Philippine Journal of Science
150 (3): 575-605, June 2021
ISSN 0031 - 7683
Date Received: 16 Jul 2020

Assessment of Socioeconomic and Climate Change-related Factors to Meeting Recommended Energy Intake (REI) of Filipino Households

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This study aimed to determine the sociodemographic, socioeconomic, and climate change-related factors associated with meeting recommended energy intake (REI) among Filipino households. This paper utilized data from selected components of the 2013 National Nutrition Survey (NNS) and 2015 Updating Survey of the Department of Science and Technology – Food and Nutrition Research Institute (DOST-FNRI), typhoon/flood occurrence from online reports of the National Disaster Risk Reduction and Management Council (NDRRMC) and drought data for the first quarter (Q1) of 2015 from the Philippine Rice Information System (PRiSM) of the International Rice Research Institute (IRRI). Multiple logistic regression using the backward elimination method was done and post-estimation tests were applied to the final model. Filipino households with more than three members were food insecure and were poor were less likely to meet the REI. On the other hand, households engaged in agricultural work, having a member working abroad, residing in rural areas, and shorter time lag exposure to typhoons/floods were more likely to meet REI. Filipino households in Mindanao, meanwhile, were less likely to meet REI if they had more than three members and were food insecure and more likely to meet REI if they were engaged in agricultural work. The study provides a snapshot of a seemingly minute but significant facet of the health and nutrition situation in the Philippines, which is meeting the REI at the household level in relation to exposure to extreme weather events such as typhoons, floods, and drought brought about by climate change. The results of the study may provide vital inputs to climate change adaptation programs of the government for vulnerable population groups, particularly among farming- and fishing-dependent households who will likely absorb the long-term impact of the extreme weather events to their livelihoods.

Keywords: drought, floods, households, Philippines, recommended energy intake, typhoons

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INTRODUCTION

The Food and Agriculture Organization (FAO) of the United Nations lists three main causal pathways that will aggravate the problem of undernutrition as a consequence of climate change. These include the impact on accessibility to sufficient, safe, and adequate food; impact on care and feeding practices; and impact on environmental health and access to health services. Food security is compromised because of crop yield reduction due to rising temperatures and variable rainfall patterns. Furthermore, it is estimated that climate change can cause 250,000 additional deaths per year between 2030–2050 from malnutrition, malaria, diarrhea, and heat stress (WHO 2018a, b).

The Philippines is one of the countries in the world highly vulnerable to the impacts of climate change and extreme weather events because of its geographic location and economic situation (2013 Climate Change Vulnerability Index, Maplecroft). Among the extreme weather events, tropical cyclones ranked first at 82% and flood ranked third at 5% in terms of the number of affected population in 2013 (CDRC 2013). Tropical cyclones also had the largest share of casualties at 92%. In 2014, tropical cyclones accounted for the top disaster in terms of the number of affected people at 13,081,129. Flashflood ranked second at 141,052 people affected and continuous rains brought by the Intertropical Convergence Zone/ monsoon at 47,759 people affected ranked fourth.

The impacts of climate change particularly from extreme weather conditions may result in considerable damage to food systems and affect the food security and nutritional and health status, particularly of the most vulnerable groups (Krishnamurthy *et al.* 2015). In terms of food production, the effects of El Niño may also be considered a natural calamity and cause considerable impact on food security and nutrition. The economic cost of climate change-related calamities is also alarming with billions of pesos worth of damages in the infrastructure, agriculture, and commercial sectors. On a global scale, the Philippines ranked second in the list of most disaster-affected countries in 2014 and ranks second in the World Disaster Risk Index 2014 (Birkman *et al.* 2014).

In the Philippines, studies on the impact of climate change on the nutrition, health, and food security status of individuals and households are wanting and highly relevant. The availability of national-scale data on nutrition and health statistics through the conduct of nutrition surveys is an opportune activity to assess the impact of climate change on the nutrition and health status of vulnerable population groups by exploring the association between exposure to typhoons, floods, and drought with nutrition and health indicators.

The results of this study may provide information on the impacts of extreme weather conditions on food security status particularly on food access and availability and on human health and nutrition using available data on food consumption, climate data, weather and rice production data, food production data, and exposure from disasters.

These may be vital inputs to climate change adaptation programs of the government for vulnerable population groups. It may also be utilized to provide evidence on how natural disasters impact human life and be a call for action and prevent being overcome by the aftermath of calamities.

Furthermore, this study is aligned with an indicator of the Sustainable Development Goal 2 of Zero Hunger, which is the prevalence of undernourishment. It estimates the proportion of the population with insufficient consumption of dietary energy levels required to maintain a normal active and healthy life (FAO 2017). Insufficient caloric intake is reflective of poverty and the welfare situation (Eli and Li 2015) because it shows the failure to attain some minimum acceptable living standard (Behrman *et al.* 1997).

Based on the 2015 Updating Survey, in the Philippines, 31.0% of households met the REI; however, the factors associated in the context of exposure to typhoons/floods and drought are yet to be explored. This study, therefore, aimed to determine the sociodemographic, socioeconomic, and climate change-related factors – specifically typhoons/ floods and drought – associated with meeting the REI among Filipino households.

MATERIALS AND METHODS

Study Design

This study used a cross-sectional analytic study design using data from the 2013 8th NNS and the 2015 Updating Survey of Nutritional Status of Filipino Children and Other Population Groups (2015 Updating Survey). The 2013 NNS was conducted by the DOST-FNRI from June–December 2013 and from February–April 2014 while the 2015 Updating Survey was conducted from July–November 2015. Data from the NDRRMC, PRISM–IRRI, and the Philippine Statistics Authority (PSA) were merged with DOST-FNRI nutrition survey data.

Study Population and Subjects

The study population for this study consists of households covered during the DOST-FNRI nutrition surveys. The PSA defines a household as "a group of persons who may be related or not, who sleep in the same dwelling unit, and have common arrangements for the preparation and consumption of food."

Based on the merged data sets of the 2013 and 2015 Nutrition Surveys and typhoon and flood occurrence, the final number of households included in the study was 8,592 and 9,925, respectively. The merged data set of the 2015 Updating Survey and drought occurrence in Mindanao yielded 2,803 households in total.

Data Collection Procedure

NNS of the DOST-FNRI. Both the 8th NNS and 2015 Updating Survey employed a stratified three-stage sampling design adopting the 2003 Master Sample of the PSA. The first stage is the selection of primary sampling units (PSUs) that is composed of one "barangay" or a combination of contiguous barangays with at least 500 households per sampling unit. The second stage is the identification of enumeration areas (EAs) within each PSU, comprising 150–200 households. The third stage is the random selection of housing units within the EAs, with the household as the sampling unit.

The 2013 NNS was conducted from June–December 2013 and from February–April 2014, while the 2015 Updating Survey was conducted from July–November 2015. Both of these surveys used four replicates of the 2003 Master Sample to obtain the national, regional, and provincial estimates for the following components: anthropometric measurements, blood pressure status and interview schedule-based information for food security, government program participation, and socioeconomic components, except for the dietary component wherein only one replicate was used to obtain national up to regional estimates.

The detailed methodology of the 8th NNS and 2015 Updating Survey is published elsewhere (DOST-FNRI 2015, 2016a).

NDRRMC (typhoons and floods). Data on typhoons and floods that occurred in the Philippines was available at the provincial level from reports published online by the NDRRMC. A province was included in the study if there was a calamity declaration, severe destruction after the calamity, and a high report of casualties caused by the calamity.

For the 2013 NNS data, typhoon/flood data used was from December 2012–April 2014; for the 2015 Updating Survey data, typhoon/flood data used was from January–December 2015.

PRiSM–IRRI (Drought). IRRI provided the data for drought occurrence through their satellite system called the PRiSM (De DDios 2018). PRiSM is a satellite-based rice crop monitoring system that provides accurate and timely data by mapping calamity flooding and drought. Available data was at the municipal level in Mindanao only for Q1 2015 and Q1 2016; however, the data for 1Q 2016 was not used in this study.

Annual data on "palay" production in metric tons per province as public use file was obtained for 2012–2016 from the OpenStat system of the PSA (2018) available online.

Data Processing and Analysis

The outcome variable for this study was meeting the REI by the households covered nationwide. Data was taken from the household dietary component of the 2013 NNS and 2015 Updating Survey. On the other hand, households in selected areas in Mindanao with PRiSM coverage were included for drought exposure and a dietary component of only the 2015 Updating Survey was used.

The REI is defined as the "level of intake of energy or nutrient which is considered adequate for the maintenance of health and well-being of healthy persons in the population" (DOST-FNRI 2016b). Meeting or not meeting the REI was based on the household's food intake. The actual household food intake per day was measured based on the one-day food-weighing method. The actual intake was then computed as the difference between the total food weight and the combined weight of leftover and given-out food and plate wastes. The actual food consumption weights were encoded to a computer library of the food composition table (FCT) to facilitate the estimation of the energy and nutrient intake of the food consumed. The energy content of food is determined by the product of the net edible weight and nutrient content of food from the FCT divided by 100 since the nutrient values are given per 100 EP raw weight of food. Estimates of energy and nutrient content of the household diet were then compared against the nutritional requirement stipulated in the Philippine Dietary Reference Intakes (DOST-FNRI 2016c). Results are presented as the proportion of households meeting the energy requirement. Households meeting 100% of REI were categorized as "meeting REI" and coded as 1; otherwise, if they were "not meeting REI," it is coded as 0.

The exposure variables included the household head's sex, age, civil status, highest educational attainment, work status, place of work, and PhilHealth (Philippine Health Insurance Corporation) membership. On the household level, exposure variables included were household food security status, "Pantawid Pamilyang Pilipino" Program (4Ps) membership of household, household size, place of residence, wealth index, meals eaten out, and reading of product labels by the meal planner. Climate-change related exposure variables included time-lag exposure to typhoons/floods and drought and palay production. Selected interaction terms were also included in the multivariate analysis. The summary of exposure variables and operational definitions are presented in detail elsewhere (Duante *et al.* 2018). Weighted statistical analyses were done using Stata Version 15.1, a statistical software designed for complex analysis, taking into

consideration the stages of household selection for participation in the survey.

Data was consolidated using past records and reports of calamities listed by the NDRRMC. Provinces affected by typhoons/floods were listed with the dates of calamity occurrence and then matched with the date of actual data collection of the 2013 NNS and 2015 Updating Survey. Areas exposed to typhoons/floods within 6 mo before actual data collection were tagged. Then, six dummy variable of exposure to typhoons/floods was generated coding zero (1) if exposed to typhoons/floods prior to data collection, and one (0) if not.

For drought exposure, municipalities in Mindanao affected by drought were grouped by provinces and matched with the date of actual data collection of the 2015 Updating Survey. Those exposed to drought for Q1 2015 were tagged. Dummy variables for drought were generated, coding 0 for non-exposure and 1 for exposure to drought in Q1 2015.

The variable "palay production" was computed using a slope formula with the recent, present, and succeeding data of production, where the year of production was "x" and the total production "y."

NNS data and data on drought exposure were merged to create an updated database. Descriptive statistics such as means, standard deviations, frequencies and percentages, and confidence intervals were generated to describe the distribution of the outcome and exposure variables. Chi-squared test was employed to determine if there was a significant difference between categories of the exposure variable. A 5% level of significance was set for the proportions derived using the NNS data. Meanwhile, a 10% level of significance was set for the univariate and multivariate analyses and backward elimination method to determine the final model. Multivariate logistic regression was performed to determine the association of the different exposure variables to the outcome variables. The backward elimination method was used in fitting the final model and post-estimation tests were applied. The goodness-of-fit (GOF) test was used to test the overall fit of the observed data to the predicted model. A model with a level of significance above 5% was considered a good fit. Wald's test was performed to determine which among the variables in the final model had no effect on the model using a 5% level of significance.

Ethical Considerations

This study titled "Assessment of Socioeconomic and Climate Change-related Factors to Meeting Recommended Energy Intake (REI) of Filipino Households" is part of a project entitled "Assessment of the Impacts of Climate Change on Human Health and Nutrition" which was approved by the Food and Nutrition Research Institute Institutional Ethics Review Committee (FIERC) on 10 May 2018, with Protocol Code FIERC-2018-009.

The 8th NNS was approved by the FIERC on 19 Feb 2013, with Protocol Code FIERC-2012-001. The 2015 Updating Survey was approved by the FIERC on 20 Jul 2015, with protocol code FIERC-2015-006. Consent was obtained in writing from study respondents prior to actual data collection. The informed consent form contained all the components of the 8th NNS and 2015 Updating Survey, detailed data collection procedures, and non-disclosure of information for anonymity and confidentiality purposes. The content of the consent form used is published elsewhere (DOST-FNRI 2015, 2016a).

RESULTS AND DISCUSSION

Typhoons/Floods

Appendix Figure I shows the areas affected by typhoons and floods in 2013 and 2015 within 6 mo prior to data collection. During the 2013 NNS data collection phase, the areas affected by typhoons/floods included provinces in Region 1 (Ilocos) and the Cordillera Administrative Region (CAR), National Capital Region (NCR), provinces in Region 4A (CaLaBaRZon) and 4B (MiMaRoPa), Region 5 (Bicol), and regions in the Visayas. Data collection for the 2015 Updating Survey coincided with typhoon/flood occurrences in the northern part of the Philippines – mainly, Regions 2 (Cagayan Valley) and 3 (Central Luzon), Catanduanes, Sultan Kudarat, and South Cotabato. Region 1 and selected provinces of CAR, MIMAROPA, and the province of Guimaras were affected by typhoons and floods within 6 mo prior to data collection for both the 2013 NNS and 2015 Updating Survey.

In 2013, typhoons/floods mostly affected Luzon and Visayas areas, which coincided with actual data collection phase of the 8th NNS. These typhoons were "Maring" (Tropical Storm Talim), "Labuyo" (Typhoon Utor), "Nando" (Tropical Storm Kong-rey), "Agaton" (Tropical Storm Lingling), "Gorio" (Severe Tropical Storm Rumbia), "Odette" (Typhoon Usagi, a southwest monsoon), "Auring" (Severe Tropical Storm Sonamu) and "Yolanda" (Typhoon Haiyan), which cost the Philippines substantial human life and economic losses.

Typhoons/floods that coincided within 6 mo during the 2015 Updating Survey data collection period included "Chedeng" (Typhoon Maysak), "Dodong" (Typhoon Noul), "Egay" (Typhoon Linfa), "Ineng" (Typhoon Goni), and flooding in Guimaras, South Cotabato, and Sultan Kudarat.

Based on the merged datasets, 37.8% and 24.3% of households who participated in the 2013 and 2015 survey

reside in the provinces were exposed to typhoons and floods, respectively. The summary of the typhoon/flood occurrence and time lag exposure of provinces prior to data collection is presented in Appendix Table I.

Time Lag Exposure to Typhoons and Floods

Profile of households, 2013 NNS, and 2015 Updating Survey. Overall, one in three households (31.7%) in 2013 and also one in three households (31.0%) in 2015 met the REI (Tables 1 and 2). Households meeting the REI in both reference years were predominantly female-headed, without partners (single/ widowed/ separated), and with an increased level of educational attainment. In terms of employment, there were more households engaged in agricultural work and households whose heads work abroad that met the REI.

The proportion of households meeting REI was significantly higher among non-4Ps recipient than 4Ps recipients for both reference years. In contrast, the proportion of households meeting the REI was not statistically different between households headed by PhilHealth and non-PhilHealth members.

The percentage of households meeting REI was found significantly highest among food secure households and those with relatively smaller sizes, *i.e.* 1–3 members than those with larger sizes for both survey years.

Moreover, the proportion of households meeting the REI increased as wealth status improved. Among households with members that have eaten meals outside of their homes, a higher proportion met the REI than those who did not. Among meal planners that read the product label, a higher proportion met the REI than those who did not but the difference was not statistically significant. Moreover, no significant difference was noted among households that met the REI and those who did not in terms of their exposure to typhoons/floods, with a lag time of 6 mo prior to the conduct of the survey.

Table 1. Profile of households meeting the REI: Philippines, 2013.

Characteristics	n	Proportion	95% CI		*p*-value
			LL	UL	
Philippines	8,592	31.7	30.4	33.0	
Sex of household head					
Male	6,882	30.6	29.2	32.0	0.0001
Female	1,710	35.8	33.4	38.2	
Age of household head					
Less than 30 yr	257	32.1	26.2	38.7	< 0.0001
30–39.9 yr	1,269	30.6	28.0	33.4	
40–49.9 yr	2,333	28.6	26.6	30.7	
50–59.9 yr	2,223	29.7	27.7	31.8	
More than 60 yr (reference)	2,510	36.7	34.4	39.1	
Civil status of household head					
With partner	6,464	30.7	29.4	32.1	0.0014
Without partner	2,124	34.5	32.3	36.8	
Highest educational attainment of household head					
No grade completed	253	26.0	20.8	32.0	< 0.0001
Elementary level	3,703	29.4	27.8	31.1	
High school level	2,776	30.6	28.6	32.6	
Vocational level	421	35.9	30.9	41.3	
College undergraduate	585	37.1	33.3	41.0	
At least college graduate	812	39.6	35.8	43.5	
Work of household head					
Agricultural work	2,532	31.2	29.3	33.1	0.7249
Non-agricultural work	4,021	30.7	29.1	32.4	
Place of work of household head					
At home	754	34.9	31.6	38.4	<0.0001

Characteristics	n	Proportion	95% CI		*p*-value
			LL	UL	
Local away from home	5,548	29.8	28.4	31.2	
Abroad	160	46.4	38.4	54.6	
Meal planner reading product labels					
No	3,883	29.1	27.6	30.8	0.0011
Yes, always	3,274	33.9	32.1	35.8	
Sometimes	1,251	32.4	29.0	36.0	
Meal eaten out					
No	5,605	30.8	29.2	32.5	0.0526
Yes	2,987	33.1	31.4	34.9	
PhilHealth membership of household					
No	3,240	31.0	29.1	33.0	0.4269
Yes	5,036	32.0	30.4	33.7	
4Ps membership of household					
No	5,037	33.9	32.2	35.6	< 0.0001
Yes	1,743	21.4	19.4	23.6	
Food security status					
Food Secure	2,383	40.9	38.3	43.5	< 0.0001
Mildly food insecure	1,200	32.9	30.3	35.6	
Moderately food insecure	3,220	28.4	26.6	30.3	
Severely food insecure	1,766	22.5	20.4	24.7	
Household size					
1–3 members	2,332	43.1	40.9	45.3	< 0.0001
4–6 members	2,898	33.0	31.0	35.1	
7 or more members	3,362	22.7	21.2	24.4	
Place of residence					
Rural	4,881	31.9	30.3	33.5	0.7674
Urban	3,711	31.5	29.5	33.5	
Wealth status					
Poor	3,214	26.4	0.9	24.6	< 0.0001
Middle	2,806	30.0	1.0	28.1	
Rich	2,350	38.2	1.3	35.7	
Time lag exposure to typhoon/floods 1 mo prior to survey					
No	7,413	31.5	30.1	32.9	0.2638
Yes	1,179	33.1	30.6	35.8	
Time lag exposure to typhoon/floods 2 mo prior to survey					
No	7,515	31.5	30.2	32.9	0.5414
Yes	1,077	32.6	29.6	35.7	
Time lag exposure to typhoon/floods 3 mo prior to survey					
No	7,708	31.3	30.0	32.7	0.0722
Yes	884	34.8	31.3	38.4	
Time lag exposure to typhoon/floods 4 mo prior to survey					
No	8,121	31.5	30.2	32.8	0.1549

Characteristics	n	Proportion	95% CI		*p*-value
			LL	UL	
Yes	471	35.4	30.2	40.9	
Time lag exposure to typhoon/floods 5 mo prior to survey					
No	7,334	32.3	31.1	33.6	0.1127
Yes	1,258	29.2	25.8	32.9	
Time lag exposure to typhoon/floods 6 mo prior to survey					
No	7,230	32.4	31.1	33.7	0.0928
Yes	1,362	29.2	25.9	32.7	

Table 2. Profile of households meeting the REI: Philippines, 2015.

Characteristics	n	Proportion	95% CI		*p*-value
			LL	UL	
Philippines	9,925	31.0	29.9	32.2	
Sex of household head					
Male	7,938	29.8	28.5	31.1	
Female	1,987	35.6	33.4	37.9	< 0.0001
Age of household head					
Less than 30 yr	473	37.7	32.7	43.0	< 0.0001
30–39.9 yr	1,674	29.3	27.0	31.6	
40–49.9 yr	2,553	28.0	26.0	30.1	
50–59.9 yr	2,461	28.1	26.2	30.1	
More than 60yr	2,764	36.3	34.4	38.2	
Civil status of household head					
With partner	7,371	29.4	28.1	30.7	< 0.0001
Without partner	2,549	35.7	33.6	37.9	
Highest educational attainment of household head					
No grade completed	329	32.0	27.1	37.2	0.4833
Elementary level	4,101	30.9	29.2	32.7	
High school level	3,367	30.3	28.6	32.0	
Vocational level	563	29.5	25.3	34.0	
College undergraduate	636	32.7	29.2	36.5	
At least college graduate	927	33.3	30.0	36.8	
Work of household head					
Agricultural work	2,882	33.9	31.7	36.3	0.0002
Non-agricultural work (reference)	5,115	29.0	27.6	30.5	
Place of work of household head					
At home	805	33.8	30.3	37.4	0.0617
Local away from home (reference)	6,998	30.0	28.7	31.4	
Abroad	194	34.3	27.9	41.2	
Meal planner reading product labels					
No (reference)	2,813	31.7	29.9	33.5	0.0268
Yes, always	2,586	32.8	30.8	34.8	
Sometimes	3,147	29.6	27.7	31.5	

Characteristics	n	Proportion	95% CI		*p*-value
			LL	UL	
Meal eaten out					
No (reference)	6,923	31.2	29.8	32.6	0.7005
Yes	3,002	30.7	28.7	32.7	
PhilHealth membership of household					
No	2,600	30.4	28.4	32.4	0.4111
Yes	6,501	31.3	29.9	32.7	
4Ps membership of household					
No	7,312	33.3	31.9	34.6	< 0.0001
Yes	2,359	23.7	21.6	25.9	
Food security status					
Food secure	3,142	36.7	34.7	38.7	< 0.0001
Mildly food insecure	1,254	31.4	28.7	34.2	
Moderately food insecure	3,146	29.6	27.7	31.5	
Severely food insecure	2,131	24.6	22.7	26.7	
Household size					
1–3 members	2,813	42.1	40.2	44.1	< 0.0001
4–6 members	3,501	32.3	30.6	34.1	
7 or more members	3,611	21.1	19.5	22.7	
Place of residence					
Rural	6,053	32.8	31.2	34.4	0.0013
Urban	3,872	29.0	27.3	30.7	
Wealth status					
Poor	3,606	29.4	1.0	27.6	0.0011
Middle	3,399	29.7	1.0	27.9	
Rich	2,819	33.8	1.0	31.9	
Time lag exposure to typhoon/floods 1 mo prior to survey					
No	8,008	30.9	29.6	32.2	0.6552
Yes	1,917	31.6	28.9	34.3	
Time lag exposure to typhoon/floods 2 mo prior to survey					
No	9,094	30.9	29.7	32.1	0.4061
Yes	831	32.7	28.8	36.8	
Time lag exposure to typhoon/floods 3 mo prior to survey					
No	9,306	30.9	29.7	32.1	0.5078
Yes	619	32.8	27.6	38.3	
Time lag exposure to typhoon/floods 4 mo prior to survey					
No	8,913	30.7	29.5	31.9	0.0628
Yes	1,012	34.8	30.7	39.0	
Time lag exposure to typhoon/floods 5 mo prior to survey					
No	8,629	30.8	29.5	32.0	0.2339
Yes	1,296	33.3	29.4	37.4	
Time lag exposure to typhoon/floods 6 mo prior to survey					
No	9,721	31.1	30.0	32.3	0.2992
Yes	204	25.4	16.7	36.7	

Univariate analysis of factors associated with meeting the REI. Univariate logistic regression was done for each exposure variable to determine its association with meeting the REI. The demographic profile of the household head that includes the age, sex, civil status, educational attainment, being a recipient of the 4Ps, and their place of residence, engagement in agricultural work, and households with members working abroad was found to be significantly associated with meeting the REI. The food security status of the household, household size, income status, and household members who have eaten meals outside their home as well as those household heads who read nutrition labels were also found to be associated with meeting the REI (Appendix Table II). In the 2015 survey (Appendix Table IV), the same factors were found to be associated with meeting the REI except for the place of work of household head and households who have members eating meals outside of their home. Exposure to typhoons and floods with a 6-mo lag time prior to the survey was found to be not associated but this was forced to the model because this is the factor of interest of the study. Interaction terms between wealth status and the number of months of exposure to floods/typhoons prior to the survey were also fitted in the regression model.

Multivariate analysis of factors associated with meeting REI. All significantly associated factors with the households meeting the REI from the univariate logistic regression analysis were included in the full model. Variables that were forced to be included in the model were the age of household head and exposure of households to typhoons and flood. Appendix Tables III and V present the results of the multivariate analyses of factors associated with meeting REI for the reference years 2013 and 2015, respectively.

Factors associated with meeting REI: Philippines, 2013. After simultaneously controlling for the effects of other variables, the final set of factors associated with households meeting the REI in 2013 are presented in Table 3. Households with more than six members were less likely to meet the REI [OR: 0.36 (0.32–0.41)] than households with fewer members.

Those households engaged in agricultural work, *i.e.* farming, fishing, *etc.*, were more likely to meet the REI [OR: 1.15 (1.02–1.30)] than those engaged in non-agricultural work.

Additionally, those households whose heads were working abroad were more likely to meet REI [OR: 1.88 (1.37–2.58)] than those who work domestically.

In terms of food security, the likelihood of meeting REI decreased as food insecurity progressed in intensity. Households exhibiting food insecurity in any of its forms were less likely to meet the REI than food-secure households.

Households with members who ate meals outside their home [OR: 1.18 (1.06–1.30)] and those who were residing in the rural areas [OR: 1.18 (1.04–1.33)] were more likely to meet the REI. The likelihood of meeting the REI increased as the wealth status improved. Households belonging to the poor wealth tertile were less likely to meet the REI [OR: 0.66 (0.57–0.76)] than the rich households.

Households with exposure to typhoons/floods with a time-lag of 3 mo prior to the survey were more likely to meet the REI than those who were not exposed. While households with exposure to typhoons/floods with a time-lag of 6 mo prior to the survey were less likely to meet the REI.

Factors associated with meeting REI: Philippines, 2015. For the 2015 survey, the final model of factors associated with meeting the REI of households is presented in Table 4. The factors significantly associated with meeting REI in 2015 were almost the same as in 2013 except for the place of work of household heads and households with members eating meals outside of their homes which did not appear for this reference year. Similar to the results of the reference year 2013, exposure to typhoon/floods with a time-lag of 6 mo prior to the survey was associated with meeting the REI.

Time Lag Exposure to Drought

Profile of households: Mindanao, 2015. Among areas in Mindanao that were exposed to drought, 31.1% of households met the REI (Table 5). These households were predominantly headed by females (32.8%), by the elderly (38%), were without partners (33.8%), have reached the elementary level of education (33.7%), and those engaged in agricultural work (35.1%).

Households with one to three members, characterized as food-secure, residing in rural areas, and belonging to the rich wealth status had relatively high proportions of meeting REI.

A higher proportion of households were noted to have not been exposed to drought but the difference was not statistically significant among the exposed.

Univariate analysis of factors associated with meeting the REI. Univariate analysis of factors showed that household size, nature of work, and 4Ps recipient status of the household were the factors significantly associated with meeting the REI (Appendix Table VI).

Multivariate analysis of factors associated with meeting the REI. All factors that were significantly associated with meeting the REI of households in the univariate analysis were included in the full model (Appendix Table VII).

Factors associated with meeting REI: Mindanao, 2015. After controlling for the effects of other variables, factors associated with households meeting the REI in selected

Table 3. Final model of factors associated with meeting the REI of household: Philippines, 2013.

Final model	Odds	*p*-value	90% CI		Wald test
			LL	UL	
Age of household head					
Less than 30 yr	0.62	0.0090	0.46	0.84	
30–39.9 yr	0.86	0.1800	0.72	1.03	
40–49.9 yr	0.83	0.0470	0.71	0.97	0.0349
50–59.9 yr	0.81	0.0260	0.69	0.95	
More than 60 yr (reference)					
Household size					
1–3 members (reference)					
4–6 members	0.61	< 0.0001	0.54	0.70	< 0.0001
7 or more members	0.36	< 0.0001	0.32	0.41	
Work of household head					
Agricultural work	1.15	0.0470	1.02	1.30	0.0467
Non-agricultural work (reference)					
Place of work of household head					
At home	1.08	0.4020	0.93	1.25	
Local away from home (reference)					0.0047
Abroad	1.88	0.0010	1.37	2.58	
Food security status					
Food secure (reference)					
Mildly food insecure	0.79	0.0200	0.67	0.93	0.0000
Moderately food insecure	0.70	< 0.0001	0.60	0.81	
Severely food insecure	0.56	< 0.0001	0.48	0.67	
Meals eaten out					
No (reference)					0.0085
Yes	1.18	0.0090	1.06	1.30	
Place of residence					
Rural	1.18	0.0310	1.04	1.33	0.0309
Urban (reference)					
Wealth status					
Poor	0.66	< 0.0001	0.57	0.76	
Middle	0.75	< 0.0001	0.66	0.86	< 0.0001
Rich (reference)					
Time lag exposure to typhoon/floods 3 mo prior to survey					
No (reference)					0.0001
Yes	1.51	< 0.0001	1.27	1.79	
Time lag exposure to typhoon/floods 6 mo prior to survey					
No (reference)					0.0289
Yes	0.81	0.0290	0.69	0.95	
GOF test *p*-value =		**0.4465**			

Table 4. Final model of selected factors associated with meeting the REI of household: Philippines, 2015.

Final model	Odds	*p*-value	90% CI		Wald test
			LL	UL	
Age of household head					
Less than 30 yr	1.04	0.7540	0.83	1.31	
30–39.9 yr	0.93	0.4340	0.81	1.08	
40–49.9 yr	0.90	0.1670	0.79	1.02	0.3490
50–59.9 yr	0.86	0.0800	0.75	0.99	
More than 60 yr (reference)					
Household size					
1–3 members (reference)					
4–6 members	0.65	< 0.0001	0.58	0.73	
7 or more members	0.38	< 0.0001	0.34	0.43	< 0.0001
Work of household head					
Agricultural work	1.35	< 0.0001	1.21	1.51	
Non-agricultural work (reference)					< 0.0001
Food security status					
Food secure (reference)					
Mildly food insecure	0.83	0.0280	0.72	0.95	
Moderately food insecure	0.81	0.0020	0.72	0.91	
Severely food insecure	0.66	< 0.0001	0.57	0.75	< 0.0001
Place of residence					
Rural	1.22	0.0050	1.09	1.37	0.0052
Urban (reference)					
Wealth status					
Poor	0.74	< 0.0001	0.65	0.85	
Middle	0.78	0.0010	0.68	0.89	0.0007
Rich (reference)					
Time lag exposure to typhoon/floods 6 mo ago prior to survey					
No (reference)					0.0497
Yes	0.43	0.0500	0.21	0.87	
GOF test *p*-value =			**0.4185**		

Table 5. Profile of households meeting the REI: Mindanao, 2015.

Characteristics	2015		
	n	% (95% CI)	*p*-value
Mindanao	2,803	31.1 (28.7–33.6)	
Sex of household head			
Male	2,286	30.7 (28.1–33.4)	0.3668
Female	517	32.8 (28.5–37.4)	
Age of household head			
Less than 30 yr	176	36.3 (28.4–45.1)	< 0.0001
30–39.9 yr	511	30.6 (26.5–34.9)	
40–49.9 yr	742	24.7 (20.9–28.9)	
50–59.9 yr	679	30.1 (26.4–34.0)	
More than 60 yr	695	38.0 (34.3–41.8)	

Characteristics	2015		
	n	% (95% CI)	*p*-value
Civil status of household head			
With partner	2,147	30.3 (27.6–33.1)	0.1386
Without partner	654	33.8 (29.6–38.2)	
Highest educational attainment of household head			
No grade completed	179	30.6 (24.2–37.8)	0.2304
Elementary level	1,269	33.7 (30.4–37.2)	
High School level	838	27.7 (24.4–31.2)	
Vocational level	104	31.0 (22.5–41.1)	
College undergraduate	169	30.7 (23.3–39.3)	
At least college graduate	243	30.3 (23.4–38.2)	
Work of household head			
Agricultural work	1,081	35.1 (31.1–39.2)	0.0003
Non-agricultural work	1,245	26.7 (24.2–29.5)	
Place of work of household head			
At home	265	35.1 (28.1–42.9)	0.2211
Local away from home	2,029	29.8 (27.2–32.6)	
Abroad	32	33.4 (21.4–48.0)	
PhilHealth membership status of household			
No	691	30.4 (26.3–34.8)	0.9311
Yes	1,963	30.2 (27.6–33.0)	
4Ps recipient status of household			
No	1,870	33.0 (30.4–35.6)	0.0027
Yes	911	26.3 (22.5–30.5)	
Food security status			
Food secure	827	36.8 (32.6–41.1)	0.0004
Mildly food insecure	309	33.1 (27.5–39.2)	
Moderately food insecure	971	27.5 (24.3–31.0)	
Severely food insecure	669	26.8 (22.8–31.2)	
Household size			
1–3 members	760	43.6 (40.2–47.0)	< 0.0001
4–6 members	1,346	28.9 (25.8–32.3)	
7 or more members	697	21.4 (17.9–25.3)	
Meal planner reading product labels			
No	1,003	30.3 (26.8–34.1)	0.5539
Yes, always	636	32.1 (28.9–35.4)	
Sometimes	744	29.5 (25.8–33.5)	
Meal eaten out			
No	2,310	32.0 (29.3–34.8)	0.0237
Yes	493	26.7 (23.1–30.7)	
Place of residence			
Rural	2,035	32.2 (29.3–35.3)	0.1600
Urban	768	28.4 (24.4–32.8)	
Wealth status			
Poor	1,547	30.4 (27.1–33.9)	0.4928

Characteristics	2015		
	n	% (95% CI)	*p*-value
Middle	781	30.1 (26.8–33.6)	
Rich	458	33.6 (28.0–39.7)	
Time lag exposure to drought in Q1 2015			
No	174	38.9 (23.0–57.6)	0.3357
Yes	2,629	30.6 (28.3–33.0)	
Palay production (mean)			
Not meeting REI	1,921	–9654.6 (–11443.1–[–7866.1])	
Meeting REI	882	–10632.2 (–126802–[–8584.1])	

Mindanao areas were household size, nature of work of the household head, and food security status (Table 6).

Households composed of more than three members and households that experienced food insecurity were less likely to meet the REI than households with a fewer number of members and food-secure status.

Household heads engaged in agricultural work were found to be more likely to meet the REI than their counterparts. Exposure of households to drought in 1Q 2015 was shown not to be associated with meeting the REI.

DISCUSSION

The final regression models of the three settings in this study yielded similar results and had a significant association with meeting REI of households, which included household size, work of household head (agricultural or non-agricultural), and food security status.

The household size determines the number of people sharing the food prepared for the members. The proportion of food shared by the individual members may decrease with increased household size and thus decrease calorie intake level (Orewa and Iyanbe 2010). As the results showed, households with more than three members – where sharing of food among members is normally expected – may contribute to not meeting the REI. These results were congruent with other studies wherein household size bore a significant negative intake on household caloric consumption (Babatunde *et al.* 2010). This is suggestive of a potential decrease in *per capita* calorie intake as the number of household members consuming food increases. With the same resources, sharing and competition for food within larger households may result in lesser portions of food per member compared to smaller households. Food distribution may be affected by the number of household members, especially among those with limited resources (Okeyo and Kirabira 2016).

Another significant factor associated with meeting the REI of households is engagement in agricultural work. The likelihood of meeting REI was increased in agricultural households, which may be comparative to self-sufficiency and first-hand access to food that they planted themselves (Babatunde *et al.* 2010; Orewa and Iyanbe 2010). Since they are agricultural households, they are more food secure in a sense, and the chances of meeting REI increase. Furthermore, agricultural households have access to productive resources and, thus, have a more stable source of food for the family compared to non-agricultural ones. Another perspective to increased odds of meeting REI by agricultural households is increased consumption due to own production and the contribution to the household income of own-produced food by selling it. Households engaged in agricultural work may be self-sufficient enough to meet their REI (Balagamwala and Gazdar 2013), which may be attributed to the nature of their livelihood, with them having easier access to resources, and their resilience. This is not to conclude, however, that agricultural households are more food secure than non-agricultural ones, as supported by literature (Yahaya *et al.* 2007; Lawal and Samuel 2010). Furthermore, agricultural households are more likely to be those residing in rural areas.

By the very definition of food security, food-secure households are those with physical, social, and economic access to food to meet dietary needs (FAO 2005), thus explaining the decreasing trend in the proportion of households meeting REI as food security status worsens. Food security is inextricably linked with caloric intake because of the concepts of availability, accessibility, affordability, and stability. In essence, food-insecure households were less likely to meet REI (Kakwani and Son 2015). Food insecure households have lower physical, economic, and social access to food needed to satisfy

Table 6. Final model of selected factors associated with meeting the REI of household: Mindanao, 2015.

Final model	Odds	*p*-value	90% CI		Wald test
			LL	UL	
Age of household head					
Less than 30 yr	0.93	0.7770	0.62	1.40	
30–39.9 yr	0.93	0.6570	0.71	1.22	
40–49.9 yr	0.72	0.0730	0.54	0.97	0.2503
50–59.9 yr	0.93	0.7020	0.70	1.25	
More than 60 yr (reference)					
Household size					
1–3 members (reference)					
4–6 members	0.53	< 0.0001	0.43	0.65	< 0.0001
7 or more members	0.37	< 0.0001	0.30	0.46	
Work of household head					
Agricultural work	1.63	< 0.0001	1.35	1.96	< 0.0001
Non-agricultural work (reference)					
Food security status					
Food secure (reference)					
Mildly food insecure	0.86	0.3460	0.65	1.12	0.0311
Moderately food insecure	0.71	0.0050	0.58	0.86	
Severely food insecure	0.67	0.0100	0.52	0.86	
Time lag exposure to drought in Q1 2015					
Not exposed (reference)					0.3677
Exposed	0.70	0.3680	0.36	1.35	
GOF test *p*-value=			**0.2425**		

energy requirements. Food may be available but not accessible nor affordable or food may be available and accessible but not affordable. Food security may also be related to household size and socioeconomic status of the household. Smaller-sized households tend to have less competition on food; therefore, they may eat more compared to large-sized households with many mouths to feed (Flagg *et al.* 2014).

Rural areas are mainly agricultural and less dense than urban areas. Most urban inhabitants engage in non-agricultural jobs and rural inhabitants are predominantly engaged with agricultural production. Given this, rural residents are more likely to meet REI because of increased availability and accessibility to food. Rural households also have a high level of self-reliance, which may translate to a higher level of self-sufficiency compared to urban households (Bruun 2013; Benfica and Kilic 2016).

Households who had meals eaten outside the home were more likely to meet the REI compared to those who had not. This may be attributed to having higher access to food available and, thus, increased food security and increased likelihood of meeting the energy requirement. Aside from food accessibility, having the financial means to eat outside is also reflective of the socioeconomic status of the household and, evidently – based on the results of this study – those in the poor tertile were less likely to meet REI. Moreover, having meals eaten outside was also found to increase the likelihood of meeting REI. Again, this may be a function of having food access due to having the means to afford the food.

Socioeconomic disparities play a crucial role in whether households meet energy and nutrient requirements (White 2012; Alkerwi *et al.* 2015). Households who are more socioeconomically-advantaged are more likely to have increased resources allotted for food and other necessities. Those who are less financially capable, on the other hand, have to divide the limited budget for their needs and, thus, the quantity of food purchased may not be enough to satisfy energy requirements.

It is perceived that household heads working abroad bring more income to the family compared to heads working locally or at home. This is a compelling reason

for Filipinos to actively seek better opportunities abroad. A higher income may mean a higher allotment for food expenses, taking into consideration nutritional quality as well as quantity, thus meeting the REI of the household. Moreover, household heads who work abroad were more likely to have more income to spend on basic necessities compared to heads working locally or at home.

The results on the association of the time gap from the occurrence of typhoon/floods to 3 mo prior to the survey and household's meeting REI was found to be significant. It was found that households exposed during this period had increased odds of meeting REI compared to those who were never exposed at all. The typhoon and province pairs relevant to third-month exposure prior to data collection were Typhoon Gorio with Camarines Sur, Oriental Mindoro, and Leyte, and Typhoon Odette with Iloilo and Guimaras. Based on the NDRRMC report for Gorio, Public Storm Warning Signal Nos. 1 and 2 were raised in the aforementioned provinces. The damage to agriculture in Camarines Sur was estimated at PHP 737,894.30 (NDRRMC 2013–2015).

One way of trying to explain this occurrence is by examining the price of commodities, particularly rice, as a proxy for food accessibility. Based on data from the PSA (2018), the retail price of rice (rice special, well-milled rice, and regular milled rice) increased by at most PHP 1.00 from May–June 2013 when the typhoons occurred. Two months after its occurrence, the retail price of rice (rice special, well-milled rice, and regular milled rice) increased by PHP 3.00–4.00 and has been increasing ever since. The minimal change in prices did not seem to affect the capability of the households to meet their REI.

On the onset of typhoon/flood occurrence, short-term relief distribution is reinforced, which includes food aid and food packs. Within 2–3 mo after the occurrence of typhoon/flood, it can be supposed that the efforts during the relief and early recovery phase was sufficient enough for the families to meet their energy requirements. They were lodged in evacuation centers. Further studies are necessary to be able to probe this supposition. It may also be that the tagged provinces were not the severely affected ones, as evidenced by the existing NDRRMC reports on damages, state of calamity, and degree of disaster response. As the study design of the NNS permits a level of analysis until the regional up to the provincial level only, even if only one municipality was affected by the typhoon, the whole province was tagged as exposed to it; thus, it may also be an explanation as to why, with a time lag of 6 mo from the typhoon occurrence to data collection, there is a significantly lower likelihood that REI is met.

It can also be inferred from the results that the decreased likelihood of meeting REI, albeit not statistically significant, of households exposed to typhoons/floods 6 mo prior to the survey may be reflective of the recovery and rehabilitation period aiming for the long-term. Aside from the concern on health and nutrition, there is also the issue of the re-establishment of sustainable livelihoods as those most affected by the typhoons/floods are more likely to be poorer, more isolated, and more dependent on agricultural activities. Agricultural households exposed to typhoons/floods may have lost their source of income and own-produced food items. The transition from the short-term, supply-driven relief activities to longer-term rehabilitation and recovery efforts should always be for the interest of the most vulnerable and affected.

It is important to note that exposure to drought of households in Mindanao was found to not be significantly associated with meeting the REI of households. This may be due to the long-term and less direct impact of drought on food security and nutrition of households unlike typhoons and floods, which have immediate tangible effects. The authors acknowledge that in order to capture a clearer picture of the effect of drought on food security and caloric intake on the household level, a longitudinal study design may be more appropriate to achieve this objective as the cross-sectional nature of this study is one significant limitation, which was not able to provide sound results for association with drought.

CONCLUSION

A larger household size, food insecurity status in any form, poor socioeconomic status, and time-lag exposure to typhoons/floods 6 mo prior to the survey decreased the likelihood of meeting the REI of Filipino households. On the other hand, engagement in agricultural work, working abroad, residing in rural areas, and time lag exposure to typhoons/floods 3 mo prior to the survey increased odds of meeting household REI.

The study provides a snapshot of a seemingly minute but significant facet of the health and nutrition situation in the Philippines, which is meeting the REI at the household level in relation to exposure to extreme weather events – typhoons, floods, and drought – brought about by climate change. Caloric insufficiency may be regarded as a proxy indicator of the poverty and welfare situation as it reflects the failure to attain some minimum acceptable living standard. The results of the study may provide vital inputs to climate change adaptation programs of the government for vulnerable population groups, particularly of agricultural households who are dependent on subsistence farming and fishing and who will most likely feel the long-term impact of typhoons/flood/drought in their livelihoods.

STUDY LIMITATIONS

This study used secondary data from the 2013 8th NNS, 2015 Updating Survey, and existing reports from the NDRRMC and IRRI-PRiSM for the typhoon/flood and drought data. The factors included in the univariate and multivariate analysis were the factors available in the secondary data sources. Since this study makes use of cross-sectional data, comparisons between the proportion of meeting REI before and after the typhoon/flood and drought and its factors was practically not feasible. Another limitation of the study is that the coping mechanisms and strategies of households as a response to food insecurity were not covered in the survey. Data on food security status before the calamity, during the calamity, and during data collection would have been useful to describe the results better. Finally, causality between the factors and the outcome was not derived from this study.

ACKNOWLEDGMENTS

This work was implemented as part of the CGIAR Research Program on Climate Change, Agriculture, and Food Security, which is carried out with support from CGIAR Fund Donors and through bilateral funding agreements. For details, please visit https://ccafs.cgiar.org/donors. The views expressed in this document cannot be taken to reflect the official opinions of these organizations.

The authors also wish to acknowledge Allan Colibao for creating the illustration of typhoons/floods occurrence on the Philippine map, and Cheder Sumangue and Jonel Patricio as support for other statistical analyses conducted.

NOTE ON APPENDICES

The complete appendices section of the study is accessible at http://philjournsci.dost.gov.ph

STATEMENT ON CONFLICT OF INTEREST

The authors declare no conflict of interest.

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APPENDICES

Table I. Summary of typhoon/ flood occurrence in the Philippines and duration of exposure of provinces prior to data collection: Philippines, 2013 and 2015.

		Time lag of exposure (prior to data collection)					
Typhoon	Date of occurrence	1 mo	2 mo	3 mo	4 mo	5 mo	6 mo
Maring	17–21 Aug 2013	Abra					
		Quezon					
		Occidental Mindoro					
		La Union					
Labuyo	09–12 Aug 2013	Albay					
		Benguet					
		Ilocos Norte					
		Ilocos Sur					
		Sorsogon					
Nando	25–29 Aug 2013	West Samar					
Agaton	17–20 Jan 2014		Antique				
Gorio	27 Jun–01 Jul 2013		Cam Sur	Leyte			
			Or. Mindoro				
Odette	16–22 Sep 2013	Negros Occ.	Iloilo				
			Guimaras				
Yolanda	06–09 Nov 2013				Aklan	Capiz	
SW Monsoon	22–26 Sep 2013					NCR District 1	NCR District 1
	08–13 Jan 2013					NCR District 2	NCR District 2
						NCR District 3	NCR District 3
						NCR District 4	NCR District 4
Auring	01–10 Jan 2013					Palawan	
Ineng	18–23 Aug 2015	Abra					
Ineng	18–23 Aug 2015	Bataan					
		Bulacan					
		Cagayan					
		Mt Province					
		Oriental Mindoro					
		Pampanga					
		Pangasinan					
Egay	02–07 Jul 2015	Benguet					
		Ilocos Norte					
		Ilocos Sur					
		Isabela					
Egay	02–07 Jul 2015	Kalinga					
		La Union					
		Apayao					
		Palawan					

		Time lag of exposure (prior to data collection)					
Typhoon	Date of occurrence	1 mo	2 mo	3 mo	4 mo	5 mo	6 mo
			Quirino				
			Aurora				
Chedeng	01–05 Apr 2015				Catan-duanes	Nueva Vizcaya	
					Nueva Ecija		
Dodong	07–12 May 2015				Ifugao		
Flood			Guimaras			South Cotabato	South Cotabato
						Sultan Kudarat	

Table II. Univariate analysis of factors associated with meeting the REI of household: Philippines, 2013.

Factors	Odds	*p*-value	90% CI	
			LL	UL
Sex of household head				
Male				
Female	1.26	< 0.0001	1.15	1.39
Age of household head				
Less than 30 yr	0.81	0.1770	0.63	1.05
30–39.9 yr	0.76	0.0010	0.67	0.87
40–49.9 yr	0.69	< 0.0001	0.62	0.77
50–59.9 yr	0.73	< 0.0001	0.65	0.81
More than 60 yr				
Civil status of household head				
With partner				
Without partner	1.19	0.0010	1.09	1.30
Highest educational attainment of household head				
No grade completed	0.54	< 0.0001	0.41	0.71
Elementary level	0.64	< 0.0001	0.55	0.73
High school level	0.67	< 0.0001	0.58	0.78
Vocational level	0.86	0.2700	0.68	1.08
College undergraduate	0.90	0.3500	0.75	1.08
At least college graduate				
Sex of household head				
Male				
Female	1.26	< 0.0001	1.15	1.39
Age of household head				
Less than 30 yr	0.81	0.1770	0.63	1.05
30–39.9 yr	0.76	0.0010	0.67	0.87
40–49.9 yr	0.69	< 0.0001	0.62	0.77
50–59.9 yr	0.73	< 0.0001	0.65	0.81
More than 60 yr				

Factors	Odds	*p*-value	90% CI	
			LL	UL
Civil status of household head				
With partner				
Without partner	1.19	0.0010	1.09	1.30
Highest educational attainment of household head				
No grade completed	0.54	< 0.0001	0.41	0.71
Elementary level	0.64	< 0.0001	0.55	0.73
High school level	0.67	< 0.0001	0.58	0.78
Vocational level	0.86	0.2700	0.68	1.08
College undergraduate	0.90	0.3500	0.75	1.08
At least college graduate				
4Ps membership of household				
No	1.88	< 0.0001	1.66	2.12
Yes (reference)				
Meal planner reading product labels				
No (reference)				
Yes, always	1.25	< 0.0001	1.14	1.37
Sometimes	1.16	0.0910	1.00	1.35
Meal eaten out				
No (reference)				
Yes	1.11	0.0530	1.02	1.21
Place of residence				
Rural	1.02	0.7670	0.92	1.13
Urban (reference)				
Wealth status				
Poor	0.60	< 0.0001	0.52	0.65
Middle	0.76	< 0.0001	0.62	0.77
Rich (reference)				
Time lag exposure to typhoon/floods 1 mo prior to survey				
No (reference)				
Yes	1.08	0.2640	0.96	1.21
Time lag exposure to typhoon/floods 2 mo prior to survey				
No (reference)				
Yes	1.05	0.5410	0.92	1.19
Time lag exposure to typhoon/floods 3 mo prior to survey				
No (reference)				
Yes	1.17	0.0720	1.01	1.35
Time lag exposure to typhoon/floods 4 mo prior to survey				
No (reference)				
Yes	1.19	0.1550	0.97	1.46
Time lag exposure to typhoon/floods 5 mo prior to survey				
No (reference)				
Yes	0.86	0.1130	0.74	1.01

Factors	Odds	*p*-value	90% CI	
			LL	UL
Time lag exposure to typhoon/floods 6 mo prior to survey				
No (reference)				
Yes	0.86	0.0930	0.74	1.00

Table III. Multivariate analysis of factors associated with meeting the REI of household: Philippines, 2013.

Factors	Odds	*p*-value	90% CI		Wald test
			LL	UL	
Sex of household head					
Male (reference)					0.2664
Female	1.17	0.2660	0.93	1.47	
Age of household head					
Less than 30 yr	0.56	0.0110	0.39	0.81	
30–39.9 yr	0.79	0.0780	0.64	0.98	
40–49.9 yr	0.79	0.0270	0.67	0.94	0.0200
50–59.9 yr	0.76	0.0080	0.64	0.90	
More than 60 yr (reference)					
Civil status of household head					
With partner (reference)					0.2164
Without partner	0.86	0.2160	0.70	1.05	
Highest educational attainment of household head					
No grade completed	0.88	0.6260	0.58	1.35	
Elementary level	0.88	0.3380	0.70	1.10	
High school level	1.02	0.9010	0.81	1.28	0.2035
Vocational level	1.00	0.9860	0.73	1.39	
College undergraduate	1.26	0.1640	0.96	1.67	
At least college graduate (reference)					
Household size					
1–3 members (reference)					< 0.0001
4–6 members	0.62	< 0.0001	0.53	0.72	
7 or more members	0.37	< 0.0001	0.32	0.43	
Work of household head					
Agricultural work	1.23	0.0130	1.07	1.41	0.0135
Non-agricultural work (reference)					
Place of work of household head					
At home	1.11	0.3510	0.92	1.33	
Local away from home (reference)					0.0036
Abroad	2.15	0.0010	1.46	3.15	
Food security status					
Food secure (reference)					< 0.0001
Mildly food insecure	0.80	0.0770	0.65	0.98	
Moderately food insecure	0.69	< 0.0001	0.58	0.82	
Severely food insecure	0.57	< 0.0001	0.47	0.70	

Factors	Odds	*p*-value	90% CI		Wald test
			LL	UL	
PhilHealth membership status of household					
No	0.98	0.7980	0.86	1.12	0.7984
Yes (reference)					
4Ps membership of household					
No	1.17	0.0890	1.00	1.35	0.0892
Yes (reference)					
Meal planner reading product labels					
No (reference)					
Yes , Always	1.01	0.8540	0.89	1.16	0.5317
Sometimes	1.11	0.2880	0.94	1.30	
Meal eaten out					
No (reference)					0.0038
Yes	1.24	0.0040	1.10	1.41	
Place of residence					
Rural	1.24	0.0160	1.07	1.43	0.0155
Urban (reference)					
Wealth status					
Poor	0.75	0.0250	0.61	0.93	
Middle	0.84	0.1260	0.70	1.01	0.0820
Rich (reference)					
Time lag exposure to typhoon/floods 1 mo prior to survey					
No (reference)					0.8729
Yes	0.97	0.8730	0.69	1.35	
Time lag exposure 1 month prior to survey x wealth status					
No x rich (reference)					
Yes x poor	1.21	0.5020	0.76	1.93	0.5541
Yes x middle	0.89	0.6540	0.57	1.38	
Time lag exposure to typhoon/floods 2 mo prior to survey					
No (reference)					0.8147
Yes	1.07	0.8150	0.68	1.68	
Time lag exposure 2 mo prior to survey x Wealth Status					
No x rich (reference)					
Yes x poor	0.69	0.2450	0.40	1.17	0.4853
Yes x middle	0.89	0.7570	0.49	1.63	
Time lag exposure to typhoon/floods 3 mo prior to survey					
No (reference)					0.1245
Yes	1.98	0.1250	0.95	4.12	
Time lag exposure 3 mo prior to survey x wealth status					
No x rich (reference)					
Yes x poor	0.64	0.3710	0.28	1.46	0.6255
Yes x middle	0.87	0.7760	0.39	1.95	

Factors	Odds	*p*-value	90% CI		Wald test
			LL	UL	
Time lag exposure to typhoon/floods 4 mo prior to survey					
No (reference)					0.8861
Yes	0.93	0.8860	0.39	2.20	
Time lag exposure 4 mo prior to survey x wealth status					
No x rich (reference)					
Yes x poor	1.27	0.6640	0.52	3.09	0.8620
Yes x middle	1.05	0.9350	0.42	2.62	
Time lag exposure to typhoon/floods 5 mo prior to survey					
No (reference)					0.5357
Yes	1.47	0.5360	0.52	4.14	
Time lag exposure 5 mo prior to survey x wealth status					
No x rich (reference)					
Yes x poor	0.91	0.9080	0.25	3.30	0.8148
Yes x middle	1.36	0.5750	0.55	3.39	
Time lag exposure to typhoon/floods 6 mo prior to survey					
No (reference)					0.6485
Yes	0.76	0.6480	0.28	2.08	
Time lag exposure 6 mo ago prior to survey x wealth status					
No x rich (reference)					
Yes x poor	0.97	0.9650	0.27	3.42	0.4693
Yes x middle	0.54	0.2390	0.23	1.28	
GOF test *p*-value =		**0.6186**			

Table IV. Univariate analysis of factors associated with meeting the REI of household: Philippines, 2015.

Factors	Odds	*p-value*	90% CI	
			LL	UL
Sex of household head				
Male (reference)				
Female	1.30	< 0.0001	1.19	1.43
Age of household head				
Less than 30 yr	1.06	0.6100	0.87	1.30
30–39.9 yr	0.73	< 0.0001	0.65	0.81
40–49.9 yr	0.68	< 0.0001	0.62	0.76
50–59.9 yr	0.69	< 0.0001	0.62	0.76
More than 60 yr (reference)				
Civil status of household head				
With partner (reference)				
Without partner	1.34	< 0.0001	1.22	1.46
Highest educational attainment of household head				
No grade completed	0.94	0.6590	0.75	1.18
Elementary level	0.90	0.2020	0.78	1.03
High school level	0.87	0.1060	0.75	1.00

Factors	Odds	*p-value*	90% CI	
			LL	UL
Vocational level	0.84	0.1760	0.67	1.04
College undergraduate	0.97	0.8100	0.81	1.17
At least college graduate (reference)				
Household size				
1–3 members (reference)				
4–6 members	0.66	< 0.0001	0.60	0.72
7 or more members	0.37	< 0.0001	0.33	0.41
Work of household head				
Agricultural work	1.26	< 0.0001	1.14	1.39
Non-agricultural work (reference)				
Place of work of household head				
At home	1.19	0.0390	1.04	1.36
Local away from home (reference)				
Abroad	1.22	0.2080	0.94	1.57
Food security status				
Food secure (reference)				
Mildly food insecure	0.79	0.0020	0.70	0.90
Moderately food insecure	0.72	< 0.0001	0.66	0.80
Severely food insecure	0.56	< 0.0001	0.51	0.63
PhilHealth membership status of household				
No	0.96	0.4110	0.88	1.04
Yes (reference)				
4Ps recipient status of household				
No	1.60	< 0.0001	1.45	1.78
Yes (reference)				
Meal planner reading product labels				
No (reference)				
Yes, always	1.05	0.3730	0.96	1.16
Sometimes	0.91	0.0870	0.83	1.00
Meal eaten out				
No (reference)				
Yes	0.98	0.7020	0.89	1.07
Place of residence				
Rural	1.20	0.0010	1.09	1.31
Urban (reference)				
Wealth status				
Poor	0.84	0.0020	0.74	0.91
Middle	0.82	0.0020	0.75	0.91
Rich (reference)				
Time lag exposure to typhoon/floods 1 mo prior to survey				
No (reference)				
Yes	1.03	0.6550	0.92	1.16

Factors	Odds	*p-value*	90% CI	
			LL	UL
Time lag exposure to typhoon/floods 2 mo prior to survey				
No (reference)				
Yes	1.08	0.4060	0.92	1.27
Time lag exposure to typhoon/floods 3 mo to prior to survey				
No (reference)				
Yes	1.09	0.5080	0.88	1.34
Time lag exposure to typhoon/floods 4 mo prior to survey				
No (reference)				
Yes	1.20	0.0630	1.02	1.41
Time lag exposure to typhoon/floods 5 mo prior to survey				
No (reference)				
Yes	1.12	0.2340	0.96	1.32
Time lag exposure to typhoon/floods 6 mo prior to survey				
No (reference)				
Yes	0.76	0.3010	0.48	1.18

Table V. Multivariate analysis of factors associated with meeting the REI of household: Philippines, 2015.

Factors	Odds	*p*-value	90% CI		Wald test
			LL	UL	
Sex of household head					
Male (reference)					0.1681
Female	1.16	0.1680	0.97	1.38	
Age of household head					
Less than 30 yr	1.13	0.4460	0.87	1.46	
30–39.9 yr	1.01	0.8920	0.85	1.20	
40–49.9 yr	1.00	0.9580	0.85	1.16	0.7245
50–59.9 yr	0.94	0.4750	0.81	1.09	
More than 60 yr (reference)					
Civil status of household head					
With partner (reference)					0.9831
Without partner	1.00	0.9830	0.86	1.17	
Highest educational attainment of household head					
No grade completed	1.07	0.7320	0.77	1.49	
Elementary level	1.00	0.9780	0.83	1.21	
High school level	1.07	0.5670	0.89	1.28	0.8709
Vocational level	0.92	0.6370	0.70	1.22	
College undergraduate	1.06	0.6490	0.86	1.32	
At least college graduate (reference)					
Household size					
1–3 members (reference)					
4–6 members	0.66	< 0.0001	0.58	0.76	< 0.0001
7 or more members	0.42	< 0.0001	0.36	0.49	

Factors	Odds	*p*-value	90% CI		Wald test
			LL	UL	
Work of household head					
Agricultural work	1.36	< 0.0001	1.20	1.53	< 0.0001
Non-agricultural work (reference)					
Place of work of household head					
At home	1.02	0.8450	0.86	1.21	
Local away from home (reference)					0.9330
Abroad	1.06	0.7450	0.79	1.42	
Food security status					
Food secure (reference)					
Mildly food insecure	0.85	0.0710	0.74	0.99	0.0019
Moderately food insecure	0.86	0.0410	0.75	0.97	
Severely food insecure	0.68	< 0.0001	0.58	0.80	
PhilHealth membership status of household					
No	0.97	0.7000	0.86	1.10	0.7003
Yes (reference)					
4Ps recipient status of household					
No	1.16	0.0940	1.00	1.34	0.0937
Yes (reference)					
Meal planner reading product labels					
No (reference)					
Yes, always	1.09	0.2410	0.97	1.23	0.0049
Sometimes	0.87	0.0600	0.78	0.98	
Meal eaten out					
No (reference)					0.1903
Yes	1.10	0.1900	0.98	1.23	
Place of residence					
Rural	1.25	0.0040	1.10	1.42	0.0041
Urban (reference)					
Wealth status					
Poor	0.86	0.2000	0.71	1.04	
Middle	0.82	0.0470	0.69	0.97	0.1373
Rich (reference)					
Time lag exposure to typhoon/floods 1 mo prior to survey					
No (reference)					0.4740
Yes	0.90	0.4740	0.70	1.15	
Time lag exposure 1 mo prior to survey x wealth status					
No x rich (reference)					
Yes x poor	0.97	0.9050	0.65	1.44	0.5720
Yes x middle	1.25	0.3480	0.85	1.84	
Time lag exposure to typhoon/floods 2 mo prior to survey					
No (reference)					0.9249
Yes	1.03	0.9250	0.59	1.82	
Time lag exposure 2 mo prior to survey x wealth status					

Factors	Odds	*p*-value	90% CI		Wald test
			LL	UL	
No x rich (reference)					
Yes x poor	0.72	0.5200	0.30	1.69	0.8098
Yes x middle	0.83	0.6500	0.42	1.65	
Time lag exposure to typhoon/floods 3 mo prior to survey					
No (reference)					0.1590
Yes	1.43	0.1590	0.94	2.17	
Time lag exposure 3 mo prior to survey x wealth status					
No x rich (reference)					
Yes x poor	0.81	0.6600	0.36	1.80	0.1905
Yes x middle	0.56	0.0690	0.33	0.94	
Time lag exposure to typhoon/floods 4 mo prior to survey					
No (reference)					0.7073
Yes	0.86	0.7070	0.45	1.66	
Time lag exposure 4 mo prior to survey x wealth status					
No x rich (reference)					
Yes x poor	0.98	0.9710	0.49	1.99	0.4019
Yes x middle	1.71	0.2360	0.81	3.58	
Time lag exposure to typhoon/floods 5 mo prior to survey					
No (reference)					0.2450
Yes	1.51	0.2450	0.84	2.72	
Time lag exposure 5 mo prior to survey x wealth status					
No x rich (reference)					
Yes x poor	0.71	0.3690	0.38	1.33	0.4200
Yes x middle	0.59	0.1940	0.31	1.15	
Time lag exposure to typhoon/floods 6 mo prior to survey					
No (reference)					0.0513
Yes	0.32	0.0510	0.12	0.84	
Time lag exposure 6 mo prior to survey x wealth status					
No x rich (reference)					
Yes x poor	2.89	0.0950	1.01	8.22	0.2457
Yes x middle	2.24	0.1720	0.85	5.93	
GOF test *p*-value =		**0.7554**			

Table VI. Univariate analysis of factors associated with meeting the REI of household: Mindanao, 2015.

Factors	Odds	*p*-value	90% CI	
			LL	UL
Sex of household head				
Male (reference)				
Female	1.10	0.3650	0.92	1.32
Age of household head				
Less than 30 yr	0.93	0.7090	0.68	1.28
30–39.9 yr	0.72	0.0060	0.59	0.87

Factors	Odds	*p*-value	90% CI	
			LL	UL
40–49.9 yr	0.53	< 0.0001	0.43	0.67
50–59.9 yr	0.70	0.0030	0.58	0.85
More than 60 yr (reference)				
Civil status of household head				
With partner (reference)				
Without partner	1.17	0.1310	0.98	1.41
Highest educational attainment of household head				
No grade completed	1.02	0.9350	0.72	1.43
Elementary level	1.17	0.4090	0.85	1.61
High school level	0.88	0.5350	0.63	1.23
Vocational level	1.04	0.8920	0.66	1.63
College undergraduate	1.02	0.9320	0.67	1.55
At least college graduate (reference)				
Sex of household head				
Male (reference)				
Female	1.10	0.3650	0.92	1.32
Age of household head				
Less than 30 yr	0.93	0.7090	0.68	1.28
30–39.9 yr	0.72	0.0060	0.59	0.87
40–49.9 yr	0.53	< 0.0001	0.43	0.67
50–59.9 yr	0.70	0.0030	0.58	0.85
More than 60 yr (reference)				
Civil status of household head				
With partner (reference)				
Without partner	1.17	0.1310	0.98	1.41
Highest educational attainment of household head				
No grade completed	1.02	0.9350	0.72	1.43
Elementary level	1.17	0.4090	0.85	1.61
High school level	0.88	0.5350	0.63	1.23
Vocational level	1.04	0.8920	0.66	1.63
College undergraduate	1.02	0.9320	0.67	1.55
At least college graduate (reference)				
4Ps recipient status of household				
No	1.38	0.0040	1.16	1.64
Yes (reference)				
Meal planner reading product labels				
No (reference)				
Yes , always	1.08	0.4560	0.91	1.30
Sometimes	0.96	0.7380	0.80	1.16
Meal eaten out				
No (reference)				
Yes	0.78	0.0260	0.65	0.93

Factors	Odds	*p*-value	90% CI	
			LL	UL
Place of residence				
Rural	1.20	0.1490	0.97	1.48
Urban (reference)				
Wealth status				
Poor	0.87	0.3300	0.66	1.11
Middle	0.89	0.4430	0.66	1.09
Rich (reference)				
Time lag exposure to drought in Q1 2015				
Not exposed (reference)				
Exposed	0.69	0.3660	0.37	1.31
Palay production (mean)				
Not meeting				
Meeting	1.00	0.0830	1.00	1.00

Table VII. Multivariate analysis of factors associated with meeting the REI of household: Mindanao, 2015.

Factors	Odds	*p*-value	90% CI		Wald test
			LL	UL	
Sex of household head					
Male (reference)					0.5268
Female	0.87	0.5270	0.61	1.25	
Age of household head					
Less than 30 yr	1.13	0.6710	0.70	1.81	
30–39.9 yr	1.13	0.5210	0.82	1.57	
40–49.9 yr	0.92	0.6750	0.65	1.30	0.6630
50–59.9 yr	1.06	0.7450	0.78	1.45	
More than 60 yr (reference)					
Civil status of household head					
With partner (reference)					0.7126
Without partner	1.08	0.7130	0.77	1.52	
Highest educational attainment of household head					
No grade completed	1.60	0.1950	0.88	2.91	
Elementary level	1.94	0.0140	1.25	3.01	
High school level	1.34	0.2870	0.85	2.09	0.0010
Vocational level	0.79	0.5130	0.44	1.43	
College undergraduate	1.50	0.2000	0.89	2.52	
At least college graduate (reference)					
Household size					
1–3 members (reference)					
4–6 members	0.51	< 0.0001	0.40	0.66	< 0.0001
7 or more members	0.38	< 0.0001	0.28	0.53	

Factors	Odds	*p*-value	90% CI		Wald test
			LL	UL	
Work of household head					
Agricultural work	1.45	0.0040	1.18	1.79	0.0040
Non-agricultural work (reference)					
Place of work of household head					
At home	1.15	0.4480	0.85	1.57	
Local away from home (reference)					0.5883
Abroad	1.29	0.5820	0.60	2.81	
Food security status					
Food secure (reference)					
Mildly food insecure	0.95	0.7740	0.73	1.25	0.0627
Moderately food insecure	0.69	0.0120	0.54	0.88	
Severely food insecure	0.67	0.0320	0.49	0.91	
PhilHealth membership status of household					
No	0.93	0.6070	0.75	1.16	0.6067
Yes (reference)					
4Ps recipient status of households					
No	1.10	0.5510	0.85	1.41	0.5508
Yes (reference)					
Meal planner reading product labels					
No (reference)					
Yes, always	1.24	0.1370	0.98	1.57	0.2029
Sometimes	1.04	0.7650	0.83	1.31	
Meal eaten out					
No (reference)					0.7843
Yes	0.97	0.7840	0.80	1.17	
Place of residence					
Rural	1.14	0.4020	0.88	1.48	0.4024
Urban (reference)					
Wealth status					
Poor	0.81	0.2880	0.58	1.13	
Middle	0.74	0.0980	0.55	1.00	0.2527
Rich (reference)					
Time lag exposure to drought in Q1 2015					
Not exposed (reference)					0.6151
Exposed	0.80	0.6150	0.38	1.68	
Palay production (mean)	1.00	0.4150	1.00	1.00	0.4154
GOF test *p*-value=		**0.8445**			

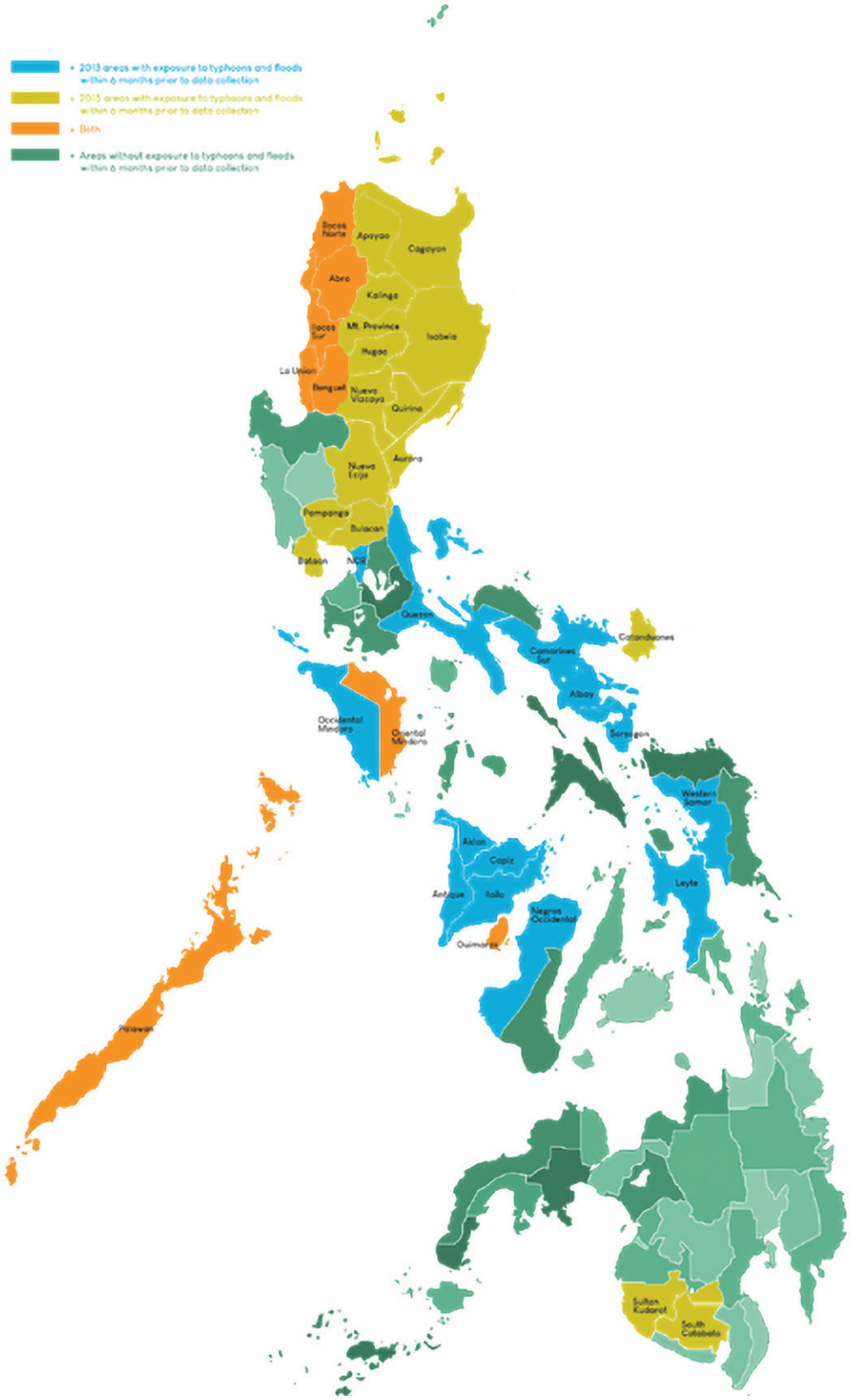

Figure I. Provinces affected by typhoons and floods within 6 mo prior to data collection of the 2013 8th NNS and 2015 Updating Survey.