

Original Research



Spatial and temporal trends in food security during the COVID-19 pandemic in Asia Pacific countries: India, Indonesia, Myanmar, and Vietnam

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ABSTRACT

BACKGROUND/OBJECTIVES: The economic recession caused by the coronavirus disease 2019 pandemic disproportionately affected poor and vulnerable populations globally. Better understanding of vulnerability to shocks in food supply and demand in the Asia Pacific region is needed.

SUBJECTS/METHODS: Using secondary data from rapid assessment surveys during the pandemic response (n = 10,420 in mid-2020; n = 6,004 in mid-2021) in India, Indonesia, Myanmar, and Vietnam, this study examined the risk factors for reported income reduction or job loss in mid-2021 and the temporal trend in food security status (household food availability, and market availability and affordability of essential items) from mid-2020 to mid-2021.

RESULTS: The proportion of job loss/reduced household income was highest in India (60.4%) and lowest in Indonesia (39.0%). Urban residence (odds ratio [OR] range, 2.20–4.11; countries with significant results only), female respondents (OR range, 1.40–1.69), engagement in daily waged labor (OR range, 1.54–1.68), and running a small trade/business (OR range, 1.66–2.71) were significantly associated with income reduction or job loss in three out of 4 countries (all $P < 0.05$). Food stock availability increased significantly in 2021 compared to 2020 in all four countries (OR range, 1.91–4.45) (all $P < 0.05$). Availability of all essential items at markets increased in India (OR range, 1.45–3.99) but decreased for basic foods, hygiene items, and medicine in Vietnam (OR range, 0.81–0.86) in 2021 compared to 2020 (all $P < 0.05$). In 2021, the affordability of all essential items significantly improved in India (OR range, 1.18–3.49) while the affordability of rent, health care, and loans deteriorated in Indonesia (OR range, 0.23–0.71) when compared to 2020 (all $P < 0.05$).

CONCLUSIONS: Long-term social protection programs need to be carefully designed and implemented to address food insecurity among vulnerable groups, considering each country's market conditions, consumer food purchasing behaviors, and financial support capacity.

Keywords: Food security; disaster planning; public policy

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Conflict of Interest

The authors declare no potential conflicts of interests.

Author Contributions

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INTRODUCTION

As of December 2021, excess mortality was estimated at 14.9 million since the start of the coronavirus disease 2019 (COVID-19) pandemic, with over 160 million people driven into poverty [1,2]. The pandemic disproportionately impacted poor and vulnerable populations [3]. Income gaps between countries and between rural and urban areas increased, exacerbating pre-existing trends in global inequality [4].

Since the pandemic, economic contraction, restrictions and lockdowns, and the subsequent collapse of the food and health system have heightened malnutrition in low- and middle-income countries (LMICs). In 2021, 118 million undernourished people were added globally to a projected 768 million people previously estimated to be undernourished [5]. The global number of children under 5 suffering from wasting was projected to increase by 9.3 million by 2022, with 6.2 million from South Asia. Approximately, 168,000 additional children under 5 years are likely to lose their lives due to the suspension of nutritional services and worsening household poverty since the pandemic began [6].

Food insecurity during the pandemic was prevalent due to loss of income and purchasing power as a result of lockdowns and business closures imposed by national/local governments [7]. In India, decisive lockdown measures to prevent COVID-19 from spreading unavoidably disrupted livelihoods and food supply chains, putting production, distribution, and markets at risk. When the pandemic began, international grain prices skyrocketed. In addition, some countries suffered from a labor supply shortage due to restrictions on movement of labor between countries. These countries faced an increase in the cost of producing food for domestic consumption [8].

Livelihoods and household ability to purchase available foods were most affected, especially among the poorest families [9,10]. Vietnam suffered from lockdown measures that negatively affected the country's economy, particularly the labor market [11]. In Indonesia, a decline in real wages was reported in the informal sector, but the country's economy still grew in 2021, suggesting an increasing socio-economic disparity within the country [12]. The Myanmar military coup led to the withdrawal of foreign direct investment affecting many sectors including healthcare, education, banking, and transportation [13].

World Vision conducted rapid response assessments in 14 Asia-Pacific countries in 2020 and 8 countries in 2021 among selected poor communities participating in World Vision programming activities [14]. Using the 2020 survey data, a previous study showed loss of job/ or reduced income was common in the region, and the economic impact of the COVID-19 lockdowns and social distancing was more severe in urban households [15]. The survey results showed that most households experienced job loss or reduced household income, and decreased food expenditure due to the COVID-19 pandemic, but with a greater impact in urban settings compared to rural ones [15]. The 2021 survey revisited communities assessed during 2020 and examined how their food security status had changed over a year.

Hence, this study adds value by characterizing the breadth and depth of these impacts in different contexts over two-time points. By comparing key outcomes in food security from 2020 to 2021 in India, Indonesia, Myanmar, and Vietnam, this study examines the risk factors of income reduction and job loss and investigates the temporal trend in several food

security domains: 1) availability of household food stock and essential items; 2) availability of essential items at markets; and 3) affordability of essential items.

SUBJECTS AND METHODS

Data sources

This secondary data analysis utilized survey data from World Vision's rapid assessment survey in May to June 2020 (Round 1) and April to August 2021 (Round 2) in India, Indonesia, Myanmar, and Vietnam. The survey population largely included socio-economically poor and disadvantaged households. Detailed sampling methods of Round 1 are described elsewhere [15]. Largely, during the first stage, either Area Program (AP) priority areas (community units supported by World Vision) were selected, or some APs were randomly or purposively sampled, followed by random sampling or convenience sampling of households within each APs depending on the country's social distancing policy related to the COVID-19 pandemic.

For Round 1 in India, a total of 111 APs and 7 special project areas (SPAs) were chosen as primary sampling units (PSU), and within each PSU, a total of 50 households were assessed by convenience sampling. In Round 2, the sampling plan was to revisit at least 600 households to detect a 6–7% difference in key food security indicators with 80% power and a 5% significance level between Round 1 and Round 2. In Round 2, a total of 79 APs were selected out of the PSU included in Round 1, and 10–11 households were randomly selected within each AP. Through this procedure, the sample size for Round 2 was reduced to 797 in Round 2 from 5,668 in Round 1. For Indonesia, the same sampling framework from Round 1 was used in Round 2, resulting in a sample size of 900 households in Round 1 and 951 for Round 2. A total of 29 APs of 30 were purposively included and thirty households were assessed by convenience sampling in each AP. If the Round 1 respondents could not be reached, they were replaced by new respondents selected by purposive sampling from APs that were not assessed in Round 1. In Round 1, Myanmar targeted households with young children, pregnant women, lactating mothers, disabled children, or VisionFund Myanmar (VFM) clients. On average 10 households in each of all 31 APs from 46 districts in 13 states and regions were included in Round 1 ($n = 499$), and on average 10 households in each of 37 APs and 5 households in each of 69 VFM groups were included in Round 2. In Round 1, approximately 95 households were randomly selected from each of all 35 APs in Vietnam. One additional AP in Round 2 was included in the sampling, increasing the sample size from 3,422 in Round 1 to 3,578 in Round 2.

Mostly phone surveys were administered by trained enumerators, but in some communities (i.e., Vietnam) face-to-face household visits were conducted in keeping with local social distancing policies. Using common and structured survey questionnaires across countries, the respondents were asked about residential areas (rural, urban), age, sex, household head of respondent, food security, income, mental health status, and child protection behaviors.

Key variables

Variable selection was based on the conceptual framework of the possible impact of the pandemic lockdowns on the food supply chain (**Fig. 1**). The pandemic-induced lockdowns impacted food producers and consumers. Along with mobility restrictions, labor shortages occurred due to the workforce's increased vulnerability to COVID-19 and travel restrictions of migrant workers. This led to both disrupted food production and trade [7,8,16]. Disruptions

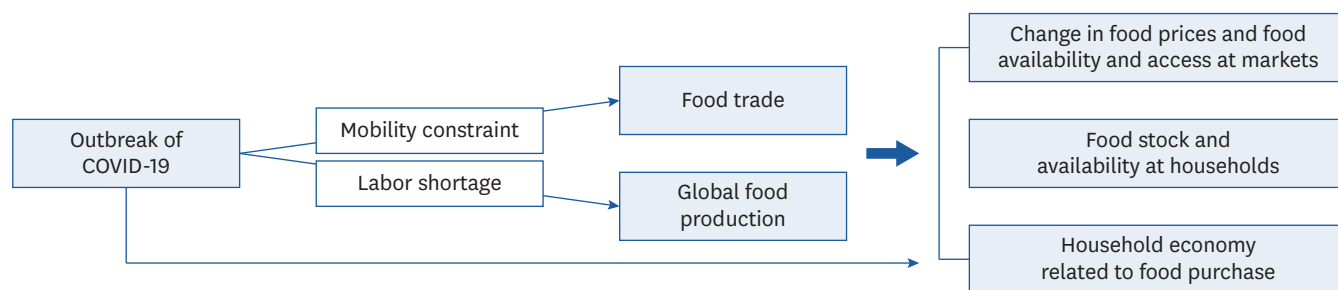


Fig. 1. Conceptual framework.
COVID-19, coronavirus disease 2019.

in the food supply chain caused changes in food prices, the livelihood of food producers, and the economy of consumers, impacting food affordability and food availability at home and in the market [8,17,18]. Livelihood activities as income sources included regular salaried work, daily wage labor, petty trade, government aid/social security, and agriculture. Respondents were asked if they experienced losing a job or income reduction due to the pandemic with three possible response options: 1) loss of a job or reduced salaries/revenues; 2) resorted to alternate sources; and 3) no change. In Round 2, respondents were asked about their weekly income (in local currency) in the past month and prior to COVID-19. The percent change in reported weekly income relative to the pre-pandemic period was arithmetically calculated.

Food stock availability at households

Survey respondents were asked about the availability of food stocks in the household with 6 possible response options: 1) enough for one week; 2) for 2 weeks; 3) for 3 weeks; 4) for 1 month; 5) for more than 1 month; and 6) no food available.

Availability of essential items at markets

Respondents were asked about the availability at markets for the following items: basic or staple foods, fresh foods, hygiene items, and essential medicines. Availability was measured with 4 possible response options: 1) always; 2) sometimes; 3) not at all; and 4) don't know.

Affordability of essential items

Respondents were asked about the affordability of 4 essential living expenses (food, rent, health care, and loan payment). Affordability was evaluated based on four possible response options: 1) fully; 2) partially; 3) not at all; and 4) don't know.

Statistical analysis

All independent and dependent outcome variables were presented as proportions for categorical variables or as means (SD) for continuous variables. Continuous variables were tested with Student's *t*-test and categorical variables were tested with χ^2 test. The percent change in reported weekly income relative to the pre-pandemic period between rural and urban groups was tested using a Student's *t*-test.

For risk factor analysis for job loss or income reduction, we first conducted univariate logistic regressions and then multivariate logistic regression. Potential risk factors were residence (urban vs. rural), respondent characteristics (sex, age, response by household head), lockdown status (curfew, lockdown, and normal), family size, and type of livelihood as income sources (regular salaried work, daily wage labor, petty trade, government aid/social

security, and agriculture). Variables significant in the univariate regression analysis ($P < 0.05$) were included in the multivariate regression analysis.

Stacked bar graphs were used to visualize some food security variables. Temporal trend analysis between 2020 and 2021 was applied for food stock availability at the household level, item availability at markets, and affordability of essential items using Round 1 and Round 2 data. Food stock availability was re-categorized into available for one week or longer vs. not available. For further logistic regression analysis, binary variables were generated for market availability (always vs. sometimes or not at all) and affordability of essential items (fully vs. partially or not at all). The replies “I don’t know” related to the market availability and the affordability of essential items were excluded from statistical analysis.

Logistic regression tested the change in household food stock availability, market availability, and affordability Round 1 and Round 2, with 2020 as the reference year. Respondent’s age, gender, household head status, residence area (rural vs. urban), and family size were covariates in the logistic regression analysis. These covariates are decided conceptually given their relevance to food security and livelihoods.

Ethical clearance

This study was deemed exempt from ethical review by the Institutional Review Board (IRB) of Johns Hopkins School of Public Health (IRB#20779). Interviewers obtained informed consent from all participants before proceeding with the survey. Data protection regulations following World Vision’s guidelines were applied.

RESULTS

General characteristics

The majority of survey respondents came from rural areas. In Round 2, Myanmar had a particularly high proportion of female respondents with more than 80%, in addition to Indonesia (76.7%). In Round 2, the social distancing orders were lifted in most countries except for Myanmar. A large proportion of respondents younger than 35 years were highest in India and lowest in Myanmar (**Table 1**). The survey participants had one or multiple reported income sources and the distribution varied by country. In India, the most prevalent income source was daily labor (69.3%), followed by agricultural practice (38.6%). In Indonesia and Vietnam, agriculture practice was 51.2% and 74.2%, respectively, as the leading income source. In Myanmar, petty trade or running a small business (50.4%) was the main source (**Fig. 2**).

Table 1. General characteristics of the sampled households for survey Round 1 (2020) and Round 2 (2021) (unit = %)

Characteristics	India		Indonesia		Myanmar		Vietnam	
	2020 (n = 5,668)	2021 (n = 797)	2020 (n = 900)	2021 (n = 951)	2020 (n = 429)	2021 (n = 678)	2020 (n = 3,431)	2021 (n = 3,578)
Rural	68.1	78.5***	88.1	92.6**	76.7	51.8***	88.2	89.0
HH head	59.0	60.6	33.6	36.7	39.9	40.6	62.9	61.1
Female	54.7	49.4**	76.2	76.7	75.5	83.2**	47.6	48.7
Status								
Curfew	2.3	2.8***	NA	3.7	63.9	51.0***	99.3	0.0***
Lockdown	94.2	12.1	NA	5.6	15.4	12.4	0.4	0.1
Normal	3.5	85.2	NA	90.8	20.7	36.6	0.2	99.9
Family size (≥ 7)	16.7	8.4***	18.6	21.8	32.2	23.9**	12.7	12.5
Age (< 35 yrs)	48.6	38.2***	35.8	32.3	16.6	13.7	25.1	22.6*

HH, household; NA, not available.

* $P < 0.05$; ** $P < 0.01$ *** $P < 0.001$ tested by χ^2 test.

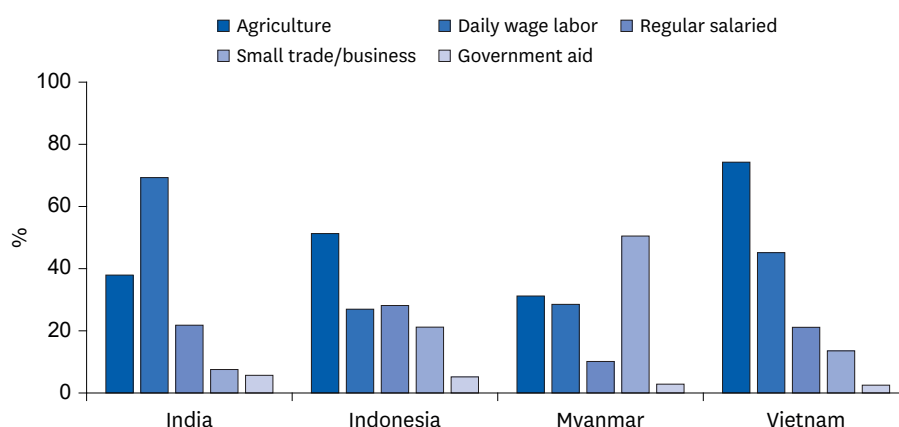


Fig. 2. Reported multiple income sources at pre-COVID-19 pandemic. COVID-19, coronavirus disease 2019.

After the pandemic began and by 2021, most countries had large proportions of job loss or reduced income: India (60.4%), Indonesia (39.0%), Myanmar (55.3%), and Vietnam (47.3%), with larger negative impacts in urban areas than in rural areas (**Supplementary Table 1**). The reduction rate in weekly income compared to pre-pandemic times was larger in urban areas in India (median percent change: 20.0% vs. 30.0%), Indonesia (16.7% vs. 38.8%), and Vietnam (16.7% vs. 22.7%) (all $P < 0.05$) but not in Myanmar (40.0% vs. 42.9%) (**Table 2**).

Risk factors for income reduction and job loss

Univariate logistic regression results for income reduction/job loss by country are presented in **Supplementary Table 2**. According to multivariate logistic regression analysis, respondents living in urban areas had higher odds of having income reduction or job loss in India (odds ratio [OR], 4.11; 95% confidence interval [CI], 2.50–6.80), Indonesia (OR, 5.75; 95% CI, 3.12–10.6), and Vietnam (OR, 2.20; 95% CI, 1.68–2.88) (**Table 3**). Female subjects were associated with higher odds of income reduction or job loss in India (OR, 1.61; 1.07–2.44), Indonesia (OR, 1.69; 95% CI, 1.07–2.68), and Vietnam (OR, 1.40; 95% CI, 1.17–1.68). Response by a household head was negatively associated with income reduction in Myanmar (OR, 1.67; 95% CI, 1.14–2.43). Respondents living in households engaged in daily waged labor were more likely to experience income reduction in all four countries: India (OR, 1.61; 95% CI, 1.10–2.36), Indonesia (OR, 1.54; 1.07–2.22), Myanmar (OR, 1.68; 95% CI, 1.11–2.54), and Vietnam (OR, 2.10; 95% CI, 1.81–2.44). Running a petty trade was associated with income loss in Indonesia (OR, 2.71; 95% CI, 1.89–3.88), Myanmar (OR, 1.66; 95% CI, 1.11–2.48), and Vietnam (OR, 2.28; 95% CI, 1.84–2.83).

Table 2. Rate of change in weekly income between urban and rural areas compared to the pre-pandemic

Country	Percent change in weekly income relative to before pandemic (%) in rural	Percent change in weekly income relative to before pandemic (%) in urban	<i>P</i> -value*
India	-20.0% (-33.3%, 0.0%)	-30.0% (-50.0%, 0.0%)	0.01
Indonesia	-16.7% (-50.0%, 0.0%)	-38.8% (-50.0%, -18.8%)	0.004
Myanmar	-40.0% (-55.6%, -16.7%)	-42.9% (-60.0%, -28.6%)	0.10
Vietnam	-16.7% (-37.5%, 0.0%)	-22.7% (-40.0%, 0.0%)	< 0.001

Values are presented as median (interquartile range).

*Compared the difference in mean rate change between rural and urban areas by Student's *t*-test.

Table 3. Risk factors for income reduction or job loss due to the COVID-19 pandemic¹⁾

Characteristics	India (n = 796)	Indonesia (n = 951)	Myanmar (n = 677)	Vietnam (n = 3,573)
Demographic				
Residence				
Rural (Ref.)	1.00	1.00		1.00
Urban	4.11 (2.50–6.80)	5.75 (3.12–10.6)		2.20 (1.68–2.88)
Response by male				
Yes (Ref.)	1.00	1.00		1.00
No	1.61 (1.07–2.44)	1.69 (1.07–2.68)		1.40 (1.17–1.68)
Response by HH head				
No (Ref.)		1.00		
Yes		0.60 (0.41–0.89)		
Family size				
≤ 6 (Ref.)			1.00	
> 6			1.67 (1.14–2.43)	
Income source at pre-pandemic				
Agriculture				
No (Ref.)	1.00			1.00
Yes	0.71 (0.51–0.99)			1.24 (1.03–1.51)
Daily wage labor				
No (Ref.)	1.00	1.00	1.00	1.00
Yes	1.61 (1.10–2.36)	1.54 (1.07–2.22)	1.68 (1.11–2.54)	2.10 (1.81–2.44)
Regular salaried				
No (Ref.)	1.00	1.00		
Yes	2.22 (1.39–3.55)	0.67 (0.46–0.98)		
Petty trade				
No (Ref.)		1.00	1.00	1.00
Yes		2.71 (1.89–3.88)	1.66 (1.11–2.48)	2.28 (1.84–2.83)
Government aid				
No (Ref.)		1.00		
Yes		0.47 (0.24–0.95)		

Values are presented as multivariable logistic regression analysis odds ratio (95% confidence interval).

COVID-19, coronavirus disease 2019; HH, household.

¹⁾Only significant results are presented.

Temporal trends in household food availability in 2020 (Round 1) and 2021 (Round 2)

The percentage of respondents reporting no available household food stock significantly decreased in 2021 compared to 2020, in all four countries studied ($P < 0.001$), particularly in Vietnam and Myanmar by 26.2 percentage points (pp) and 24.7 pp, respectively. Reported household food stock availability improved in all four countries in 2021 compared to 2020, with higher odds of availability in Vietnam (OR, 4.45; 95% CI, 3.94–5.02) and Myanmar (OR, 3.88; 95% CI, 2.88–5.22), followed by Indonesia (OR, 1.97; 95% CI, 1.46–2.66) and India (OR, 1.91; 95% CI, 1.42–2.56) (Table 4).

Temporal trends in essential item availability at markets in 2020 (Round 1) and 2021 (Round 2)

In India, the availability of essential items was severely affected in 2020, with a recovery of market functioning in 2021 (Fig. 3, Supplementary Table 3). The proportion of full availability of basic foods and fresh foods at markets increased from 54.1% to 73.0% and from 24.0% to 54.7%, respectively, between 2020 and 2021. The odds of full availability of essential items increased for basic foods (OR, 2.39; 95% CI, 2.02–2.83), fresh foods (OR, 3.99; 95% CI, 3.41–4.66), hygiene items (OR, 1.96; 95% CI, 1.67–2.31), and medicine (OR, 1.45; 95% CI, 1.24–1.69) in 2021 compared to 2020. In other countries, the change in the full availability of basic foods seemed to be minor between 2020 and 2021. In Indonesia, full availability at markets for basic foods, fresh foods, and hygiene items did not differ between

Table 4. Food stock availability, fully availability of essential items at markets, and fully affordability of essential items in 2020 (Round 1 survey) and 2021 (Round 2 survey)¹⁾

Characteristics	India		Indonesia		Myanmar		Vietnam	
	2020 (n = 5,668)	2021 (n = 797)	2020 (n = 892)	2021 (n = 951)	2020 (n = 429)	2021 (n = 678)	2020 (n = 3,431)	2021 (n = 3,578)
Food stock availability								
No	755 (13.4)	53 (6.6)	134 (15.0)	77 (8.1)	179 (41.7)	115 (17.0)	1,343 (39.1)	463 (12.9)
Yes, for one week	1,726 (30.6)	256 (32.1)	290 (32.5)	284 (29.9)	62 (14.5)	154 (22.7)	785 (22.9)	976 (27.3)
Yes, more than one week	3161 (56.0)	488 (61.2)	468 (52.5)	590 (62.0)	188 (43.8)	409 (60.3)	1,303 (38.0)	2,139 (59.8)
P-value	< 0.001		< 0.001		< 0.001		< 0.001	
Food availability								
2020 (Ref.)	1.00				1.00		1.00	
2021	1.91 (1.42, 2.56)		1.97 (1.46, 2.66)		3.88 (2.88, 5.22)		4.45 (3.94, 5.02)	
Always available at markets								
Basic foods								
2020 (Ref.)	1.00		1.00		1.00		1.00	
2021	2.39 (2.02, 2.83)		1.28 (0.99, 1.65)		1.42 (0.76, 2.66)		0.85 (0.74, 0.97)	
Fresh foods								
2020 (Ref.)	1.00				1.00		1.00	
2021	3.99 (3.41, 4.66)		1.19 (0.96, 1.47)		2.99 (2.14, 4.18)		0.94 (0.84, 1.05)	
Hygiene items								
2020 (Ref.)	1.00		1.00		1.00		1.00	
2021	1.96 (1.67, 2.31)		1.14 (0.87, 1.50)		1.70 (0.99, 2.90)		0.81 (0.71, 0.92)	
Medicines								
2020 (Ref.)	1.00		1.00		1.00		1.00	
2021	1.45 (1.24, 1.69)		0.81 (0.67, 0.99)		1.31 (0.96, 1.80)		0.86 (0.77, 0.95)	
Fully affordable at households								
Foods								
2020 (Ref.)	1.00		1.00		1.00		1.00	
2021	2.58 (2.21, 3.01)		1.67 (1.39, 2.02)		2.01 (1.53, 2.64)		1.21 (1.10, 1.33)	
Rent								
2020 (Ref.)	1.00		1.00		1.00		1.00	
2021	3.44 (2.74, 4.33)		0.23 (0.16, 0.34)		1.07 (0.72, 1.60)		1.06 (0.93, 1.21)	
Health care								
2020 (Ref.)	1.00		1.00		1.00		1.00	
2021	1.18 (1.01, 1.39)		0.67 (0.55, 0.81)		1.08 (0.79, 1.47)		1.01 (0.92, 1.12)	
Loan								
2020 (Ref.)	1.00		1.00		1.00		1.00	
2021	3.49 (2.64, 4.62)		0.71 (0.55, 0.92)		1.57 (1.09, 2.26)		0.80 (0.71, 0.91)	

Values are presented as number of patients (%) or odds ratio (95% confidence interval).

¹⁾Adjusted for residence (rural vs. urban), respondent's sex, age, household head, and family size.

2020 and 2021, but the full availability of medicines (OR, 0.81; 95% CI, 0.67–0.99) decreased in 2021. In Myanmar, full availability of fresh foods increased from 68.5% in 2020 to 89.4% in 2021 with higher odds of full availability (OR, 2.99; 95% CI, 2.14–4.18). In contrast, in Vietnam, the odds of availability were significantly lower in 2021 compared to 2020: basic foods (OR, 0.85; 95% CI, 0.74–0.97), hygiene (OR, 0.81; 95% CI, 0.71–0.92), and medicines (OR, 0.86; 95% CI, 0.77–0.95) (**Table 4**).

It is notable that at the time of the survey, roughly half of the respondents in Vietnam (57.9%) found it more difficult to access markets compared to the pre-pandemic period. The proportion of respondents who had difficulty accessing markets in rural areas was significantly higher than in urban Vietnam and Indonesia ($P < 0.01$; **Supplementary Fig. 1**). A moderate to high proportion of respondents (14.8–67.0%, depending on the country) reported travel restrictions due to COVID-19 mitigation as the reason behind the difficulty in accessing markets. Increased political insecurity was the major reason for increased curfews (51.4%) and lockdowns (12.4%) in Myanmar (**Table 1**).

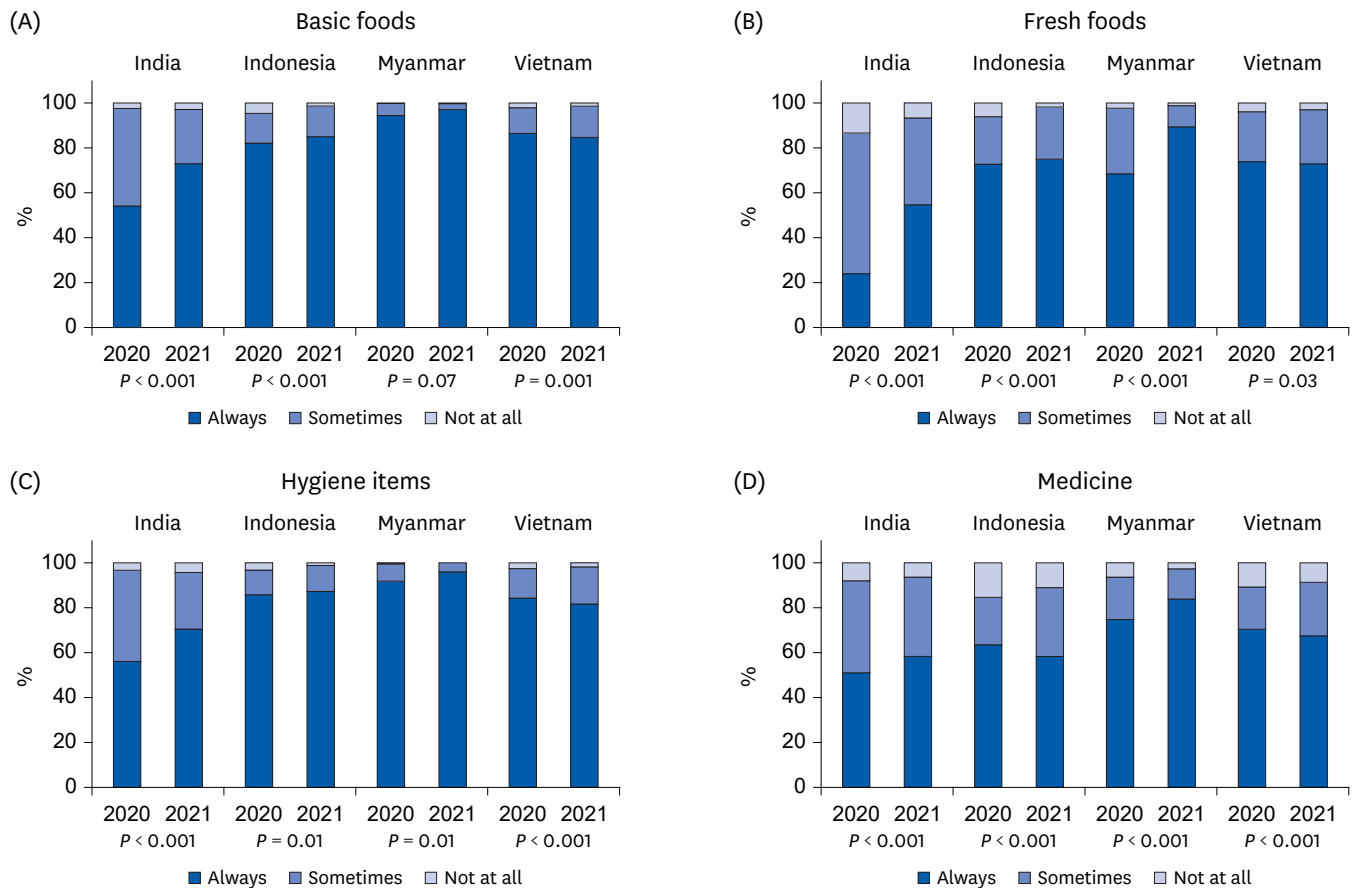


Fig. 3. Availability of essential items at markets in 2020 (Round 1) and 2021 (Round 2).

Temporal trends in affordability of essential items in 2020 (Round 1) and 2021 (Round 2)

Temporal trends between 2020 and 2021 for the affordability of essential items varied by item and country (Fig. 4, Supplementary Table 4). Improvement in full affordability of foods was notable in India (29.8% in 2020 to 53.0% in 2021), Indonesia (52.8% to 65.2%), and Myanmar (28.0% to 47.4%). In Indonesia, affordability of essential items except for food items deteriorated. In Vietnam, full affordability of essential items did not notably change.

In India, odds of improving in full affordability for food (OR, 2.58; 95% CI, 2.21–3.01), rent (OR, 3.44; 95% CI, 2.74–4.33), health care (OR, 1.18; 95% CI, 1.01–1.39), and loans (OR, 3.49; 95% CI, 2.64–4.62) in 2021 were all significant. In Indonesia, however, there was only an improvement in full affordability of foods (OR, 1.67; 95% CI, 1.39–2.02) in 2021. Rent (OR, 0.23; 95% CI, 0.16–0.34), health care (OR, 0.67; 95% CI, 0.55–0.81), and loans (OR, 0.71; 95% CI, 0.55–0.92) all became less affordable in 2021 compared to 2020. In Myanmar, full affordability improved for foods (OR, 2.01; 95% CI, 1.53–2.64) and loans (OR, 1.57; 95% CI, 1.09–2.26). In Vietnam, full affordability of foods (OR, 1.21; 95% CI, 1.10–1.33) improved, but the affordability of loans (OR, 0.80; 95% CI, 0.71–0.91) worsened in 2021, compared to 2020 (Table 4).

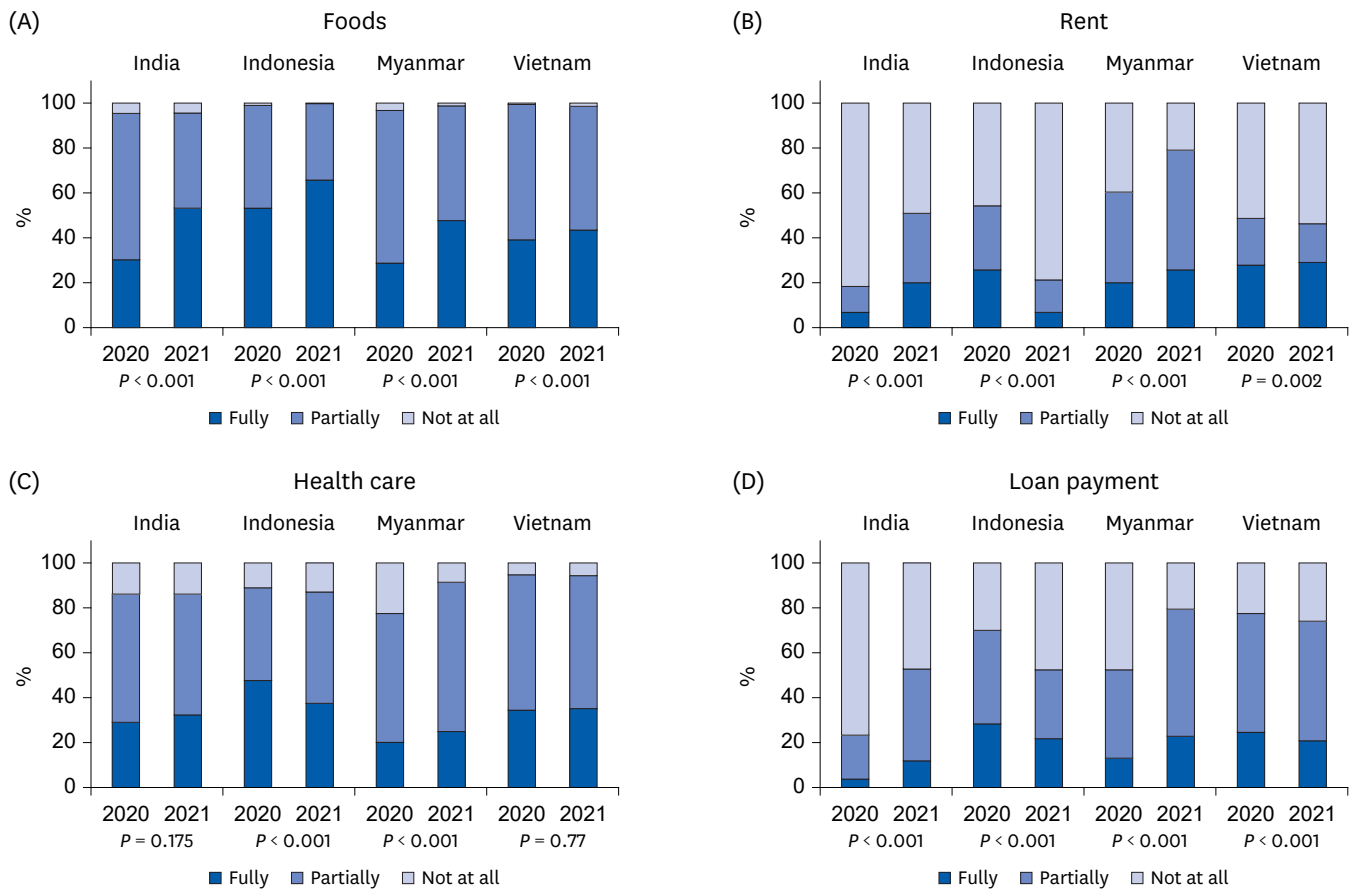


Fig. 4. Affordability of essential items in 2020 (Round 1) and 2021 (Round 2).

DISCUSSION

Survey data from India, Indonesia, Myanmar, and Vietnam showed that urban residence, response by females, engagement in daily waged labor, and engagement in a petty trade were associated with a higher risk of income reduction or job loss during COVID-19 in three out of four countries. These results helped to identify vulnerable populations during the pandemic. Similar findings were found in other Asia-Pacific countries [19-21]. Many reports pointed out that women were more vulnerable to losing their jobs and income due to economic recession during the pandemic than men in the UK, US, and Germany [22] and were at higher risk of food security across regions. Child care and domestic responsibilities account for the higher negative economic impact among women [5].

Low-wage workers were hit harder than high-wage groups [23]. Before the pandemic started, low-wage workers made up 43% of the workforce globally. After a year of the pandemic, they make up 52% of displaced populations. Food stock availability at households and market availability of essential items largely improved in 2021 compared to 2020 in India, Indonesia, and Myanmar; however, availability of essential items at markets decreased during the same period in Vietnam. The affordability of key essential items showed inconsistent patterns by item and by country, with significant improvement in India and Myanmar but worsening in Indonesia compared to 2020.

In May 2020, availability and affordability of foods were severely affected in India [15], due in part to the decisive lockdown measures to prevent COVID-19 spread that unavoidably disrupted livelihoods and food supply chains, placing production and distribution at risk and creating dysfunctional markets. However, our study shows that over the course of a year, the costs of food, rent, health care, and loans become more affordable than at the start of the pandemic.

According to a cohort survey in Gaya and Nalanda districts of Bihar state in India, from December 2019 to September 2020, household food insecurity increased considerably during lockdowns, rising from 20% to 47% [24].

If the reinforcement of food security for consumers is the primary goal of support, in-kind support should be given priority over cash transfers. Careful targeting of households, along with calibrating the amount and composition of in-kind support, is imperative to achieving the “optimal consumption basket” [25].

The government of India took proactive actions to provide economic relief and deliver basic services and essential commodities. Through the Targeted Public Distribution System, 67% of the population was able to purchase grains at highly subsidized rates [9]. This bolstered efforts to counteract food insecurity caused by the government-mandated lockdowns. Furthermore, the government introduced Pradhan Mantri Garib Kalyan Anna Yojana (PMGKAY) in early 2020 as part of the pro-poor policy, providing nearly 800 million under the National Food Security Act with additional staple foods [26,27]. The goal of the policy, which was extended to November 2021, was to safeguard poor and vulnerable households from food inaccessibility [26]. India’s Public Distribution System became an example of unparalleled food security by providing nearly 900 lakh metric tonnes of food grains successfully supplied to over 800 million beneficiaries.

Cash utility by beneficiaries is maximized when cash is directly supported. If consumers are the main target of the assistance, and reducing the ‘overall’ financial burden of households rather than strengthening food security is the main policy goal, cash transfers can be considered as the most reasonable financial measure to mitigate food insecurity [28]. Under India’s PMGKAY program, several one-time cash transfers were provided to vulnerable groups. A total of 200 million women were given Rs 500 per month, for a total of 3 months, and 30 million vulnerable groups including seniors, widows and the disabled were given Rs 1,000 over the length of three months [27].

In Indonesia, our study found a greater proportion of job loss in urban areas and that the affordability of basic commodities had not improved substantially since the start of the pandemic. Only food became more affordable, while rent, health care, and loans became less affordable. Mass social and mobility restrictions impacted the working poor in the urban and informal sectors the most. More than 2.6 million people experienced job loss, and continued instability of the job market [29]. A survey that assessed eight provinces in Indonesia in mid-2020 reported that 51% of the households were food insecure [30]. In Jakarta and Depok, semi-urban and urban areas, respectively, 65% of households reported food insecurity in semi-urban and urban areas [31].

Mobility restrictions in the first half of 2020 disrupted imports and port-to-market domestic distribution. [29]. In late 2020 food prices declined as a result of weak demand and decreased household purchasing power. Labor force from other sectors joined the agricultural

sector, dampening the shock effect of the pandemic. However, the agricultural sector experienced the second worst relative income reduction after the transportation, storage, and communication sectors [29]. Social protection benefits were particularly meaningful for the poorest households, comprising 22% of their total household expenditure compared to only 4% of the household expenditure of the richest households [12].

In July 2021 the Indonesian government provided a one-time rice assistance to nearly 29 million households that were beneficiaries of other social protection programs [12]. To alleviate the impact on food security, Indonesia's Ministry of Agriculture utilized the Pekarangan Lestari and Kredit Usaha Rakyat programs, where eligible communities, women, and youth farmer groups were able to receive support to develop nurseries, produce crops, and market harvested crops [29]. A National Economy Recovery program was created in 2020 to mitigate economic hardship in Indonesia, but the budget allocation for social protection programs was reduced in 2021 [12].

The pandemic and consequent lockdowns and restrictions had negative impacts on household incomes in Myanmar, resulting in rising rates of income-based poverty in both urban and rural areas. After the second wave of COVID-19 infections and accompanying lockdowns, in September 2020, 35% of respondents stated their household earned no income. Income losses were more frequent in urban areas due to stricter preventive measures and greater dependence on non-farm livelihoods [32]. On February 1, 2021, the political crisis due to the Myanmar military coup led to protests, strikes, and closures or slowdowns in several sectors including healthcare, education, banking, and transportation. It also led to a new wave of population displacement, resulting in an additional 440,000 newly displaced people added to the existing 370,000 displaced population [33]. Myanmar's economy collapsed just as it was recovering from the crisis caused by COVID-19 mitigation actions [34]. Food prices showed steady increases, and World Food Programme estimated that an additional 3.4 million people across the country are at risk of food insecurity [35].

In 2020, a survey with 1,476 households sampled from 75 townships in eight states and regions reported that 13.4% of them reported poor or borderline food consumption, 66% experienced a decrease in household income, and 14% had no access to markets in the past 7 days [36]. In another study using a convenience sample of 546 women from 11 factories in peri-urban communities from the Yangon region, 50% reported at least a mild or higher level of food insecurity [37].

In our study, since the early period of the COVID-19 pandemic, household food affordability and stock also improved in Myanmar, along with loans. Our study also found a higher percentage of beneficiaries of cash transfer and social assistance in rural areas compared to urban (data not shown). In 2020, at-risk populations were provided with basic food items including rice, fresh vegetables, and oils [38], however, as of May 2021, government assistance in the form of cash and food transfers had almost entirely collapsed [39]. Based on the May 2021 Rural and Urban Food Security Survey conducted by International Food Policy Research Institute, only 0.9% of respondents received any kind of assistance [32].

Compared to the other countries assessed, Vietnam had relatively stable food security indicators in 2020. Vietnam commended for its early implementation of COVID-19 protective and mitigation measures in response to the initial outbreak. However, like most other countries, Vietnam also suffered from lockdown measures that negatively affected the country's economy, particularly the labor market [40].

We found that rent and loans have become less affordable in 2021 compared to 2020. The decline in Vietnam's gross domestic product at the height of the crisis in 2020 was the smallest of any country in the East Asia and Pacific region. Exports also increased as some manufacturing production relocated to Vietnam from other countries [41]. Another study in Vietnam reported that income loss during the pandemic was associated with self-reported livelihood impact, but there were no differences in food availability within households and affordability to purchase essential items [42]. However, our study found that rent and loans have become less affordable in 2021 compared to 2020, which could be due in part to the restrictions imposed by the government in early 2021, but also due to other factors unrelated to the pandemic.

The rate of income loss lessened considerably between June 2020 [15] and this survey in 2021. However, widespread income loss did not disappear completely. According to responses from the World Bank monitoring surveys, approximately 30% of households still reported lower incomes in March 2021 than the previous year [36]. Additionally, our study found only a small percentage of respondents receiving any form of benefits related to food security. The government issued a social protection program to provide cash support with a budget of \$2.6 billion to vulnerable groups [40].

This study revisited survey participants in the same communities in 8 Asia-Pacific countries in 2021 as in 2020 and assessed food security and livelihoods. We tested time trends in four different countries comparing two time points during the COVID-19 pandemic. The large sample size also is an advantage of the study. The Round 1 survey data did not adjust for the pre-pandemic differences in rural and urban areas [15], which remained a limitation of the previous study. However, the current time trend analysis could overcome this limitation.

There are a few limitations in this study. First, the surveyed samples did not necessarily represent the national population, although many participants were recruited from diverse communities. Most participants recruited from World Vision-supported communities have socio-economic status resembling the poor and vulnerable in the country. COVID-19 unevenly impacts populations, with poor and vulnerable populations being the hardest hit [3]. Also, the survey participants could have benefited more from World Vision's emergency support than other populations. Unfortunately, assessment of food insecurity at the national level during COVID-19 was rare. Most literature used smaller survey sample sizes than this study. Many dimensions of food security and the application of various assessment approaches hindered us from comparing food security status between the national level and our sampled population. Secondly, the sampling strategy during survey Round 2 attempted to reflect Round 1; however, these surveys did not assess the completely equal participants between Round 1 and Round 2. This situation could increase the variance of each indicator. On the other hand, the study participants in a primary sampling unit were likely to share common infrastructure and living practices. This trade-off would not be large enough to change the main study results. Thirdly, questions about weekly income and livelihood activities during pre-pandemic depended on recall; this approach might bias the data towards remembering the pre-pandemic status as better than it was. Lastly, no information was available in the Vietnam dataset on which households were assessed by phone interviews or household visits. Study participants interviewed by mobile phones might have better social status than those receiving household visits.

This study explored the risk factors of income reduction or job loss and the time trend in food security indicators in Asia Pacific countries. In 2021, there was a re-activation in markets in India after a decisive lockdown in early 2020, while a slowdown in market activity was expected in Vietnam likely due to continued and repeated mobility restrictions. The extent to which essential items were available at markets reflects the status of market activity. The affordability of foods improved in all four countries in 2021 compared to 2020. India's ability to purchase essentials improved through massive social protection, and Indonesia's household economy in 2021 appeared to be struggling, attributed to limited social protection and disrupted domestic food system. Long-term social protection programs need to be implemented for vulnerable groups (urban, females, daily wage labor, or running small trade or owning a small business), and continued food security monitoring is needed.

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SUPPLEMENTARY MATERIALS

Supplementary Table 1

Loss of income and jobs in 2021 since COVID-19 in rural and urban areas

Supplementary Table 2

Univariate regression analysis for income reduction or job loss due to the COVID-19 pandemic in India, Indonesia, Myanmar, and Vietnam

Supplementary Table 3

Fully availability of essential items at markets in 2020 (Round 1) and 2021 (Round 2)

Supplementary Table 4

Fully affordability of essential items in 2020 (Round 1) and 2021 (Round 2)

Supplementary Fig. 1

Difficulties in market access in rural and urban areas in 2021.

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