8
No change	47.0 (44.0, 50.0)	544
Somewhat harder	37.4 (34.6, 40.2)	413
Much harder	4.8 (3.7, 6.1)	48
Undecided	10.0 (7.5, 13.1)	108

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**Table 2.** Model coefficients representing difference in indicator between households who self-reported that it is harder to access food during the pandemic and those who report no change/easier; and those who decreased spending during the pandemic and those who did not. Adjusted models for households control for household ethnicity, household size, education level of mother and the head of household, and district. Adjusted models for mothers include additionally mother’s age. Adjusted models for children include additionally child’s age and sex. FCS = food consumption score; CSI = coping strategy index; DDS = dietary diversity score. Lower values for FCS and DDS and higher values of CSI indicate greater food insecurity.

	Model coefficients				Population mean (95% CI)
	Harder to access food during the pandemic		Decreased expenditures during the pandemic		
	Crude difference (95% CI)	Adjusted difference (95% CI)	Crude difference (95% CI)	Adjusted difference (95% CI)	
FCS	-3.36 (-5.42, -1.29)*	-2.74 (-4.92, -0.55)*	-6.53 (-8.23, -4.79)*	-5.24 (-7.05, -3.42)*	60.9 (59.7, 62.3)
CSI	0.07 (-0.86, 0.99)	0.36 (-0.65, 1.37)	0.83 (-0.07, 1.74)	1.32 (0.40, 2.29)*	3.6 (3.1, 4.1)
DDS (child)	-0.21 (0.41, -0.01)*	-0.21 (-0.43, 0.01)	-0.20 (-0.38, -0.02)*	-0.11 (-0.31, 0.08)	4.14 (4.04, 4.24)
DDS (mother)	-0.15 (-0.40, 0.01)	-0.10 (-0.34, 0.15)	-0.08 (-0.28, 0.12)	0.06 (-0.14, 0.25)	5.38 (5.26, 5.51)

\*represents statistical significance at p<0.05

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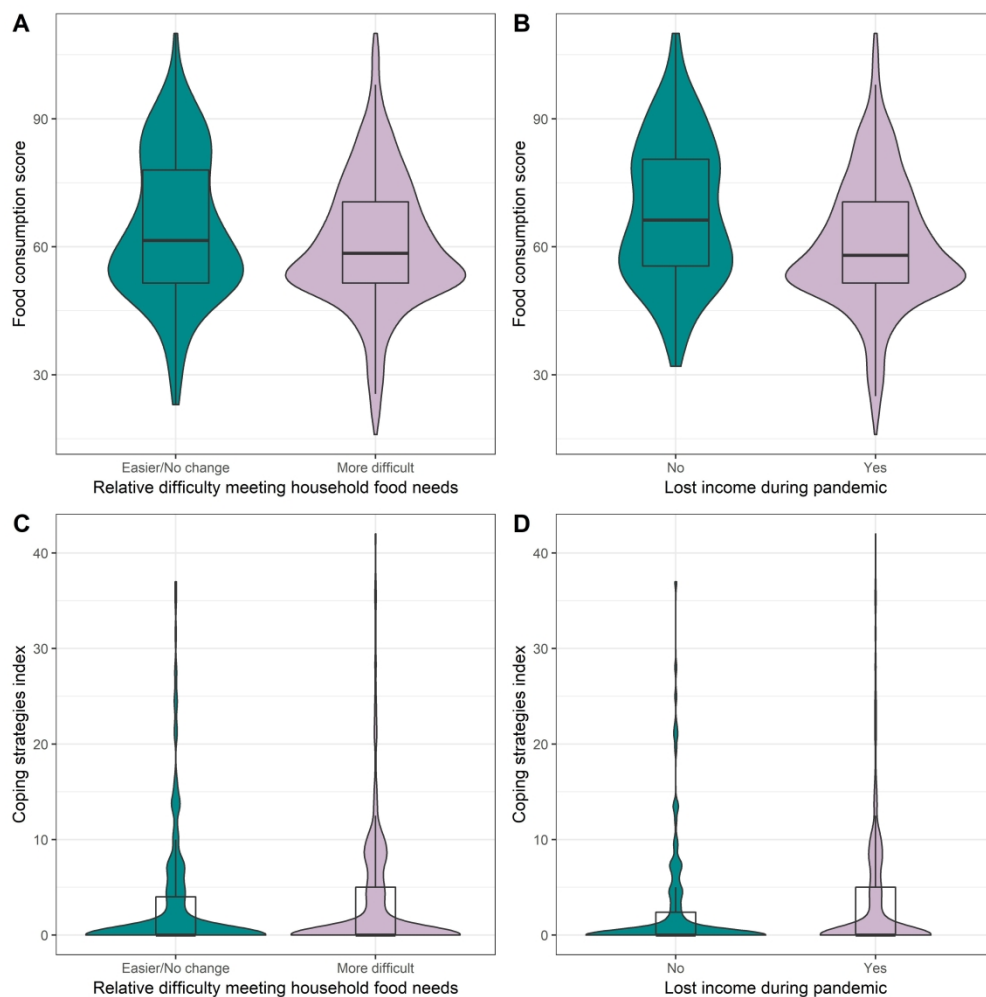


Figure 1. Violin plot showing distribution of two household food security measures, together with their median and interquartile range (IQR). Household food security was measured through food consumption score (FCS) (A, B) and coping strategies index (CSI) (C, D). Food insecurity is associated with low FCS and high CSI.

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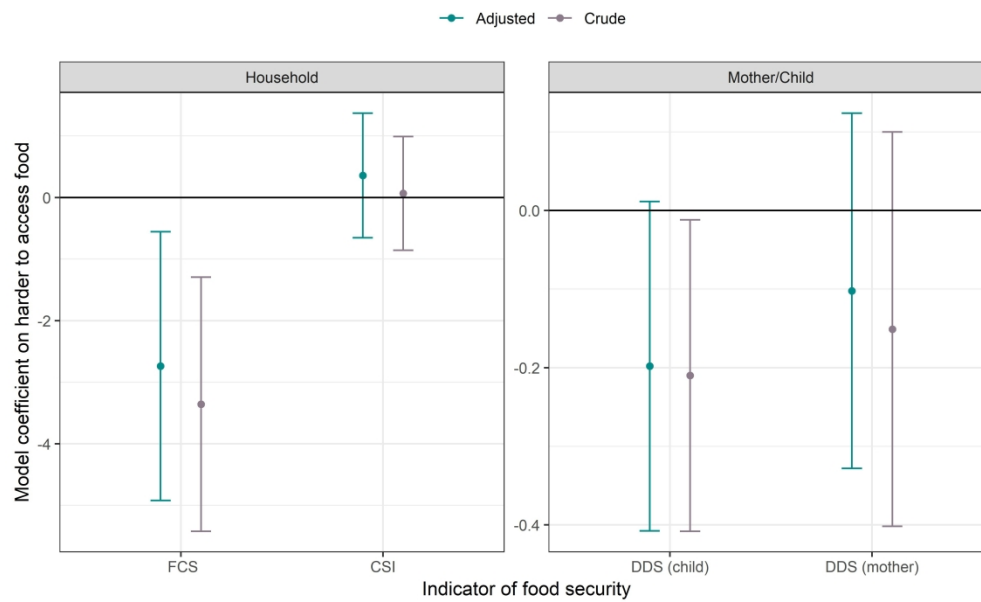


Figure 2. . The difference in mean of food security indicator among households who had a harder time meeting their food needs during the pandemic compared to those who did not. Vertical bars represent 95% confidence intervals. Adjusted models for households control for household ethnicity, household size, education level of mother and the head of household, and district. Adjusted models for mothers include additionally mother's age. Adjusted models for children include additionally child's age and sex. FCS = food consumption score; CSI = coping strategy index; DDS = dietary diversity score. Lower values for FCS and DDS and higher values of CSI indicate greater food insecurity.

203x127mm (600 x 600 DPI)



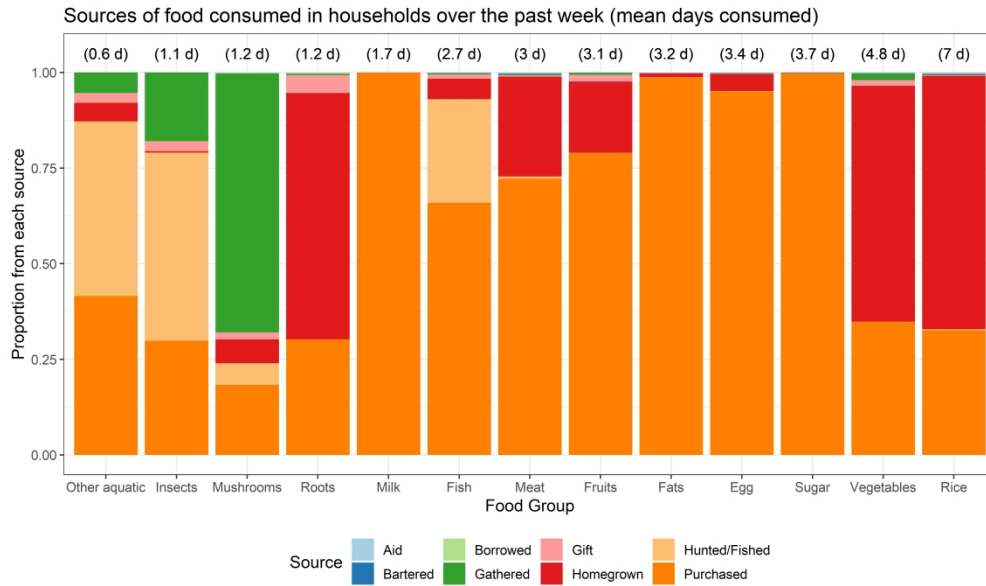


Figure 3. Proportional source of each food group consumed during the past week by households. Numbers in parenthesis above the bars indicates the mean number of days per week household consumed these food groups.

254x152mm (600 x 600 DPI)

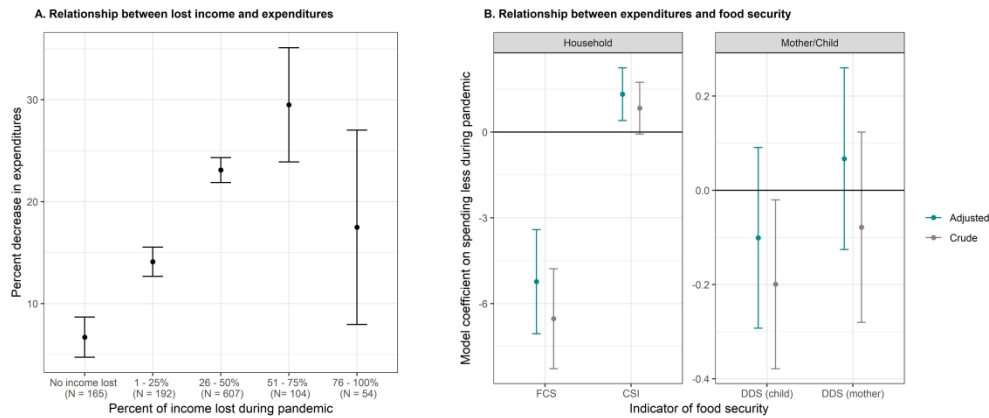


Figure 4. A) Mean decrease in expenditures reported, stratified by the percent reduction in household income. Vertical bars represent 95% confidence intervals. B) The difference in mean of food security indicator among households who reduced spending during the pandemic compared to those who did not. Vertical bars represent 95% confidence intervals. Adjusted models for households control for household ethnicity, household size, education level of mother and the head of household, and district. Adjusted models for mothers include additionally mother's age. Adjusted models for children include additionally child's age and sex. FCS = food consumption score; CSI = coping strategy index; DDS = dietary diversity score. Lower values for FCS and DDS and higher values of CSI indicate greater food insecurity.

304x127mm (600 x 600 DPI)

## Supplemental Info for:

### Changes in household food security, access to health services, and income in northern Lao PDR during the COVID-19 pandemic: a cross-sectional survey

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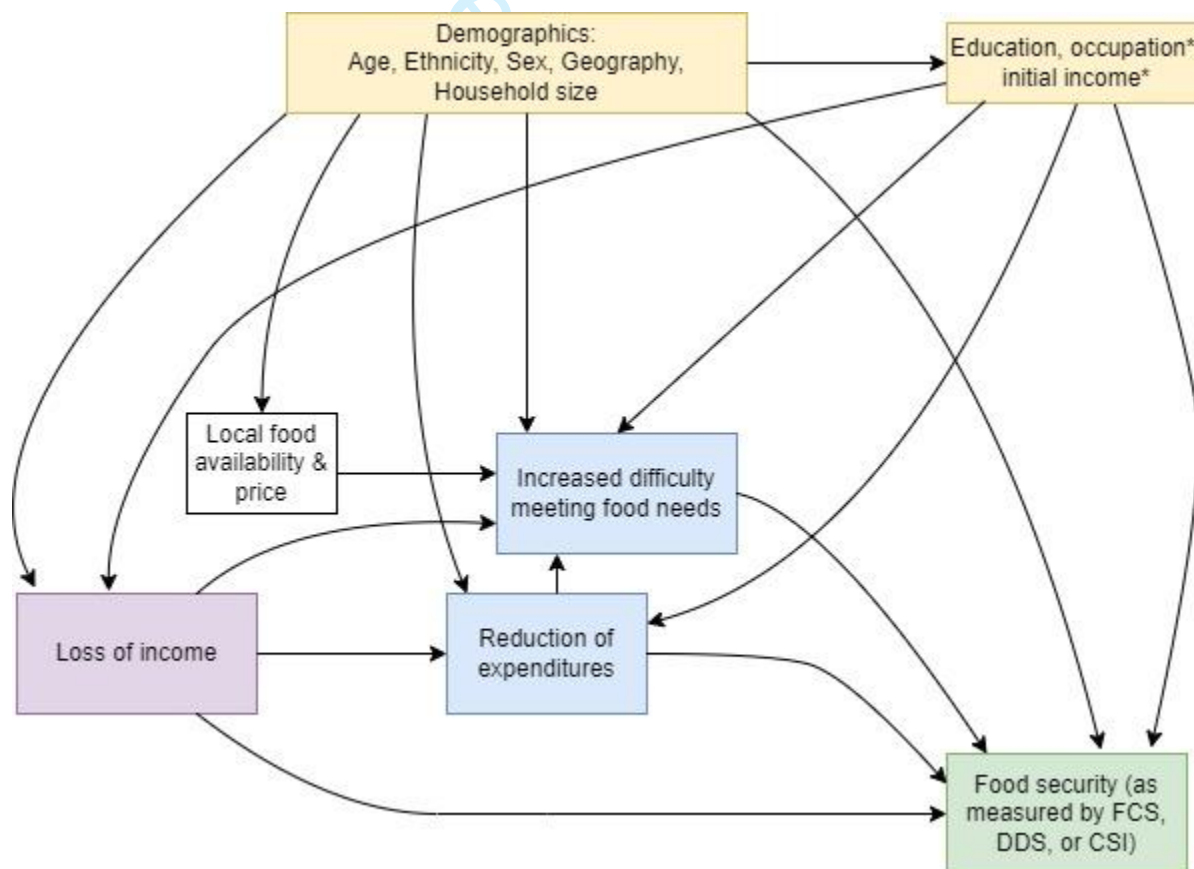
\*Corresponding author: Jennifer R. Head, MPH

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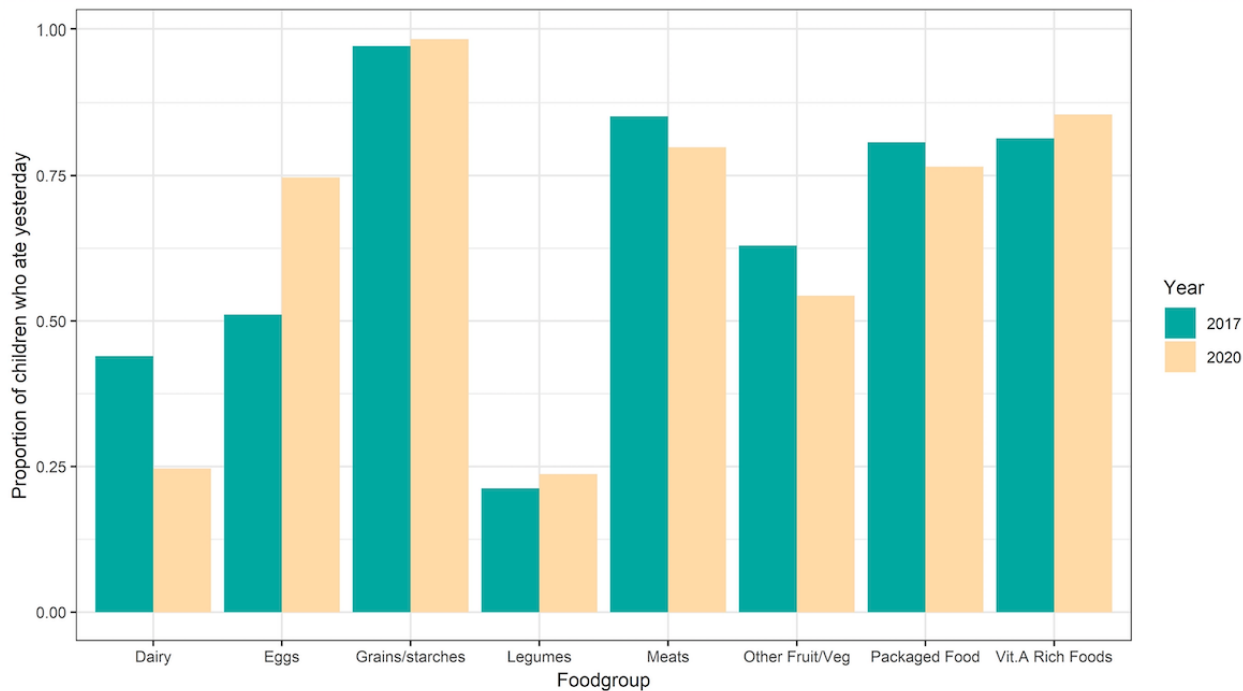
**Table S1.** Multivariate model results adding additional covariates to the model. Coefficients represent the difference in indicator between households who self-reported that it is harder to access food during the pandemic and those who report no change/easier; and those who decreased spending during the pandemic and those who did not. Adjusted models for households control for household ethnicity, household size, education level of mother and the head of household, district, **total expenditures**, and **percent of expenditures spent on food**. Adjusted models for mothers include additionally mother's age. Adjusted models for children include additionally child's age and sex. FCS = food consumption score; CSI = coping strategy index; DDS = dietary diversity score. Lower values for FCS and DDS and higher values of CSI indicate greater food insecurity.

	Model coefficients (95% CI)	
	Harder to access food during the pandemic	Decreased expenditures during the pandemic
FCS	-2.76 (-5.03, -0.50)*	-5.10 (-6.94, -3.27)*
CSI	0.23 (-0.81, 1.27)	1.46 (0.52, 2.41)*
DDS (child)	-0.23 (-0.45, -0.01)*	-0.10 (-0.30, 0.10)
DDS (mother)	-0.11 (-0.35, 0.14)	0.06 (-0.14, 0.25)

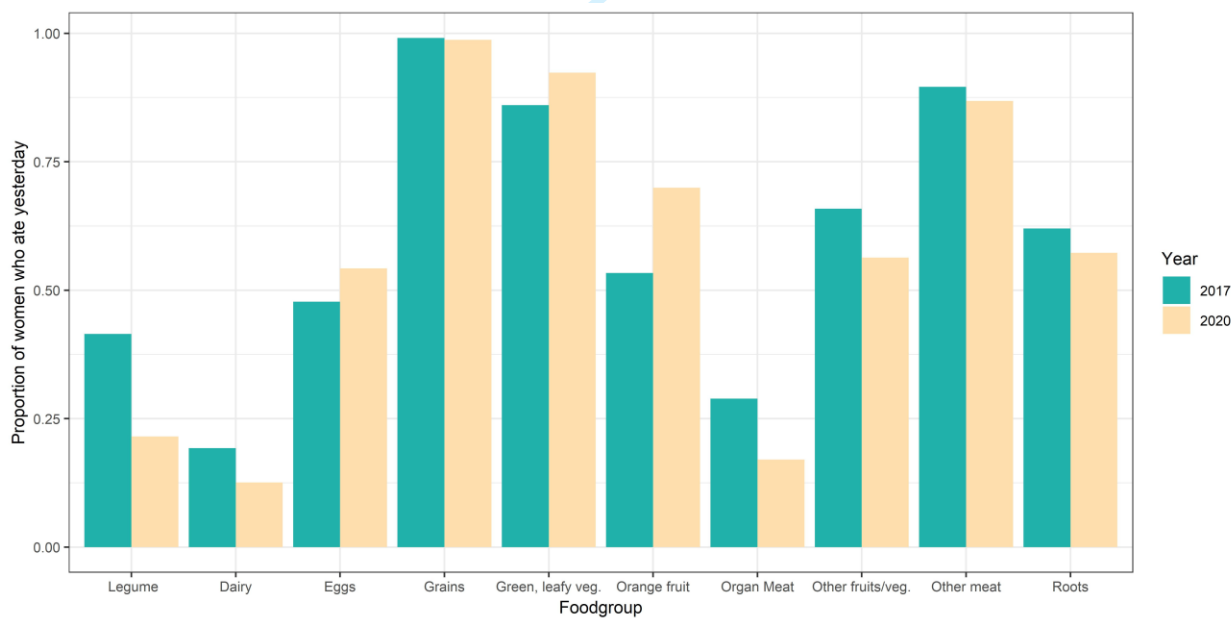
\*represents statistical significance at  $p < 0.05$



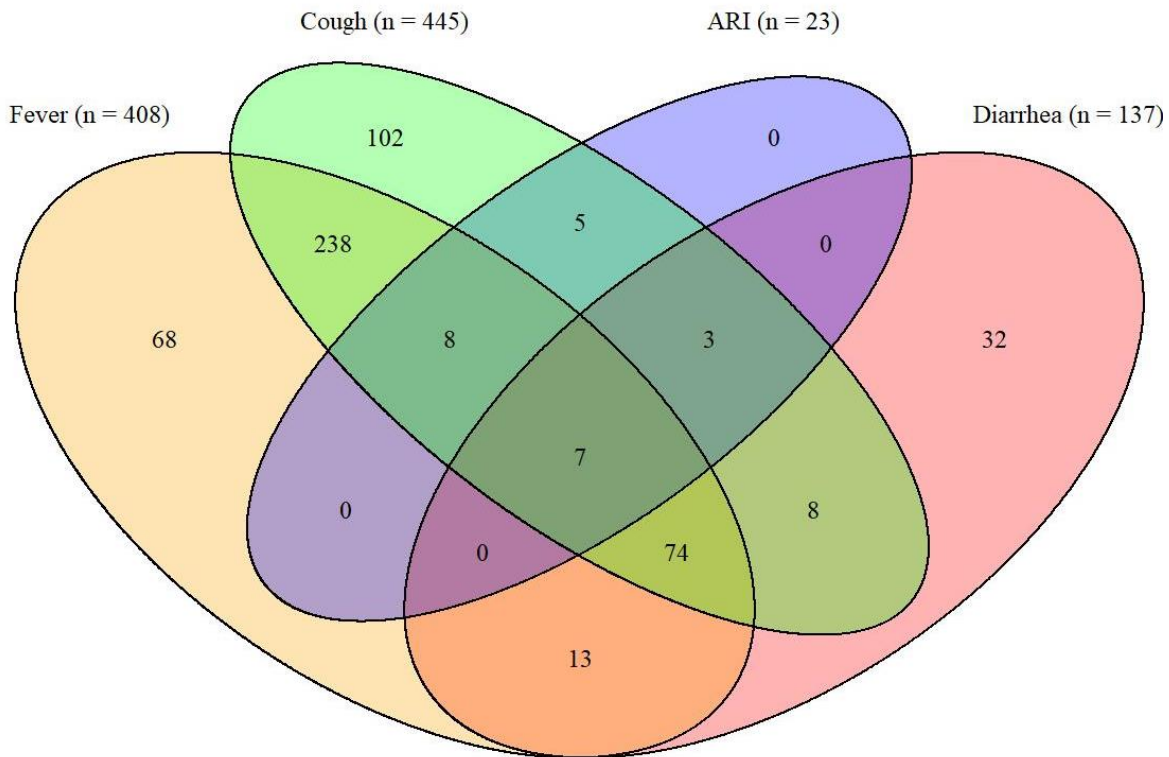
**Figure S1.** Directed acyclic graph (DAG) indicating the minimum set of covariates (yellow) to remove backdoor pathways between exposures (blue) and outcomes (green). White boxes are unmeasured upstream influences. Covariates indicated with an asterisk (\*) are unmeasured. FCS = Food Consumption Score; DDS = Dietary Diversity Score; CSI = Coping Strategies Index.



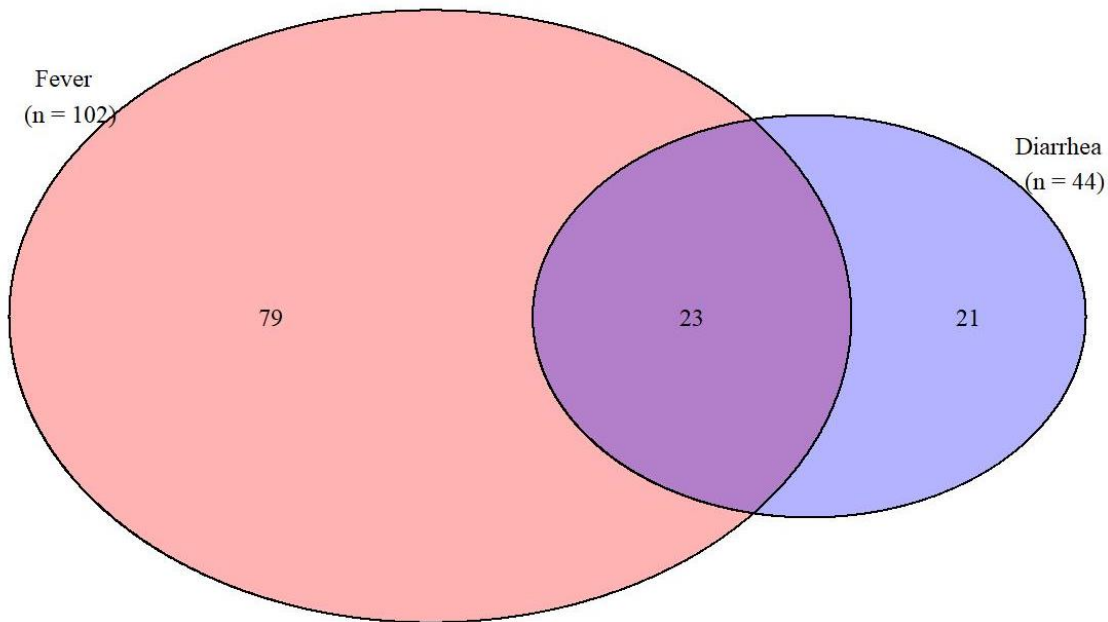
**Figure S2.** Prevalence of food group consumption in children 6-59 months, past 24 hours



**Figure S3.** Prevalence of food group consumption in mothers of children <59 months, past 24 hours



**Figure S4.** Venn diagram showing distribution of symptoms among the 557 children with fever, cough, ARI, or diarrhea in the past two weeks.



**Figure S5.** Venn diagram showing distribution of symptoms among the 123 mothers with fever or diarrhea in the past two weeks.

# Survey tool

## Endline Interview Questionnaire – 2020

### Health and Nutrition Assessment

#### Introductory Statement to the Interview

Good Morning/Good Afternoon.

My name is \_\_\_\_\_ and I am here on behalf of the Primary Health Care program. We are conducting a survey on the health and nutritional status of women and children. You have been selected by chance from the list of families with children under the age of five. Is this correct? The purpose of this interview is to obtain information about the health and nutrition status of you and your child. We are interested in interviewing mothers of children aged five or less. Are you the mother of the child? *(If no), Is the mother of the child at home? (If yes, wait until she arrives, and re-explain purpose).* Could you please spare some time (around 45 minutes) for the interview? The information you give will be confidential and will only be used to prepare a report of general findings – but will not include any names. You will not get any additional entitlements because of the interview. At any time during the survey, you are free to stop the survey, or choose not answer any question. If you are willing to participate in this survey, please indicate your oral consent by saying “yes” or “no”.

#### May I start now?

- Yes, permission is given ⇒ Go to 101 to begin the interview.
- No, permission is not given ⇒ Tell this result to your supervisor and move to the next household.

**Enumerators**– *If the respondent is not willing, do not ask any of the questions and move to the next household. If the household contains children under the age of 5, but the mother is not present, ask when it is a good time to return, and return at a later time. We only want to interview mothers of children under the age of 5.*

General Information				
No.	Item	Name		
101	District			
102	Village			
103	Date of interview	DD	MM	YYYY
		--	--	2016
104	Interviewer's Name/Number	--		

Household Demographic Information			
First, we would like to ask some questions about yourself and the people who live in this household.			
No.	Question	Response	Notes
201	How old are you?	Age (in completed years): __ __	
202	To what ethnic group does the head of this household belong?	1.....Lao Lom 2.....Hmong 3.....Khmu 4.....Mien 5.....Lue 6.....Akha 7.....Muser 98.....Other (Specify.....)	
203	What is your marital status?	1.....Married (monogamous) 2.....Married (polygamous) 3.....Not married, but living with a man 4.....Single 5.....Divorced or separated 6.....Widowed	



204	What is your relationship to the head of the household (HHH)?	1..... Head of household 2..... Wife of the HHH 3..... Daughter of the HHH 4.....Daughter in law of HHH 5.....Granddaughter of HHH 98...Other relation	1 → 206 2 → 206
205	Is the head of the household male or female?	0.....Female 1.....Male	<i>if 204 ≠ 1 or 2</i>
206	Have you ever attended school?	1.....Yes 0.....No	0 → 208
207	What is the highest level of school you completed?	1.....Preschool 2.....Primary 3.....Lower Secondary 4.....Upper secondary 5.....Post-secondary vocational, tertiary/ diploma 6.....Higher	<i>if 206 = 1</i>
208	Did the head of the household attend school?	1.....Yes 0.....No 99...Don't know	<i>if 204≠1</i> 1 → 209 0 → 210
209	What is the highest level of school completed by the head of the household?	1.....Preschool 2.....Primary 3.....Lower Secondary 4.....Upper secondary 5.....Post-secondary vocational, tertiary/ diploma 6.....Higher 99...Don't know	<i>if 208 = 1</i>
210	How many household members are aged 15 years or more?	_____	

	<i>Prompt to include self in this count</i>		
211	How many household members are below 15 years of age?	___ ___	
212	How many household members are below 5 years of age?	___ ___	Check: 212 ≤ 211
213	How many members are in your own family?	___ ___	

<b>Dietary Intake</b>			
Now we would like to ask some questions about the diet of yourself and one of your children. Enumerators, if there are more than one children under the age of five, randomly select one child. Ask the name of the child, and use that name for the rest of the interview.			
No.	Question	Response	Notes
400	When was this child born? <i>Probe: Using MCH book, house registration, other official document</i>	___ ___ ___	
401	How many months old is this child? <i>Probe: Using important holidays, dates, etc.</i>	___ ___ months	0-59 only!
402	Is the child selected (Child's name) your youngest child? <i>Probe: the last child of alive children?</i>	1.....Yes 0.....No	
403	Yesterday during the day or night, was your diet a typical diet? <i>Probe: She had special ceremonies or illnesses that led her to have less or much more than her typical eating.?</i>	1.....Yes 2.....No. I ate more. 3.....No. I ate less 99.....Do not know	
404	Yesterday during the day or night, did you eat more or less or same amount of food compared to your eating before this pregnancy?	1.....Increased amount 2.....Same amount 3.....Decreased amount 99.....Do not know	<i>if 226=1 (currently pregnant)</i>
405	Yesterday during the day or night, did you eat more or less or same amount of animal source foods compared to your eating before this pregnancy?	1.....Increased amount 2.....Same amount 3.....Decreased amount 99.....Do not know	<i>if 226=1 (currently pregnant)</i>

	<i>Probe: Using examples of animal food or product in their general contexts and comparing with her usual eating style</i>		
<b>406</b>	<p>I would like to ask you about foods that you may have had yesterday during the day or night. I am interested to know whether you had the item even if combined with other foods. Please include foods consumed outside of your home.</p> <p>YESTERDAY DURING THE DAY OR NIGHT, DID YOU DRINK/EAT (FOOD GROUP ITEMS)?</p> <p><i>Questions and filters (Circle the corresponding code and you can underline more than one answer)</i></p> <p>Always start with: 'YESTERDAY DID YOU EAT...'</p>		
<b>406a</b>	<p>Any offal items (excluding intestines)?</p> <p><i>Probe: such as liver, brain, lung, heart, gizzard, kidney, of any animal</i></p>	<p>1.....Yes 0.....No 99.....Do not know</p>	
<b>406b</b>	<p>The intestine of any animal?</p>	<p>1.....Yes 0.....No 99.....Do not know</p>	
<b>406c</b>	<p>Any kind of meat?</p> <p><i>Probe: such as any meat, such as beef (fresh or dry), buffalo, pork, goat, chicken, goose, duck, sausage, blood sausage, sour sausage</i></p>	<p>1.....Yes 0.....No 99.....Do not know</p>	
<b>406d</b>	<p>Any kind of eggs?</p> <p><i>Probe: 'such as?' eggs from chicken, duck, turtle or other animals</i></p>	<p>1.....Yes 0.....No 99.....Do not know</p>	
<b>406e</b>	<p>Any kind of fish or aquatic animals?</p> <p><i>Probe: 'such as?' fresh, fermented or dried fish, swamp eel, squid, shrimp (fresh or dry), crab, granulated ark, clam, snail, frog, water insects</i></p>	<p>1.....Yes 0.....No 99.....Do not know</p>	
<b>406f</b>	<p>Any kind of wild animals?</p> <p><i>Probe: 'such as?' lizard, rat, rabbit, wild bird, small birds</i></p>	<p>1.....Yes 0.....No 99.....Do not know</p>	

1 2 3 4 5 6 7	<b>406g</b>	Any kind of insects or grubs?  <i>Probe: 'such as?' silk worm pupa, cricket, weaver ant, ant egg, etc.</i>	1.....Yes 0.....No 99.....Do not know	
8 9 10 11 12 13	<b>406h</b>	Any kind of dairy products (not including coffee creamer)?  <i>Probe: 'such as?' cheese (butter), yogurt, or other milk products</i>	1.....Yes 0.....No 99.....Do not know	
14 15 16 17	<b>406i</b>	Other foods that came from an animal. Example: pork skin	1.....Yes 0.....No 99.....Do not know	
18 19 20 21 22 23	<b>406j</b>	Sticky rice (refined or unrefined), roasted rice, rice, pre-chewed rice, rice noodles, maize, noodles, thick porridge, or other foods made from grains?	1.....Yes 0.....No 99.....Do not know	
24 25 26 27 28 29	<b>406k</b>	White or purple coloured foods from roots such as white yams, purple yams, yam bean, cassava, white radish, white potato, or any other white or purple colored foods from roots.	1.....Yes 0.....No 99.....Do not know	
30 31 32 33	<b>406l</b>	Pulses/lentils/tofu/bean curd	1.....Yes 0.....No 99.....Do not know	
34 35 36 37	<b>406m</b>	Nuts or seeds (e.g. Sesame seeds, mung bean, ground bean, sun flower seed, cashew nuts etc.)	1.....Yes 0.....No 99.....Do not know	
38 39 40 41 42	<b>406n</b>	Any dark green leafy vegetables such as pak choi, swamp cabbage, morning glory, sweet potato leaves, Chinese kale	1.....Yes 0.....No 99.....Do not know	
43 44 45 46 47	<b>406o</b>	Ripe orange fleshed mangoes, ripe orange fleshed papayas, pumpkin, carrots, sweet potatoes that are yellow or orange inside?	1.....Yes 0.....No 99.....Do not know	
48 49 50	<b>406p</b>	Other vegetables	1.....Yes 0.....No 99.....Do not know	
51 52 53 54	<b>406q</b>	Other fruit	1.....Yes 0.....No 99.....Do not know	
55 56 57 58 59 60	Now, I would like to ask about feeding practices for your child selected.			

1			
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5	<b>407</b>	Has (CHILD'S NAME) ever been breastfed?	1.....Yes 0.....No <i>if 401 &lt; 24</i> 0 → 409
6			
7	<b>408</b>	Was (CHILD'S NAME) breastfed yesterday, either during the day or the night?	1.....Yes 0.....No 99.....Do not know <i>if 401 &lt; 24</i> & 407 = 1
8			
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11	<b>409</b>	Did (NAME) drink anything from a bottle with a nipple yesterday, during the day or night?	1.....Yes 0.....No 99.....Do not know <i>if 401 &lt; 24</i>
12			
13			
14	<b>410</b>	Did (NAME) drink or eat vitamin or mineral supplements yesterday, during the day or night?	1.....Yes 0.....No 99.....Do not know <i>if 401 &lt; 24</i>
15			
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18	<b>411</b>	How long after birth did you first put (NAME) to the breast?  <i>If immediately, record 00. If less than 24 hours, record hours. If over 24 hours, record 25. If unknown, record 99.</i>	_____ hours  <i>if 401 &lt; 24</i> & 407 = 1
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27	<b>412</b>	Did (CHILD'S NAME) have any liquid other than breast milk, such as canned, powdered or fresh animal milk, infant formula, juice, thin porridge, or clear soup (Nam Keang) yesterday, during the day or night?	1.....Yes 0.....No 99.....Do not know <i>if 401 &lt; 24</i> 0 → 413 99 → 413
28			
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35	<b>412a</b>	How many times did (CHILD'S NAME) receive milk other than breastmilk, such as canned, powdered or fresh animal milk, or infant formula?	_____ times 99.....Do not know <i>if</i> <i>401 = 6-23</i> & 412 = 1
36			
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40	<b>413</b>	When do you think is the best time to start breastfeeding a child after giving birth?	<b>Enumerators: read off all answer choices and circle the best one</b>  1.....Within the first hour after giving birth 2.....Within the first six hours after giving birth 3.....Within the first twelve hours after giving birth 4.....Within one day after giving birth 99.....Do not know
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<b>414</b>	<p>I would like to ask you about foods that the selected child (CHILD'S NAME) may have had yesterday during the day or night. I am interested to know whether HE/SHE had the item even combined with other foods. Please include foods consumed outside of your home.</p> <p>YESTERDAY DURING THE DAY OR NIGHT, DID THE SELECTED CHILD (CHILD'S NAME) DRINK/EAT (FOOD GROUP ITEMS)?</p> <p>Always start with: 'YESTERDAY DID (NAME) EAT....'</p>	<i>if 401 ≥ 6</i>
<b>414a</b>	Commercially fortified baby food, e.g., cerelac	1.....Yes 0.....No 99.....Do not know
<b>414b</b>	Sticky rice (white or brown), roasted rice, rice, pre-chewed rice, rice noodles, maize, noodles, porridge, or other foods made from grains?	1.....Yes 0.....No 99.....Do not know
<b>414c</b>	Pumpkin, carrots or sweet potatoes that are yellow or orange inside?	1.....Yes 0.....No 99.....Do not know
<b>414d</b>	White or purple coloured foods from roots such as white yams, purple yams, yam bean, cassava, white radish, white potato, or any other white or purple colored foods from roots.	1.....Yes 0.....No 99.....Do not know
<b>414e</b>	Any dark green, leafy vegetables such as pak choi, swamp cabbage, morning glory, sweet potato leaves, Chinese kale?	1.....Yes 0.....No 99.....Do not know
<b>414f</b>	Ripe or orange-fleshed mangos, or papayas	1.....Yes 0.....No 99.....Do not know
<b>414g</b>	Any other fruits or vegetables	1.....Yes 0.....No 99.....Do not know
<b>414h</b>	Liver, brain, lung, heart, gizzard, kidney, intestine, or other organ of any animal	1.....Yes 0.....No 99.....Do not know
<b>414i</b>	Any meat, such as beef (fresh or dry), buffalo, pork, lamb, goat, chicken, goose, duck, sausage, blood sausage, sour sausage	1.....Yes 0.....No 99.....Do not know
<b>414j</b>	Eggs from chicken, duck, turtle or other animals	1.....Yes 0.....No

		99.....Do not know	
<b>414k</b>	Fresh, fermented or dried fish, swamp eel, squid, shrimp (fresh or dry), shellfish, crab, granulate ark, clam, snail	1.....Yes 0.....No 99.....Do not know	
<b>414l</b>	Any wild animals such as lizard, frog, rat, rabbit, wild bird, small bird	1.....Yes 0.....No 99.....Do not know	
<b>414m</b>	Insects or grubs such as silk worm pupa, cricket, weaver ant, any insect eggs, water insects	1.....Yes 0.....No 99.....Do not know	
<b>414n</b>	Any foods made from beans, Leucanea (bean), common pea, lentils, or nuts, including tofu?	1.....Yes 0.....No 99.....Do not know	
<b>414o</b>	Cheese, yogurt, or other food made from milk?	1.....Yes 0.....No 99.....Do not know	
<b>414p</b>	Any oil, pork fat, or butter or foods made with any of these	1.....Yes 0.....No 99.....Do not know	
<b>414q</b>	Any packaged foods such as packaged noodles, chocolates, sweets, candies, pastries, cakes, or biscuits	1.....Yes 0.....No 99.....Do not know	
<b>415</b>	How meals (solid or semi-solid food) did (CHILD'S NAME) eat yesterday?  <i>Enter 99 if unknown</i>	_____ times  99.....Do not know	<i>if 401 ≥ 6</i>
<b>416</b>	Did (CHILD'S NAME) eat any solid, semi-solid or soft foods (such as porridge, rice, pre-chewed rice, fruits, bread, meat, eggs, vegetables) yesterday?	1.....Yes 0.....No 99.....Do not know	<i>if 401 &lt; 6</i> <i>0 → 418</i> <i>99 → 418</i>
<b>417</b>	In the first three days after delivery or when you returned to work in the rice field, was ( <i>name</i> ) given anything to drink other than breast milk?	1.....Yes 0.....No 99.....Do not know	<i>if 401 &lt; 6</i> <i>&amp; 407 = 1</i>
Now, I understand eating pattern of you and your child. I would now like to ask more about eating practices of women who are breastfeeding.			
<b>418</b>	Yesterday during the day or night, did you eat more or less or same amount of food compared to your eating before this pregnancy?	1.....Increased amount 2.....Same amount 3.....Decreased amount 99.....Do not know	<i>if 401 &lt; 6</i> <i>&amp; 407 = 1</i>

	<i>Probe: Comparing with her usual eating style.</i>		
419	Yesterday during the day or night, did you eat more or less amount of animal source foods compared to your eating before this pregnancy?  <i>Probe: Using example of animal food or product in their general contexts and comparing with her usual eating style.</i>	1.....Increased amount 2.....Same amount 3.....Decreased amount 99.....Do not know	<i>if 401 &lt; 6 &amp; 407 = 1</i>

Household Food Security and Expenditures		
No.	Question	Response
I would like to ask you some questions about how much your household spends on health services and other things. <i>For all questions in this section report all values in local currency, whether paid in cash or in kind</i>		
501	In the last 4 weeks, how much did your household spend on:  Food, including such things as [rice], meat, fruits, vegetables, and cooking oils. Include the value of any food that was produced and consumed by the household, and exclude alcohol, tobacco and restaurant meals.	_____,000 kip
502	In the last 4 weeks, how much did your household spend on:  Housing, gas, electricity, water, telephone, and heating fuel	_____,000 kip
503	In the last 4 weeks, how much did your household spend on:  Education fees and supplies	_____,000 kip
504	In the last 4 weeks, how much did your household spend on:  Health care costs	_____,000 kip
505	In the last 4 weeks, how much did your household spend on:  All other goods and services not yet mentioned	_____,000 kip
506	In the last 4 weeks, how much did your household spend in total? (Should equal 501 + 502 + 503 + 504 + 505)	_____,000 kip
507	In the <b>past month</b> , how often have you used any of the methods when you did not have enough food or money to buy food?	
507a	Rely on less preferred, less expensive foods?	1.....1 day per week 2.....1-2 days a week



		3.....3-4 days a week 4.....5-6 days a week 5.....Daily 6.....Never/<1 time per week
507b	Borrow food or money from friends or relatives?	1.....1 day per week 2.....1-2 days a week 3.....3-4 days a week 4.....5-6 days a week 5.....Daily 6.....Never/<1 time per week
507c	Limit portions at mealtimes?	1.....1 day per week 2.....1-2 days a week 3.....3-4 days a week 4.....5-6 days a week 5.....Daily 6.....Never/<1 time per week
507d	Limit adult intake?	1.....1 day per week 2.....1-2 days a week 3.....3-4 days a week 4.....5-6 days a week 5.....Daily 6.....Never/<1 time per week
507e	Reduce number of meals per day?	1.....1 day per week 2.....1-2 days a week 3.....3-4 days a week 4.....5-6 days a week 5.....Daily 6.....Never/<1 time per week
Now I would like to ask you some questions about food that the household ate in the last 7 days		
	<p><b>508.</b> How many <b>days</b> in the past week (last 7 days) did your household eat the following foods? Number of days eaten (out of last 7 days)</p>	<p><b>509</b> What is the source of this food for each item mentioned? <i>if 508 &gt; 0</i></p> <p>Food Source Code:</p> <ol style="list-style-type: none"> <li>1. Home grown crop or livestock production</li> <li>2 Purchased food</li> <li>3 Gathered forest products</li> <li>4 Hunting/fishing</li> <li>5 Borrowed</li> </ol>

			6 Food aid 7 Exchanged/barter 8 Gift from family/relatives
A. Rice (sticky rice, white rice)			
B. Maize / Corn			
C. Cassava			
D. Other roots of tubers (potatoes, yam)			
E. Pulses/Lentils/Tofu/Bean Curd			
F. Vegetables (green leafy, carrot, pumpkin...)			
G. Bamboo shoots / mushrooms			
H. Fruits			
I. Fish, fish paste			
J. Other aquatic animals (crab, snail, shrimp...)			
K. Meat (beef, pork, chicken)			
L. Wild animals/Insects			
M. Eggs			
N. Milk			
O. Sugar			
P. Oil/Butter/Animal Fat			
<b>510</b>	How many hours in the past week did you spend gathering food from the forest?		<i>if any</i> 509 = 3
<b>511</b>	How many hours in the past week did you spend hunting?		<i>if any</i> 509 = 4
<b>512</b>	How many hours in the past week did you spend fishing?		<i>if any</i> 509 = 4
<b>513</b>	Compared to before the pandemic, is it easier or harder to meet your family's food needs?	1. Much easier 2. Somewhat easier 3. No change 4. Somewhat harder 5. Much harder 99. Don't know/no answer	1 → 514 2 → 514 3 → 514 99 → 514
<b>513a</b>	What is the reason it is harder to meet your food needs during the pandemic?  Select all that apply	1. Items are more expensive 2. Markets being closed 3. Foods not available 4. HH had lost income.	<i>if 513 =</i> 4 or 5

		98. Others (specify) 99. Don't know/no answer	
<b>514</b>	Did you lose income due to the pandemic?	1. Yes 0. No 99. Don't know/no answer	0→515 99→515
<b>514a</b>	If yes, how much did you lose, as a proportion of your income? (give best guess)	1. 0-25% 2. 25-50% 3. 50-75% 4. 75-100%	<i>if 514=1</i>
<b>515</b>	Do you spend less money due to the pandemic?	1. Yes 0. No 99. Don't know/no answer	0→516 99→516
<b>515a</b>	If yes, how much did you spend less, as a proportion of your expenditure? (give best guess)	1. 0-25% 2. 25-50% 3. 50-75% 4. 75-100%	<i>if 515=1</i>
<b>516</b>	Is it more difficult to access health services now compared to before the pandemic?	1. Much easier 2. Somewhat easier 3. No change 4. Somewhat harder 5. Much harder	

<b>VI. Illness and Treatment</b>			
Now we would like to ask about any recent illnesses that the selected child (CHILD'S NAME) may have had.			
No.	Question	Response	
<b>601</b>	Did (CHILD'S NAME) have diarrhea in the past two weeks, where diarrhea is defined as three or more loose stools or one loose, bloody stool in a 24 hour period?	1.....Yes 0.....No 99.....Do not know	0→603 99→603
<b>602a</b>	Now I would like to know how much (CHILD'S NAME) was given to drink, including breast milk, during the diarrhea  Was he/she given less than usual to drink, about the same amount, or more than usual to drink?  <i>If less, probe: Was he/she given much less than usual to drink or somewhat less?</i>	1.....Much less 2.....Somewhat less 3.....About the same 4.....More 5.....Nothing to drink 99.....Do not know	<i>if 601 = 1</i>

1 2 3 4 5 6 7 8 9 10 11	<b>602b</b>	During the time (CHILD'S NAME) had diarrhea, was HE/SHE given either: a) A fluid made from a special packet called (ORALYTE/NAM THA LAY PHOUN)? b) Recommended homemade fluid such as coconut water or rice water with salt?	1.....Yes, Nam Tha Lay Phoun 2.....Yes, Recommended Homemade Fluid 3.....No 99.....Do not know	<i>if 601 = 1</i>
12 13 14 15 16 17 18 19 20	<b>602c</b>	When (CHILD'S NAME) had diarrhea, was he/she given less than usual to eat, about the same amount, or more than usual to eat?  <i>If less, probe: Was he/she given much less than usual to eat or somewhat less?</i>	1.....Much less 2.....Somewhat less 3.....About the same 4.....More 5.....Nothing to eat 99....Do not know	<i>if 601 = 1</i>
21 22 23	<b>603</b>	Has (CHILD'S NAME) been ill with a fever any time in the past two weeks?	1.....Yes 0.....No 99.....Do not know	
24 25 26 27	<b>604</b>	Has (CHILD'S NAME) had an illness with a cough at any time in the last two weeks?	1.....Yes 0.....No 99.....Do not know	0→605 99→605
28 29 30 31 32 33	<b>604a</b>	When (CHILD'S NAME) was sick with a cough, did he/she breathe faster than normal with short, rapid breaths or have difficulty breathing?	1.....Yes 0.....No 99.....Do not know	<i>if 604 = 1</i> 0→605 99→605
34 35 36 37 38	<b>604b</b>	Was the fast or difficult breathing due to a problem in the chest or to a blocked or runny nose?	1.....Chest only 2.....Nose only 3.....Both 99.....Do not know	<i>if 604a = 1</i>
39 40 41 42	<b>605</b>	At any time during the past two weeks, did you ( <i>mother</i> ) have diarrhea?	1.....Yes 0.....No 99.....Do not know	
43 44 45 46 47 48 49 50 51 52	<b>606</b>	At any time during the past two weeks, have you ( <i>mother</i> ) been ill with a fever?	1.....Yes 0.....No 99.....Do not know	
53 54 55 56 57 58 59 60	<b>607</b>	When (CHILD'S NAME) was sick, did you seek advice or treatment from any source?	1.....Yes 0.....No 99.....Do not know	<i>if 601, 603 or 604 = 1</i> 0→609 99→609
	<b>608</b>	From where did you seek advice or treatment?	1...Government hospital 2.....Health centre	<i>if 607 = 1</i>

	<p><i>Probe: Anywhere else?</i></p> <p><i>(Multiple response)</i></p>	<p>3...Village health worker</p> <p>4.....Outreach team</p> <p>5...Lao Women Union worker</p> <p>6...Private hospital/clinic</p> <p>7.....Private physician</p> <p>8.....Private pharmacy</p> <p>9.....Mobile Clinic</p> <p>10.....Relative/friend</p> <p>11.....Shop</p> <p>12...Traditional healer</p> <p>98.....Other</p>	
<b>609</b>	<p>When (YOU) was sick, did you seek advice or treatment from any source?</p>	<p>1.....Yes</p> <p>0.....No</p> <p>99.....Do not know</p>	<p><i>if 605 or 606=1</i></p> <p>0 → 700</p> <p>99→ 700</p>
<b>610</b>	<p>From where did you seek advice or treatment?</p> <p><i>Probe: Anywhere else?</i></p> <p><i>(Multiple response)</i></p>	<p>1.....Government hospital</p> <p>2.....Health centre</p> <p>3.....Village health worker</p> <p>4.....Outreach team</p> <p>5.....Lao Women Union worker</p> <p>6.....Private hospital/clinic</p> <p>7.....Private physician</p> <p>8.....Private pharmacy</p> <p>9.....Mobile Clinic</p> <p>10.....Relative/friend</p> <p>11.....Shop</p> <p>12...Traditional healer</p> <p>98.....Other</p>	<p><i>if 609 = 1</i></p>

VIII. Anthropometry			
No	Question	Response	Notes
	<p>As part of this survey, we are measuring the growth of children 0-59 mo. Child growth is an important indicator of health. Poor growth is a serious health problem that usually results from poor nutrition, poor sanitation, or infection. This measurement will help us design programs to improve child health. We will share with you the measurements, but will not share the information with anyone else outside the survey team. Do you have any questions?</p>		

1 2 3 4 5	901	What is the age, in months, of (NAME)?	_____	Same as 401
6 7	902	What is the sex of (NAME)?	0.....Female 1.....Male	
8 9 10 11 12	903	<b>Enumerator:</b> Check for bilateral pitting edema	1.....Present 0.....Not present 99...Unsure 98....Not checked	1→906
13 14 15 16 17 18 19 20 21 22 23 24	904	Now I am going to weigh (NAME).  <b>Enumerator:</b> If the child is under 2 years old, weigh the mom by herself. The child should wear as few clothes as possible. If the child is wearing clothes, weigh the mom holding an extra pair of clothes (if an extra pair exists) similar to the weight of the clothes the child is wearing. Tare the scale. Then weigh the mom holding the child. Record the weight of the child.	_____ . _____ kg	if 903 =0
25 26 27 28 29 30 31	905	<b>Enumerator:</b> was (NAME) undressed to the minimum?  (note...if child was dressed but mother held clothes, indicate 'no clothes')	0.....No clothes 1.....Few clothes 2.....Many clothes	
32 33 34 35 36	906	Now I am going to measure the arm of (NAME).  <b>Enumerator:</b> record the MUAC measurement, in cm	_____ . _____ cm	if 401 ≥ 6
37 38 39	907	Record the color of the MUAC tape	1.....Green 2.....Yellow 3.....Red	if 401 ≥ 6
40 41 42 43 44 45 46 47	908	Now I am going to measure the height of (NAME).  <b>Enumerator:</b> record the height measurement of the child, in cm. If the child is less than 23 months, measure the child lying down.	_____ . _____ cm	
48 49	909	How was the person actually measured? Lying down or standing up?	1.....Lying down 2.....Standing	
50 51 52 53 54 55 56 57 58 59 60	910	Now I am going to measure your arm.  <b>Enumerator:</b> record the MUAC measurement of the mother, in cm.	_____ . _____ cm	

**Closing Statement to the Interview**

The interview is complete. Thank you so much for your time and patience. Your help will allow us to work together to improve the health and nutrition of your child and community.

**Enumerators:** *indicating completeness:*

- Yes, interview is complete ⇒ Move to the next household
- No, interview was not complete ⇒ Tell this result to your supervisor and move to the next household.

For peer review only

Ethical approval

ສາທາລະນະລັດ ປະຊາທິປະໄຕ ປະຊາຊົນລາວ  
ສັນຕິພາບ ເອກະລາດ ປະຊາທິປະໄຕ ເອກະພາບ ວັດທະນາຖາວອນ



ກະຊວງສາທາລະນະສຸກ  
ມະຫາວິທະຍາໄລ ວິທະຍາສາດ ສຸຂະພາບ  
ຄະນະກຳມະການຈັນຍາທຳການຄົ້ນຄວ້າວິທະຍາສາດ  
ເບີໂທ: 021 240255

ເລກທີ 131-- /ຄຈສ  
ນະຄອນຫຼວງວຽງຈັນ, ວັນທີ 19 FEB 2021

**ໃບອະນຸມັດຈັນຍາທຳ**

ຊື່ໂຄງການ: ສຶກສາຜົນກະທົບຈາກການລະບາດຂອງພະຍາດໂຄວິດ ຕໍ່ກັບຄວາມປອດໄພ ແລະ ການບໍລິໂພກອາຫານ, ການເຂົ້າເຖິງການບໍລິການສາທາລະນະສຸກ ແລະ ການໃຊ້ຈ່າຍ ໃນແຕ່ລະຄອບຄົວ ຢູ່ທາງພາກເໜືອຂອງ ສປປ ລາວ (ບົດ Proposal version 2.1, ລົງວັນທີ 09 ກຸມພາ ປີ 2021).

ຊື່ຜູ້ຄົ້ນຄວ້າຫຼັກ: ປອ. ດຣ ເພັດສະຫວັນ ຈັນທະວິໄລ, ຮອງຫົວໜ້າພະແນກຄົ້ນຄວ້າວິທະຍາສາດ, ສະຖາບັນຄົ້ນຄວ້າ ແລະ ພັດທະນາການສຶກສາ.

ໄລຍະເວລາການອະນຸມັດ: 01 ປີ.

ຄະນະກຳມະການຈັນຍາທຳການຄົ້ນຄວ້າວິທະຍາສາດ ໄດ້ທຳການພິຈາລະນາໂຄງການຄົ້ນຄວ້າດັ່ງກ່າວ ແລະ ເຫັນວ່າ ການຄົ້ນຄວ້າດັ່ງກ່າວນີ້ຈະບໍ່ສົ່ງຜົນກະທົບທາງດ້ານສຳຮາກ ແລະ ຈິດໃຈຂອງຜູ້ທີ່ເຂົ້າຮ່ວມໃນການສຶກສາ ແລະ ບໍ່ແຕະຕ້ອງ ເຖິງບັນຫາຈັນຍາທຳຂອງການຄົ້ນຄວ້າ. ໂຄງການຄົ້ນຄວ້າດັ່ງກ່າວນີ້ຈະມີຜົນປະໂຫຍດອັນໃຫຍ່ຫຼວງ ໃນການປະກອບ ສ່ວນວຽກງານການສົ່ງເສີມສຸຂະພາບ ໂດຍທາງກົງ ແລະ ທາງອ້ອມ ຕໍ່ຜູ້ເຂົ້າຮ່ວມການສຶກສາ, ແລະ ເປັນຂໍ້ມູນພື້ນຖານ ທີ່ສຳຄັນໃນການຄົ້ນຄວ້າຕໍ່ໄປແກ່ ວົງການສາທາລະນະສຸກລາວ ແລະ ຂະແໜງການວິທະຍາສາດ ໃນອະນາຄົດ.

ດັ່ງນັ້ນ, ຄະນະກຳມະການຈັນຍາທຳການຄົ້ນຄວ້າຂອງ ມະຫາວິທະຍາໄລ ວິທະຍາສາດ ສຸຂະພາບ ຈຶ່ງຕົກລົງເຫັນ ດີອະນຸມັດດ້ານຈັນຍາທຳການຄົ້ນຄວ້າສຳລັບໂຄງການດັ່ງກ່າວນີ້. ຜູ້ເຮັດການຄົ້ນຄວ້າຫຼັກຕ້ອງຮັບປະກັນວ່າທຶມງານຄົ້ນ ຄວ້າທັງໝົດໄດ້ຮັບຮູ້ ກ່ຽວກັບ ເງື່ອນໄຂຂອງການອະນຸມັດຈາກຄະນະກຳມະການຈັນຍາທຳການຄົ້ນຄວ້າ ຂອງ ມວສ ລວມທັງເອກະສານທີ່ຖືກອະນຸມັດ. ຜູ້ເຮັດການຄົ້ນຄວ້າຫຼັກຕ້ອງໄດ້ແຈ້ງໃຫ້ກອງເລຂາຂອງຄະນະກຳມະການຈັນຍາທຳ ຄົ້ນຄວ້າຮັບຊາບຖ້າມີ ການແກ້ໄຂເພີ່ມເຕີມ ຫຼື ການປ່ຽນແປງ ແລະ ຕ້ອງລາຍງານຄວາມຄືບໜ້າຂອງໂຄງການຄົ້ນຄວ້າ ຄືດັ່ງລຸ່ມນີ້:

- ກໍລະນີມີການປ່ຽນແປງໃດໆທີ່ມີຄວາມສຳຄັນຕໍ່ກັບໂຄງການ ແລະ ເຫດຜົນຂອງການປ່ຽນແປງນັ້ນ, ລວມທັງຂໍ້ບົ່ງ ຊີ້ທາງດ້ານຈັນຍາທຳ;
- ເກີດຜົນກະທົບທີ່ຮ້າຍແຮງຕໍ່ຜູ້ເຂົ້າຮ່ວມ ແລະ ການແກ້ໄຂຜົນກະທົບດັ່ງກ່າວ;
- ເກີດເຫດການທີ່ບໍ່ໄດ້ຄາດຄິດ ຫຼື ຄາດເດົາລ່ວງໜ້າ;
- ກໍລະນີຜູ້ເຮັດການຄົ້ນຄວ້າຫຼັກບໍ່ສາມາດສືບຕໍ່ເຮັດໜ້າທີ່ຂອງຕົນໄດ້ ຫຼື ມີການປ່ຽນແປງໃດໆທີ່ກ່ຽວຂ້ອງກັບບຸກ ຄົນໃນໂຄງການຄົ້ນຄວ້າດັ່ງກ່າວ;
- ກໍລະນີມີການຊີ້ປະກັນໄພຄຸ້ມຄອງຜູ້ເຂົ້າຮ່ວມການສຶກສາ ແລະ ການປະກັນໄພໝົດກຳນົດ;
- ເກີດຄວາມຊັກຊ້າໃນການເລີ່ມຕົ້ນໂຄງການເກີນກວ່າ 12 ເດືອນ; ແລະ
- ມີການຍຸຕຕິ ຫຼື ປິດໂຄງການຄົ້ນຄວ້າກ່ອນໂຄງການຈະສຳເລັດ.

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ເອກະສານທີ່ອະນຸມັດ

ເອກະສານທີ່ໄດ້ຮັບການທົບທວນຝ່າຍລະນາ ແລະ ອະນຸມັດຈາກ ຄະນະສຳມະການຈັນຍາທຳການຄົ້ນຄວ້າວິທະຍາສາດ

ເອກະສານປະກອບ	ສະບັບທີ (version)	ວັນທີ
ບົດສະເໜີໂຄງການຄົ້ນຄວ້າ	Version 2.1	09 ກຸມພາ ປີ 2021
ເຄື່ອງມືເກັບຂໍ້ມູນ (ແບບຟອມສອບຖາມ ແລະ ອື່ນໆ)	Version 1.3	09 ກຸມພາ ປີ 2021

ປະທານ

ຄະນະສຳມະການຈັນຍາທຳຄົ້ນຄວ້າວິທະຍາສາດ



ດຣ.ນ. ຈັນຖະໜອມ ມະນີທິບ

STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

	Item No	Recommendation	Page No
<b>Title and abstract</b>	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	1
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2
<b>Introduction</b>			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3-7
Objectives	3	State specific objectives, including any prespecified hypotheses	7
<b>Methods</b>			
Study design	4	Present key elements of study design early in the paper	8
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	7-8
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	8
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	8-10
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	8-10
Bias	9	Describe any efforts to address potential sources of bias	8,11
Study size	10	Explain how the study size was arrived at	8
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	11
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	11
		(b) Describe any methods used to examine subgroups and interactions	N/A
		(c) Explain how missing data were addressed	12
		(d) If applicable, describe analytical methods taking account of sampling strategy	11
		(e) Describe any sensitivity analyses	N/A
<b>Results</b>			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	12
		(b) Give reasons for non-participation at each stage	12
		(c) Consider use of a flow diagram	-
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	12
		(b) Indicate number of participants with missing data for each variable of interest	12
Outcome data	15*	Report numbers of outcome events or summary measures	13-15; 26

1			
2	Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted
3			estimates and their precision (eg, 95% confidence interval). Make clear
4			which confounders were adjusted for and why they were included
5			
6			(b) Report category boundaries when continuous variables were
7			categorized
8			(c) If relevant, consider translating estimates of relative risk into absolute
9			risk for a meaningful time period
10			
11	Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions,
12			and sensitivity analyses
13			
14	<b>Discussion</b>		
15	Key results	18	Summarise key results with reference to study objectives
16	Limitations	19	Discuss limitations of the study, taking into account sources of potential
17			bias or imprecision. Discuss both direction and magnitude of any
18			potential bias
19			
20	Interpretation	20	Give a cautious overall interpretation of results considering objectives,
21			limitations, multiplicity of analyses, results from similar studies, and
22			other relevant evidence
23			
24	Generalisability	21	Discuss the generalisability (external validity) of the study results
25			
26	<b>Other information</b>		
27	Funding	22	Give the source of funding and the role of the funders for the present
28			study and, if applicable, for the original study on which the present
29			article is based
30			

\*Give information separately for exposed and unexposed groups.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at [www.strobe-statement.org](http://www.strobe-statement.org).