



# Understanding the Agility and Adaptability of Local SNAP-Ed Systems Using COVID-19

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## ABSTRACT

*Objective.* Describe how local Supplemental Nutrition Assistance Program Education (SNAP-Ed) programs adapted as they experienced a major system disruption.

*Methods.* This exploratory quantitative study compared SNAP-Ed programming from March 11-September 30, 2019, with the same period in 2020. Chi-square tests examined differences of proportion in reported activities. Subgroup analyses evaluated variations by agency type and geography.

*Results.* The relative amounts of five policy, systems, and environmental supports increased, while the relative amount of direct education decreased, generally with small effects. Health departments reported a more modest decline in total activities (38.7%) than cooperative extension (59.2%). Emergency food support increased in frontier, Indian, and rural but not urban areas.

*Conclusions and Implications.* SNAP-Ed agencies had varied COVID response strategies. Health departments pivoted rapidly to address emergent food security needs, while cooperative extension maintained broader programmatic support. Investing in flexible, context-specific approaches can sustain large public health programs amid system disruptions.

**Keywords:** Supplemental Nutrition Assistance Program – Education, Public Health Systems Research, Organizational Change, Pandemic Preparedness, Food Security

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**Note.** As an analysis of secondary data, no institutional review board approval was needed because human subjects were not involved, as per US Department of Health and Human Services guidelines (<http://www.hhs.gov/ohrp/policy/checklists/decisioncharts.html#c1>).

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## INTRODUCTION

On March 11, 2020, the Arizona Governor declared a state of emergency due to coronavirus disease 2019 (COVID-19).<sup>1</sup> Over the next two years, the state experienced the highest standardized cumulative COVID-19 death rate in the United States, comparable to the rates of the worst-hit countries in the world.<sup>2</sup> Amid this crisis, Arizona's public health programs were challenged to maintain their services while simultaneously responding to their communities' unique and evolving needs. One such program was the Arizona Supplemental Nutrition Assistance Program—Education (SNAP-Ed), which addresses food insecurity by promoting healthy eating and active living among SNAP participants and eligibles.<sup>3</sup>

Founded on the tenets of the social ecological model, typical SNAP-Ed services “are delivered through partners in multiple venues and involve activities at the individual, interpersonal, community, and societal levels.”<sup>3(p9)</sup> In Arizona, SNAP-Ed Local Implementing Agencies (LIAs) support multi-level public health interventions, including policy, systems, and environmental (PSE) changes at the sectors and settings levels and direct education at the individual level. Social and organizational relationships are central to the Arizona SNAP-Ed scope of work, which prioritizes interventions in local food, active living, and childhood education systems.<sup>4</sup>

Before the pandemic, Arizona SNAP-Ed already operated as a *complex adaptive system*<sup>5-7</sup>—a dynamic, interrelated, and open network of actors bonded by the common SNAP-Ed goal. A primary challenge already faced by LIAs was to ensure programmatic continuity by responding to the variable needs of communities and state agencies. With the rapid onset of COVID-19, LIAs had to consider the pandemic's disruptive influence on all aspects of their program delivery model, including the sudden closure of most program sites, widespread changes to local food

systems, and the evolving roles of internal and external partners. Thus, the pandemic afforded a unique opportunity to study the operations of a statewide nutrition education program during a pre-pandemic period of general homeostasis characterized by minor and regular system adaptations followed by a period of major disruption that threatened sustainability without extensive adaptations.

Retrospective studies have offered some insight into the SNAP-Ed pandemic response. In a survey of state SNAP administrators, Bresnahan<sup>8</sup> found that 78% of states moved some or all programming online, a shift also reported at the local level.<sup>9-11</sup> While many program pivots involved virtual direct education, researchers have also reported innovative food security efforts in the Southeast<sup>12</sup> and Southwest,<sup>13</sup> and how school partnerships helped to meet emerging community needs amid school closures in California.<sup>14,15</sup>

Even so, the adaptations made by LIAs in response to this major system disruption are not well understood within an overarching systems framework. Here, the concepts of agile and adaptive governance can guide a deeper understanding of how SNAP-Ed systems change over time.<sup>16</sup> *Agile* governance centers around the speed of the organizational response, while *adaptive* governance describes the organization's ability to deal with complex issues through systems change. According to Janssen and van der Voort,<sup>16</sup> these concepts can work synergistically when the period of rapid decision-making (agility) is followed by a period of reflection to improve future organizational response strategies (adaptability).

**Aim.** This quantitative study sought to elucidate LIAs' agility and adaptability during crisis response by assessing the programmatic changes they made following the governor's declaration

of a COVID-19 public health emergency. We also explored differences in LIAs' activity patterns by LIA type (county health departments versus university cooperative extension units) and geographical region to better understand how organizational structure and geography related to agility and adaptability.

## METHODS

**Study Design.** This project was an exploratory quantitative analysis of existing data from the Arizona SNAP-Ed electronic data system. As an analysis of secondary data with no human subjects involved, no institutional review board approval was needed, as per [US Department of Health and Human Services guidelines](#).

We predetermined a 2019 time period during which LIAs delivered SNAP-Ed programming prior to the onset of COVID-19 (March 11-September 30, 2019) and a 2020 period during which LIAs delivered programming immediately after COVID-19 onset (March 11-September 30, 2020). Using the same 6.5-month periods allowed us to account for the seasonal nature of Arizona SNAP-Ed activities. We then retrospectively analyzed the LIA-reported SNAP-Ed activities shown in [Table 1](#) before and during COVID-19.

**Data Collection.** Nineteen LIAs—12 county cooperative extension units and seven county health departments—conducted SNAP-Ed PSE and direct education activities during the study period. They operated in all of Arizona's 15 counties: seven counties were supported by cooperative extension, three were supported by a health department, and five were supported by both agency types. Per state funding requirements, LIAs were obligated to report all of their SNAP-Ed program activities in the Arizona SNAP-Ed electronic data system. These activities spanned the sectors, settings, and individual levels of the socio-ecological model<sup>3</sup> and included nutrition- and physical activity-related PSE supports as well as direct education.

**Data Analysis.** [Table 1](#) provides descriptions of each of the 10 PSE and six direct education activities analyzed. These were the most-reported activities in the Arizona SNAP-Ed electronic data system in the three state focus areas of Food Systems, Active Living, and Childhood.

We used the chi-square test of association to examine the relationship between two binary categorical variables: time period (0=pre-COVID-19, 1=during COVID-19) and SNAP-Ed activity (0=not implemented, 1= implemented). The null hypothesis assumed no association between the time period and SNAP-Ed activity. The analysis involved testing whether the observed cell frequencies for the data were significantly different from those that were expected under the null hypothesis for each of 16 activities. The contrasts were the SNAP-Ed activity implementation conditions (implemented, not implemented) at the LIA level evaluated for chi-square value, degrees of freedom, significance, and Phi ( $\phi$ ) effect size. We referenced Cohen<sup>17</sup> to interpret  $\phi$  values: .1 = small effect, .3 = medium effect, and .5 = large effect. To verify the chi-square results, standardized residuals allowed us to test for differences in the observed proportions across time periods. Here, multiple tests of differences in proportions (two tests) used Bonferroni adjusted p-values. We set the significance level for all tests at alpha ( $\alpha$ ) = .05.

In addition to our primary analysis, we conducted two subgroup analyses. Because health departments and cooperative extension agencies have distinct missions and organizational structures,<sup>18</sup> we examined results to investigate how, if at all, SNAP-Ed activity implementation differed by LIA type. We also analyzed by four subgroups using Arizona's frontier, Indian, rural, and urban Primary Care Area designations<sup>19</sup> to explore any geographical variations in how LIAs implemented SNAP-Ed activities. Of note, in Arizona, most—but not all—areas designated as Indian are similar to frontier in terms of their substantial geographical isolation from a major population center.<sup>20</sup>

**Table 1. Arizona’s Local SNAP-Ed Implementing Agency Activities Assessed Pre-COVID-19 (March 11-September 30, 2019) and at COVID-19 Onset (March 11-September 30, 2020)**

<b>SNAP-Ed Activity</b>	<b>Description</b>
<b>PSE: Community Food Security</b>	
Improve Emergency Food	Improve the availability, appeal, and promotion of healthy food items at food banks and/or with emergency food providers.
Increase Benefits Redemption	Increase redemption of SNAP benefits and/or Farmers Market Nutrition Program checks at farmers markets or farm stands.
Increase Local Food Purchase/Procurement	Increase purchases of locally grown or produced items via informal or formal procurement processes.
Increase Meal Participation	Increase the number of meals served at Summer Food Service Program sites.
Support Existing Gardens	Support the maintenance of community, home, school, and ECE gardens.
<b>PSE: Community-Based Physical Activity</b>	
Partner on Recurring Physical Activity Event	Help create a sustainable community event by partnering with local organizations, giving community members opportunities to be physically active.
<b>PSE: School-Based Nutrition &amp; Physical Activity</b>	
Assist with Implementing Nutrition Education	Assist a school to insure all students are receiving nutrition education that is linked with the school food environment.
Assist with Wellness Promotion & Marketing	Assist a school to promote & market Local Wellness Policy implementation in and encourage participation in school wellness activities.
Develop Written Local Wellness Policies	Assist a school or school district with the development of their written Local Wellness Policy for nutrition & physical activity practices & environments.
Support Policy Implementation, Evaluation & Communication	Assist a school or district with implementing, evaluating and/or communicating the Local Wellness Policy.
<b>Direct Education in Support of a PSE</b>	
Direct Education – ECE-Based Nutrition	Teach evidence-based curriculum to support interventions focused on nutrition in ECEs.
Direct Education – ECE-Based Physical Activity	Teach evidence-based curriculum to support interventions focused on physical activity in ECEs.
Direct Education – Gardens	Teach evidence-based curriculum to support interventions focused on community, home, school, & ECE gardens.
Direct Education – Local Wellness Policy	Teach evidence-based curriculum to support interventions focused on Local Wellness Policies.
Direct Education – School-Based Nutrition	Teach evidence-based curriculum to support interventions focused on nutrition in schools.
Direct Education – School-Based Physical Activity	Teach evidence-based curriculum to support interventions focused on physical activity in schools.

PSE: policy, systems, environment; ECE: early care & education

Both types of LIAs served similar overall geographical regions: Of the seven county health departments, 14.3% served urban areas, 100% served rural, 71.4% served Indian, and 57.1%

served frontier. Of the 12 cooperative extension units, 16.7% worked in urban areas, 75.0% worked in rural, 66.7% worked in Indian , and 58.3% worked in frontier.

## RESULTS

**Overall Changes.** Table 2 shows how LIAs' reported PSE and direct education activities changed before and after the onset of COVID-19. There were increases in the absolute numbers and relative amounts of two PSE activities related to community food security: Improve Emergency Food and Increase Local Food Purchase/ Procurement. Increase Meal Participation saw an increase in relative but not absolute amount. LIAs also reported more work to Partner on Recurring Physical Activity Events and Assist with Implementing Nutrition Education in schools. Conversely, LIAs reported decreased amounts of all six direct education activities, including significant declines in the proportion of all LIA activities dedicated to direct education—generally with small effect sizes.

**County Health Departments versus Cooperative Extension Units.** Overall, health departments saw a more modest decline in their *total* number of PSE and direct education activities (from 2,435 pre-COVID to 1,493 COVID, a 38.69% decrease) than cooperative extension (from 5,619 pre-COVID to 2,293 COVID, a 59.19% decrease). Changes in the absolute number of reported community food security PSE activities were markedly different by agency type: Cooperative extension units saw a 59.07% decline, while health departments saw a 152.97% increase. For community-based physical activity, cooperative extension units increased their absolute number of PSE activities by 42.56%, while health departments decreased theirs by 61.11%. Both LIA types reported fewer absolute numbers of all four school-based nutrition and physical activity PSE supports combined, with cooperative extension uniquely increasing support for Implementing Nutrition Education and health

departments uniquely increasing support for Policy Implementation, Evaluation & Communication. Both LIA types also reported far fewer direct education across all six topics with the onset of COVID-19.

Table 3 shows changes in the *relative* amounts of PSE activities by LIA type, pre-COVID-19 to COVID-19. Compared to cooperative extension, health departments had a significantly greater increase in the proportion of their overall programming to Increase Meal Participation (667.10%, <0.001, large effect:  $\phi=0.56$ ) and Increase Local Food Purchase/ Procurement (5250.00%, <0.001, medium effect:  $\phi=0.25$ ). Conversely, cooperative extension demonstrated a significantly greater increase in their proportion of overall activity to Improve Emergency Food (664.70%, <0.001, medium effect:  $\phi=0.24$ ), Assist with Implementing Nutrition Education (572.70%, <0.001, medium effect:  $\phi=0.24$ ), and Partner on Recurring Physical Activity Events (325.00%, <0.001, medium effect:  $\phi=0.22$ ).

Figure 1 offers a visual representation of the pivots that health departments and cooperative extension made to PSE activities during COVID-19. The dashed lines show that health departments spread their *reduced* support across five PSE activities, and the thick solid lines show how they *intensified* their programming on five other PSE activities, focusing on Increase Meal Participation and Local Food Purchase/ Procurement. Means, cooperative extension units reduced their support for just two activities and increased their support across the other eight PSE activities, especially Improve Emergency Food, Partner on Physical Activity Events, and Implement Nutrition Education.

**Table 2. Changes in Local SNAP-Ed Implementing Agencies' Reported PSE and Direct Education Activities Before and After the Onset of COVID-19, March 2019-September 2020**

SNAP-Ed Activity	Time Period <sup>a</sup>		Total (Both Periods) n (%)	Chi Square Test <sup>d</sup> $\chi^2$ (df=1)	P-value	Effect Size <sup>e</sup> phi
	Pre-COVID <sup>b</sup> n (%)	COVID <sup>c</sup> n (%)				
<b>PSE: Community-Based Food Security</b>						
Improve Emergency Food	240 (3.0)	355 (9.4)	595 (5.0)	220.79	<.001	.14
Increase Benefits Redemption	298 (3.7)	94 (2.5)	392 (3.3)	11.92	<.001	-.03
Increase Local Food Purchase/Procurement	35 (0.4)	192 (5.1)	227 (1.9)	294.44	<.001	.16
Increase Meal Participation	1174 (14.6)	989 (26.1)	2163 (18.3)	229.94	<.001	.14
Support Existing Gardens	1173 (14.6)	530 (14.0)	1703 (14.4)	0.668	.41	-.01
<b>PSE: Community-Based Physical Activity</b>						
Partner on Recurring Physical Activity Event	296 (3.7)	418 (11.0)	714 (6.0)	246.55	<.001	.14
<b>PSE: School-Based Nutrition &amp; Physical Activity</b>						
Assist with Implementing Nutrition Education	190 (2.4)	387 (10.2)	577 (4.9)	343.45	<.001	.17
Assist with Wellness Promotion & Marketing	1589 (19.7)	228 (6.0)	1817 (15.3)	372.47	<.001	-.18
Develop Written Local Wellness Policies	229 (2.8)	105 (2.8)	334 (2.8)	0.046	0.83	-.002
Policy Implementation, Evaluation, Communication	315 (3.9)	257 (6.8)	572 (4.8)	46.37	<.001	.06
<b>Direct Education on the Topics Listed</b>						
Direct Education – ECE-Based Nutrition	572 (7.1)	22 (0.6)	594 (5.0)	229.82	<.001	-.14
Direct Education – ECE-Based Physical Activity	68 (0.8)	0 (0.0)	68 (0.6)	32.15	<.001	-.05
Direct Education – Gardens	857 (10.6)	152 (4.0)	1009 (8.5)	145.04	<.001	-.11
Direct Education – Local Wellness Policy	612 (7.6)	41 (1.1)	653 (5.5)	209.82	<.001	-.13
Direct Education – School-Based Nutrition	155 (1.9)	4 (0.1)	159 (1.3)	64.31	<.001	-.07
Direct Education – School-Based Physical Activity	251 (3.1)	12 (0.3)	263 (2.2)	92.93	<.001	-.09

PSE: policy, systems, & environment; ECE: early care and education. <sup>a</sup> Pre-COVID: March 11-September 30, 2019; COVID: March 11-Sept 30, 2020. <sup>b</sup> The total number of all SNAP-Ed activities reported pre-COVID was n=8,054; column percents (%) use this as the denominator. <sup>c</sup> The total number of all SNAP-Ed activities reported COVID was n=3,786; column percents (%) use this as the denominator. <sup>d</sup> Chi-square ( $\chi^2$ ) test of independence. All  $\chi^2$  values have degrees of freedom (df) of 1. <sup>e</sup> The effect size for the  $\chi^2$  two-by-two contingency table is phi. Cohen's guidelines (1988) for interpreting phi are: small effect=.1, medium effect=.3, and large effect=.5.

**Geographical Variation.** **Figure 2** shows changes in the relative amount of select PSE activities before and during COVID-19 in each of four geographical regions. PSE activities not shown did not exhibit clear geographical variation, nor did direct education, which was generally cancelled across all four regions.

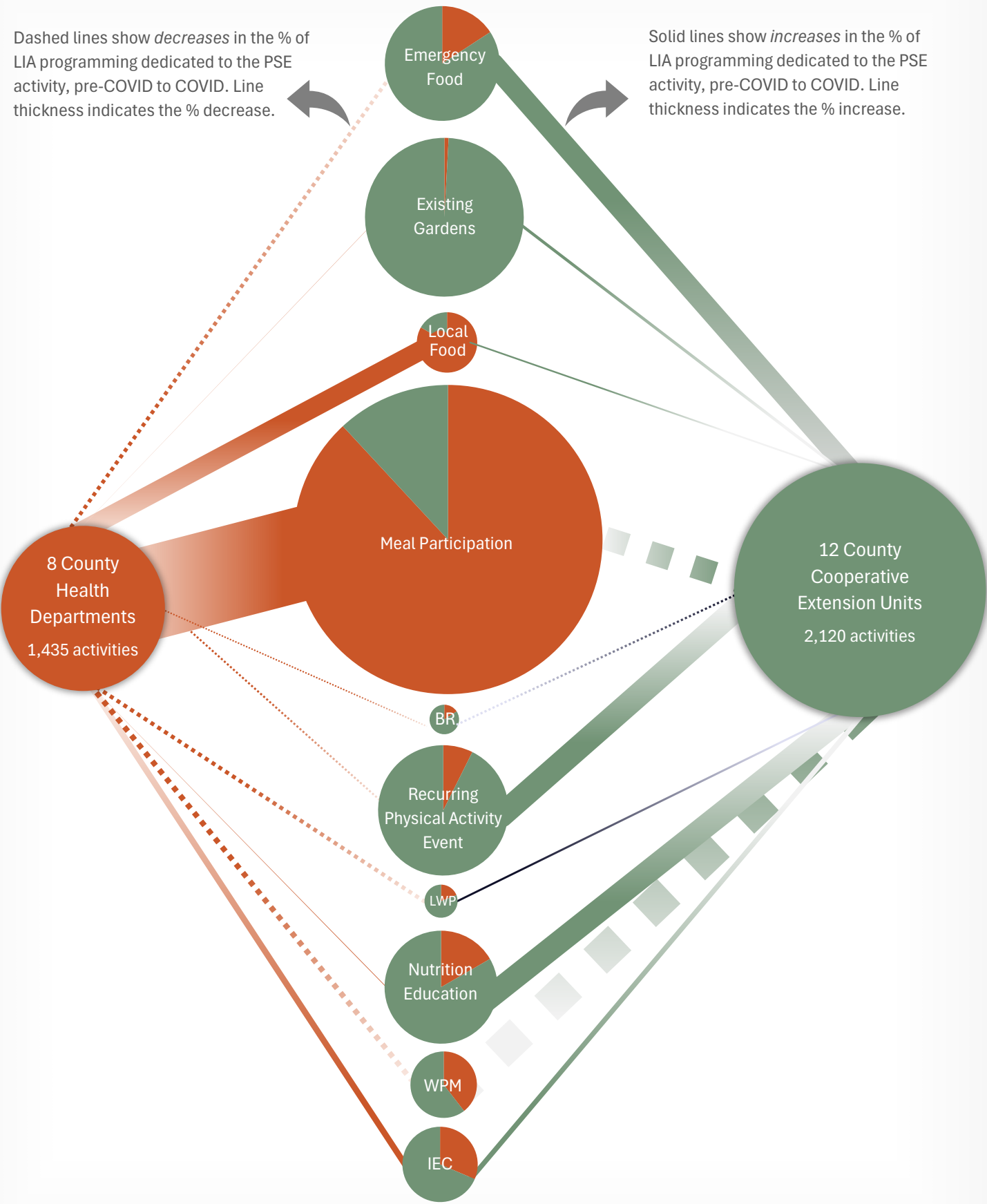
During COVID-19, the proportion of activities dedicated to Improve Emergency Food was higher in frontier, Indian, and rural areas, but not in urban areas. In contrast, the proportion of LIA support for Increase Meal Participation, Partner on Physical Activity Events, and Implement Nutrition Education saw significant increases in urban areas, usually

**Table 3. Changes in Policy, Systems, & Environment Activities Before and After COVID-19 Onset, by Local Implementing Agency Type (County Health Department vs Cooperative Extension)**

SNAP-Ed Activity	Local Implementing Agency Type	Time Period <sup>a</sup>		Relative Change in the % <sup>d</sup>	P-value <sup>e</sup>	Effect Size <sup>f</sup> phi
		Pre-COVID <sup>b</sup> n (%)	COVID <sup>c</sup> n (%)			
<b>Community Food Security</b>						
Improve Emergency Food	Health Department	143 (5.9)	56 (3.8)	<b>-35.59%</b>	.003	<b>-.05</b>
	Cooperative Extension	97 (1.7)	299 (13.0)	<b>664.70%</b>	<.001	<b>.24</b>
Increase Benefits Redemption	Health Department	57 (2.3)	23 (1.5)	-34.80%	.09	-.03
	Cooperative Extension	241 (4.3)	71 (3.1)	-27.90%	.01	-.03
Increase Local Food Purchase/ Procurement	Health Department	6 (0.2)	160 (10.7)	<b>5250.00%</b>	<.001	<b>.25</b>
	Cooperative Extension	29 (0.5)	32 (1.4)	<b>180.00%</b>	<.001	<b>.05</b>
Increase Meal Participation	Health Department	185 (7.6)	871 (58.3)	<b>667.10%</b>	<.001	<b>.56</b>
	Cooperative Extension	989 (17.6)	118 (5.1)	<b>-71.00%</b>	<.001	<b>-.16</b>
Support Existing Gardens	Health Department	64 (2.6)	41 (2.7)	3.80%	.82	.004
	Cooperative Extension	1109 (19.7)	489 (21.3)	8.10%	.11	.02
<b>Community-Based Physical Activity</b>						
Partner on Recurring Physical Activity Event	Health Department	72 (3.0)	28 (1.9)	<b>-36.70%</b>	.04	<b>-.03</b>
	Cooperative Extension	224 (4.0)	390 (17.0)	<b>325.00%</b>	<.001	<b>.22</b>
<b>School-Based Nutrition &amp; Physical Activity</b>						
Assist with Implementing Nutrition Education	Health Department	67 (2.8)	47 (3.1)	<b>10.70%</b>	.47	<b>0.01</b>
	Cooperative Extension	123 (2.2)	340 (14.8)	<b>572.70%</b>	<.001	<b>0.24</b>
Assist with Wellness Promotion & Marketing	Health Department	220 (9.0)	90 (6.0)	-33.30%	.001	-.05
	Cooperative Extension	1369 (24.4)	138 (6.0)	-75.40%	<.001	-.21
Develop Written Local Wellness Policies	Health Department	85 (3.5)	20 (1.3)	-62.90%	<.001	-.06
	Cooperative Extension	144 (2.6)	85 (3.7)	42.30%	.006	0.03
Policy Implementation, Evaluation, Communication	Health Department	80 (3.3)	99 (6.6)	100.00%	<.001	.08
	Cooperative Extension	235 (4.2)	158 (6.9)	64.30%	<.001	.06

<sup>a</sup>Pre-COVID: March 11-September 30, 2019; COVID: March 11-Sept 30, 2020. <sup>b</sup>Pre-COVID, Health Departments reported 2,435 SNAP-Ed activities and Cooperative Extension Units reported 5,619: Column percents (%) use these as the denominators. <sup>c</sup>COVID, Health Departments reported 1,493 SNAP-Ed activities, and Cooperative Extension Units reported 2,293: Column percents (%) use these as the denominators. <sup>d</sup>Calculated as the raw change in % pre-COVID to COVID divided by the pre-COVID %. <sup>e</sup>Calculated using the chi-square ( $\chi^2$ ) test of independence. <sup>f</sup>The effect size for the  $\chi^2$  two-by-two contingency table is phi. Cohen's guidelines (1988) for interpreting phi are: small effect=.1, medium effect=.3, and large effect=.5. **The most notable differences between LIA types are in bold green.**

**Figure 1. With COVID onset, county health departments (orange) and cooperative extension units (green) adapted their SNAP-Ed support for 10 Policy, Systems, & Environment (PSE) activities in unique ways.**



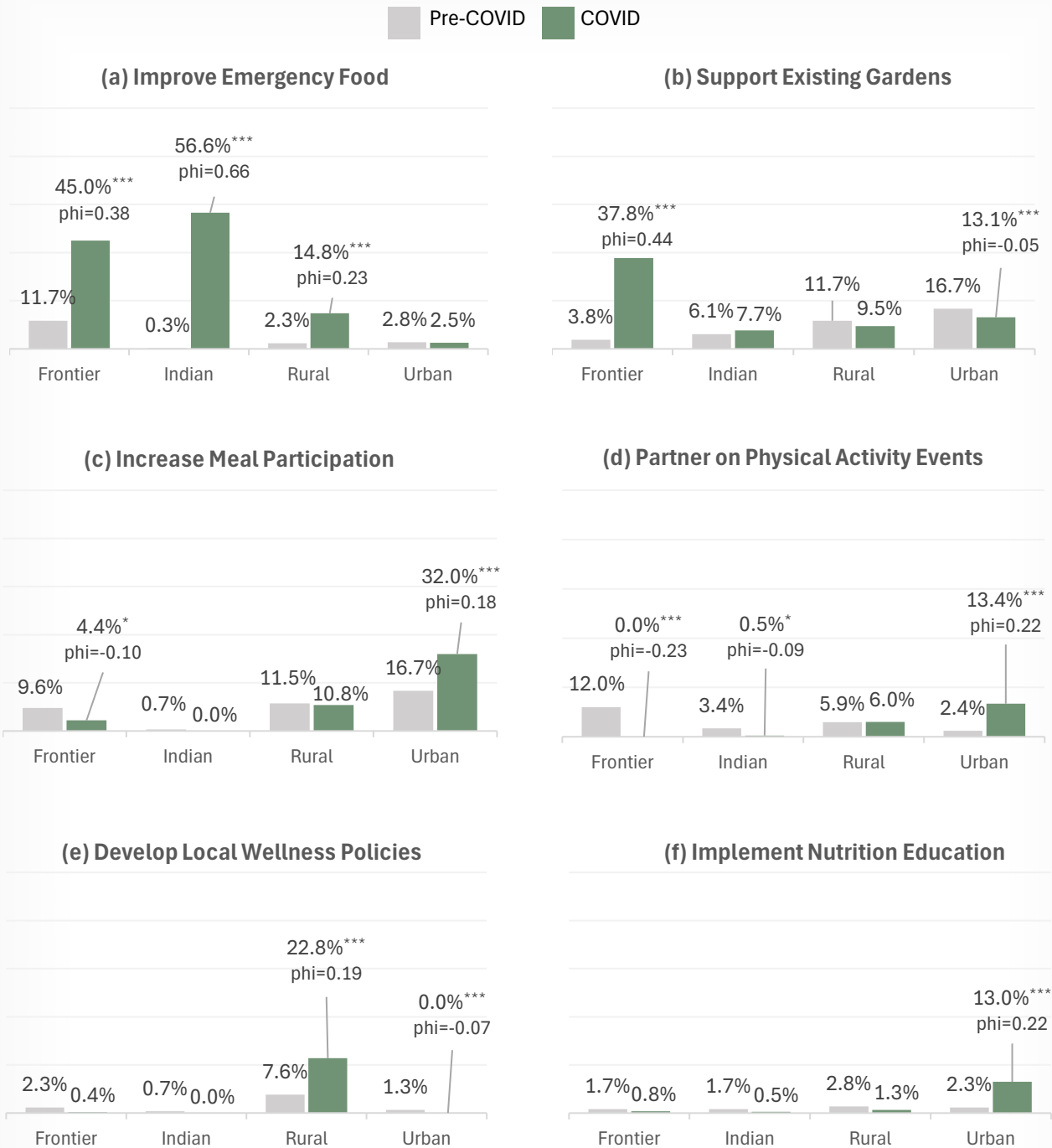
BR: Benefits Redemption; LWP: Local Wellness Policy; WPM: Wellness Promotion & Marketing; IEC: Policy Implementation, Evaluation & Communication. Pre-COVID: 3/11/19–9/30/19, COVID: 3/11/20–9/30/23. The size of each PSE activity circle (center column) corresponds to the proportion of all activities reported during COVID. Pie slices represent the % of the activity supported by health department (orange) or cooperative extension (green).



with a decrease in other regions. LIAs uniquely shifted their support for gardens to frontier

regions and their support for school wellness policies to rural regions.

**Figure 2. Changes in the proportion of Select SNAP-Ed Policy, Systems, & Environment Activities Before<sup>a</sup> and After<sup>b</sup> the Onset of COVID-19, by Geographical Region<sup>c</sup>**



Changes were calculated using the chi-square ( $\chi^2$ ) test of independence, with the phi effect size given for all statistically significant differences. Cohen's guidelines (1988) for interpreting phi are: small effect=.1, medium effect=.3, and large effect=.5. \* $p < .05$ , \*\*\* $p < .001$ .<sup>a</sup> Pre-COVID, the total number of all SNAP-Ed activities reported by region was 343 for Frontier, 293 for Indian, 1,947 for Rural, and 5,471 for Urban. <sup>b</sup>During COVID, the total number of all SNAP-Ed activities reported by region was 249 for Frontier, 182 for Indian, 452 for Rural, and 2,903 for Urban. <sup>c</sup>Per Arizona's Primary Care Area designations in the Frontier Special Area 2020 Statistical Profiles.

## What are the key lessons learned?

There were notable differences in how LIAs pivoted their PSE programming, according to the type of agency and the agency's geographical location.

## DISCUSSION

This study provided an in-depth examination of the local SNAP-Ed response to a complex crisis, specifically the first seven months following the declaration of Arizona's COVID-19 public health emergency. While LIAs' SNAP-Ed activities broadly decreased with the quick onset of COVID-19, changes in their PSE activities were nuanced by activity type, LIA type, and geographical region. Most community food security activities continued—and even expanded—at the start of the pandemic, while most school-based PSEs declined in absolute numbers but increased in their overall proportion, especially supports for Implementing Nutrition Education and Policy Implementation, Evaluation & Communication. Partner on Recurring Physical Activity Events, which generally involved LIA planning support and participation in outdoor event activities, also increased. In contrast, Direct Education, commonly delivered in-person prior to COVID-19, sharply declined, suggesting a major disruption of typical SNAP-Ed activities during the pandemic.

These findings are consistent with other reported pivots in SNAP-Ed programming at the onset of COVID-19. Across eight southeastern states, LIAs continued to focus on food security, albeit using new food distribution systems via drive-through pantries and gardens.<sup>12</sup> In California, LIAs reported many cancellations in their planned school-based interventions, but they also leveraged school meal distributions to connect with community members around nutrition and food access.<sup>15</sup> In-person direct education was largely cancelled, being replaced to varying degrees by virtual lessons.<sup>8-10,14,15</sup> One nuance uncovered in this analysis was that, despite the overall decline in school-based PSE activities, the relative amounts of three of the four activities increased significantly for cooperative extension units and the relative amount of one activity increased for health departments. This underscores

the importance of statistical analyses to better understand change over time.

**Variation by Agency Type.** We found notable differences in the programmatic shifts of local health departments versus cooperative extension. The greater decline in cooperative extension's overall number of reported activities (59.19% vs. 38.69% for health departments) suggests that health departments may have been better poised to make rapid pivots to address emergent, community-wide needs amid widespread food system disruptions. Indeed, health departments increased their overall number of community food security PSE activities by 152.97%, while cooperative extension decreased theirs by 59.07%. As shown in Figure 1, health departments reduced their support for many PSE activities and focused their COVID-19 programming on Increase Meal Participation and Local Food Purchase/Procurement. Kao et al. reported a similar pattern in California, where local health departments provided free groceries and gardening kits during school meal distributions.<sup>15</sup> Thus, health department activities appear to have responded to broader supply chain disruptions by supporting local level food production and distribution via their existing school channels.

Conversely, cooperative extension may have been better positioned to develop creative ways to continue typical SNAP-Ed programming amid COVID-19. Unlike health departments, cooperative extension units spread their support across many types of PSE activities, including Improve Emergency Food, Partner on Physical Activity Events, and Implement Nutrition Education. As illustrated in Figure 1, these programmatic pivots were less pronounced than the changes made by health departments, but they were broader in scope. Many of the activities supported by cooperative extension were designed to reach residents directly, often with the help of external partners like schools or food

banks. Similarly, cooperative extension agencies in Utah and New Mexico sought to maintain contact with residents by increasing their virtual outreach and partnering more with non-governmental emergency response agencies.<sup>21,22</sup>

Agile and adaptive governance together describe organizations' ability to respond to dynamic and uncertain conditions. Agility is focused on how practices—and even organizational culture more broadly—can facilitate quick response; the organization adjusts rapidly, incrementally, and reactively versus taking a methodical planning approach. Organizations addressing agility questions might ask: “What do we do right now, and what do we need to do it?” Adaptability draws from evolutionary science and is focused on how organizations adjust to meet emergent selective pressures; systemic changes can enhance an organization's ability to respond. Organizations addressing adaptability questions might ask: “In what order should we respond to the many issues we are facing? At what level(s) should we respond (ex., more locally, more centralized)? How can we pivot in ways that allow us to survive?” By merging both response types, organizations can also ask, “If we ‘lock in’ this agile response, what happens to our ability to adapt?”<sup>16</sup>

As we considered the differences in how local health departments and cooperative extension units responded to COVID-19, we found the concepts of agile and adaptive governance helpful. Local health departments are designed to address emergent and existing threats to public health. Indeed, they provide more than health promotion and education services; they have specialized units to address epidemiology and disease surveillance, emergency preparedness and response, community health services, and more.<sup>23</sup> By leveraging these intra-organizational support systems, Arizona's local health departments may have been better able to (1) pivot interventions more quickly to pandemic

conditions, an agile response made possible by their familiarity with emergency response protocols and (2) prioritize their efforts on the immediate need to enhance food security amid food system disruptions, an adaptive response facilitated by the health department's structure and mission.

While cooperative extension agencies do address public health issues, their organizational mission grew out of an agriculturally-focused land grant university system.<sup>18</sup> Extension programs are uniquely structured to engage communities around enhancing local food systems using an educational outreach lens. In Arizona, cooperative extension addresses specialized work in youth development (ex., 4-H), animal husbandry, gardening, natural resources (ex., water), and more.<sup>24</sup> Thus, with COVID-19 onset, cooperative extension LIAs may have been less agile, needing more time to re-focus their outreach and education missions. At the same time, their continued attention to activities such as Support Existing Gardens, Partner on Physical Activity Events, and Implement Nutrition Education allowed these LIAs to pivot, engaging residents directly in spaces deemed safe during COVID-19. They also drew upon relationships with local partners like food banks to address local food systems disruptions through the Improve Emergency Food activity, showing evidence for adaptability to changing conditions.

***Geographical Variation.*** Our geographical analysis revealed distinct patterns in SNAP-Ed activities. Urban areas saw significant increases in activities related to Increase Meal Participation, Partner on Physical Activity Events, and Implement Nutrition Education, likely reflecting the higher population densities and greater availability of resources. In particular, LIAs leveraged the school setting as a food-and-information distribution hub in urban areas. In contrast, frontier, Indian, and rural areas focused more on Improving Emergency Food and Support

Existing Gardens (frontier only), which may be due to their greater geographical isolation and the corresponding need to ensure basic food security. LIAs also uniquely shifted their support for school wellness policies to rural regions, which allowed them to continue their school-based PSE support remotely and/or asynchronously in harder-to-reach areas that may have been disproportionately impacted by COVID-19.

Together, these findings underscore the importance of context-specific strategies in public health crisis responses. The ability to tailor interventions to the unique needs of different regions is crucial for the effectiveness and resilience of SNAP-Ed programs.

***Theoretical Implications.*** From a theoretical perspective, this study supports the application of complex adaptive systems (CAS) theory to understand SNAP-Ed operations during the pandemic. CAS theory posits that organizations and their management systems function as dynamic, interrelated networks capable of adapting to changing conditions.<sup>5,6</sup> The varied responses of LIAs—ranging from the rapid, focused adjustments of health departments to the broader, diverse strategies of cooperative extension units—illustrate the adaptive capacities of these organizations within a complex, evolving crisis.

Moreover, the concepts of agile and adaptive governance provide a valuable framework for interpreting these findings. Health departments' swift pivots and cooperative extension units' broad-based adaptations align with the principles of agile and adaptive governance, emphasizing the need for rapid decision-making followed by reflective learning to enhance future resilience.

***Limitations.*** Several limitations should be noted when interpreting the findings of this study. We focused on the first seven months of the pandemic, capturing only the immediate responses of LIAs. Long-term adaptations and outcomes remain to be

explored. In addition, the analysis reported here relied solely on quantitative data from the Arizona SNAP-Ed electronic data system. Incorporating qualitative data can provide richer insights into the decision-making processes and contextual factors influencing LIA responses. Moreover, differences in reporting practices across LIAs may have influenced the results. It is also important to acknowledge that this study was specific to Arizona, and findings may not be generalizable to other states or regions with different demographic, social, and economic contexts. However, this specificity is a feature of evaluating complex adaptive systems.

## IMPLICATIONS

This study highlights the agility and adaptability of local SNAP-Ed systems in responding to a pervasive system disruption—in this case, a pandemic. Health departments and cooperative extension units demonstrated distinct but complementary strategies to address emergent community needs, underscoring the importance of flexible, context-specific approaches in public health programming. Future research can build on these findings by exploring long-term adaptations and incorporating qualitative insights to deepen our understanding of organizational resilience in public health or other crises that threaten a program's status quo operations and/or overall existence. In terms of practical application, SNAP-Ed policymakers and program managers may wish to invest in systems that enhance the agility and adaptability of their programming by exploring, with staff and community stakeholders, a variety of potential response strategies to deploy in cases of community-wide disruptions or emergencies.

### What are the key take-aways?

SNAP-Ed policymakers and program managers can use findings to inform system investments that enhance their programs' agility and adaptability.

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