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Association between nutritional status of Filipino preschool children and participation in government programmes at the household and individual levels

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ABSTRACT

Introduction: Health and nutrition interventions in developing countries have been linked to better thriving and survival of children. Identifying programmes with significant effect on the nutritional status of Filipino preschool children may aid in identifying impactful interventions in addressing malnutrition. This study evaluated the association between nutritional status of preschool children and government programme participation based on the 2018 Expanded National Nutrition Survey (ENNS) results. **Methods:** Secondary data analysis of 12,949 preschool children was performed from the 2018 ENNS. The selected data included socioeconomic, anthropometric, and self-reported household-level and individual-level government programme participation. Chi-square test for association and multiple logistic regression were conducted using Stata version 16. **Results:** Participation in immunisation programme, growth monitoring, household food production, and awareness and usage of iodised salt were negatively associated with at least one type of undernutrition. Consequently, participation in deworming programme was positively associated with both underweight and stunting. Regression analysis showed that preschool children who underwent growth monitoring were less likely to be stunted (*OR*=0.58), while those who underwent newborn screening were less likely to be underweight (*OR*=0.53) and stunted (*OR*=0.62). On the contrary, dewormed children were more likely to be stunted (*OR*=1.63) and those from 4Ps households were more likely to be wasted (*OR*=2.24). **Conclusion:** There is a need to re-evaluate programme strategies to maximise the benefits provided. Programmes showing significant associations with nutritional status including immunisation, growth monitoring, deworming, household food production, and awareness and usage of iodised salt should be continued and sustained with updated policies.

Keywords: government programmes, nutritional status, preschool children

INTRODUCTION

The national policies of most countries worldwide are geared towards implementation of nutrition-specific and -sensitive programmes, as well as strategies in line with the global nutrition and diet-related 2025 non-communicable disease (NCD) targets of the Sustainable Development Goals and the United Nations Decade of Action on Nutrition (WHO, 2018). However, despite all the efforts of including nutrition targets in the national policies

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and programmes in the government, malnutrition still persists in many countries. Undernutrition continues to cause nearly half of the deaths among children aged below 5 years old and impedes the achievement of their full economic, social, educational, and occupational potential (Yang *et al.*, 2020).

As part of the Philippine Development Plan, the Philippine Plan of Action for Nutrition (PPAN) provides the framework for improving the nutritional status of Filipinos. National and local government agencies are tasked to implement programmes and strategies to achieve set nutrition targets such as micronutrient supplementation, maternal and neonatal care, promotion of good nutrition and healthy lifestyle behaviours, home and community food production, livelihood and assistance programmes, provision of health insurance, and other services.

Results from the 2018 Expanded National Nutrition Survey (ENNS) conducted by the Food and Nutrition Research Institute (FNRI) showed that 19.1% of preschool children were underweight, 30.3% were stunted, and 4.0% were overweight (FNRI- DOST, 2020). The high prevalence of stunting and wasting among children under 5 years old and deficiencies in vitamin A, iron, and iodine are problems of public health significance.

The government programme participation (GP) component of the 2018 ENNS obtains information on the extent of participation of Filipino households and selected population groups in various food, nutrition, and health-related programmes implemented in the country. These include nutrition-specific programmes (national dietary supplementation, micronutrient supplementation, growth monitoring), health programmes (newborn screening, national immunisation programme, food labelling programme), and social protection programmes (*Pantawid Pamilyang Pilipino Programme*). The survey results document the knowledge, awareness, and participation of households and individuals in the different national programmes implemented across the regions in the Philippines (FNRI- DOST, 2020).

Community-based programmes play a key role in the substantial reduction of maternal and child mortality, as well as malnutrition reduction through access to health services, education, and livelihood income (Jamison *et al.*, 2006). The preschool age, 0-59 months, is a period wherein there is rapid physical growth and neurological development, which still encompasses the First 1000 days window of opportunity, the unique period of opportunity where the foundations of optimum health across the lifespan are established. Malnutrition weakens this foundation, which may lead to significant morbidities or early mortality if not addressed properly by well-timed interventions. Monitoring the citizens' participation in relevant government programmes is crucial in further strengthening existing interventions and developing new programmes (FNRI-DOST, 2020). This study evaluated the association between the nutrition outcomes of preschool children and their participation in individual- and household-level GP based on the 2018 ENNS results.

MATERIALS AND METHODS

Study design and participants

This study employed a cross-sectional design wherein a secondary analysis of the 2018 ENNS results was performed. The ENNS is a designated statistical activity that provides empirical data on the nutritional and health status of Filipinos for planning nutrition and health development programmes, and for timely policy decisions at the national and provincial levels.

The 2018 ENNS adopted the new 2013 master sample, developed by the

Philippine Statistics Authority, as its sampling design. It was a two-stage cluster sampling design wherein the first stage was the selection of primary sampling units composed of one barangay or a combination of contiguous barangays composed of 100-400 households, followed by the selection of secondary sampling units composed of housing units.

The ENNS information utilised in this study included socioeconomic, anthropometric, household, and children's participation in various government programmes. A total of 17,167 preschool children were included in the survey. Among these, 12,949 preschool children aged 0-59 months with complete information on sociodemographic profile, anthropometry, and GP data were included in the analysis.

Key components and relationships framework

The key components of this study were: 1) Nutritional status of preschool children, which was measured using weight-for-age, weight-for-height, and height-for-age indicators, 2) Participation in government health and nutrition programmes, and 3) Sociodemographic characteristics of the children and their households.

The relationships between these key components suggested that the nutritional status of preschool children, which was considered as the dependent variable, was influenced by their participation in government health and nutrition programmes, the independent variable. The sociodemographic characteristics of the household, such as the educational attainment and occupation of the household head, household size, place of residence, and wealth status, may also influence the participation of preschool children in government health and nutrition programmes.

Data collection

Outcome variables

Weights of the children were measured using Seca 874 digital weighing scales (Seca, Hamburg, Germany) with a 160kg capacity. Children below 2 years of age and those not able to stand independently were weighed together with their mother or caregiver, then used to subtract the weight of the mother/caregiver without the child to obtain the weight of the child. Weight was recorded to the nearest 0.1 kg.

The standing height of children 2 years and above was measured using a Seca 213 stadiometer (Seca, Hamburg, Germany), while the recumbent length of children less than 2 years was measured using a Seca 417 infantometer (Seca, Hamburg, Germany). Height and length were recorded to the nearest 0.1 cm.

The World Health Organization-Child Growth Standards (WHO-CGS) (WHO, 2006) was used to assess the nutritional status of children 0-5 years old (0-60 months), based on weight and height measurements.

Independent variables

The GP survey assessed the participation of households and members in selected government nutrition and related programmes. Face-to-face interviews were done using a pre-tested questionnaire lodged in an electronic data collection system. Other sources of information such as immunisation cards, birth certificates, and PhilHealth membership IDs were used to verify answers from respondents.

The GP component of the 8th ENNS was categorised into household- and individual- level programmes based on the selected programmes' target population. For household-level GP, the respondent was either the household head or any knowledgeable adult member of the household, while individual-level GP was assessed based on the specific age group the programme was intended for.

For household level, the government programmes were the following: household food production, *Pantawid Pamilyang* Pilipino Programme (4Ps), Family Development Session (FDS), Sustainable Livelihood Programme (SLP), and awareness and usage of iodised salt. The proportion of households/families who participated or were aware of these food, nutrition, and health programmes was obtained.

For individual level, government programmes were assessed by age groups. In this particular study, data on government programmes for preschool children, which included newborn screening (for 0-6 months old), immunisation (for 12-23 months old), vitamin A supplementation (for 0-60 months old), iron supplementation (for 0-60 months old), growth monitoring (for 0-60 months old), national dietary supplementation programme (for 6-60 months old), and deworming (for 12-60 months old) were obtained. Participation in these programmes was asked among mothers/caregivers of children 0-71 months of age. Information on the duration and/or frequency of participation during the last 12 months was obtained for growth monitoring programme, national dietary supplementation programme, vitamin A supplementation, and deworming, while duration and/or frequency of participation during the last 6 months were obtained for iron supplementation.

Statistical analysis

Descriptive statistics were used to describe the basic features of the data in this study, providing simple summaries of the sample and measures. These were particularly used in the tabulation of anthropometric results and proportion of the government programmes participated in.

Data subjected to analysis were the nutritional status of children based on weight-for-age, height-for-age and weight-for-height. The results generated proportion of households participating at the household-level (household food production, 4Ps, FDS, SLP, awareness and usage of iodised salt) and individual-level (newborn screening, immunisation, vitamin A supplementation, iron supplementation, growth monitoring, national dietary supplementation programme, and deworming) government programmes.

Chi-square test for association and multiple logistic regression were used to test the association between nutritional status and GP of preschool children's households. To determine the likelihood of having a normal nutritional status if one participated in government programmes, multiple logistic regression analysis was performed. All statistical analyses were done using STATA version 16 (StataCorp, Texas, USA).

Ethical review

The ENNS was evaluated and approved by the FNRI Institutional Review Committee (Protocol code: 2021-011). Respondents were given informed consent forms to confirm their voluntary participation in the survey and were allowed to withdraw from the study at any given time.

RESULTS

Profile of study children

A total of 12,949 preschool children aged 0-59 months and a total of 10,041 households were included in the study. There were 1,039 (8.0%) 0-5 months old, 1,125 (8.3%) 6-11 months old, 2,290 (17.7%) 12-23 months old, 2,386 (18.8%) 24-35 months old, 2,918 (22.4%) 36-47 months old, and 3,191 (24.7%) 48-59 months. Majority were males (51.8%), while 48.2% were females.

Based on the sociodemographic profile of the household heads (Table 1), majority were married (63.7%), the highest educational attainment was at least high school (40.3%), most were in the agricultural, forestry and fishery industry (24.3%), majority resided in

Table 1. Sociodemographic characteristics of preschool children

Sociodemographic characteristic	*n*	*%*	*95% CI*	
			Lower limit	*Upper limit*
Sex of preschool children				
Male	6675	51.8	50.9	52.8
Female	6274	48.2	47.2	49.1
Age group				
0-5 months	1039	8.0	7.2	8.9
6-11 months	1125	8.3	7.6	9.0
12-23 months	2290	17.7	16.2	19.3
24-35 months	2386	18.8	17.8	20.0
36-47 months	2918	22.4	21.6	23.2
48-59 months	3191	24.7	23.5	26.0
Sex of household head				
Male	8261	79.5	76.1	82.6
Female	1780	20.5	17.4	23.9
Civil status of household head				
Single	201	2.1	1.7	2.5
Married	6440	63.7	59.2	68.0
Widow/Widower	1026	10.5	9.8	11.3
Separated/Annulled/Divorced	258	2.4	2.1	2.8
Common-law/Live-in	2116	21.3	17.7	25.3
Educational attainment of household head				
No grade completed	264	2.1	1.3	3.4
At least elementary level	3823	34.3	30.4	38.5
At least high school Level	3817	40.3	37.5	43.1
At least college Level	2090	22.7	20.1	25.6
Others (Special Education, Alternative Learning System, Arabic Schooling)	47	0.5	0.2	1.3
Occupation of household head				
Armed forces occupations	18	0.1	0.1	0.2
Managers	224	2.2	1.7	2.9
Professionals	149	1.6	1.1	2.3
Technicians and associate professionals	214	2.3	1.8	3.0
Clerical support workers	169	1.9	1.4	2.6
Service and sales workers	1021	11.4	9.4	13.9
Skilled agricultural, forestry and fishery	3042	24.3	19.6	29.7
Craft and related trades workers	940	10.4	8.5	12.8
Plant and machine operators and assemble	1198	13.2	11.7	14.8
Elementary occupations	1511	15.0	13.1	17.0
Not classified	1555	17.5	15.9	19.4
Household size				
≤5	4880	49.7	46.5	53.0
>5	5161	50.3	47.0	53.5
Place of residence				
Rural	6788	55.3	39.2	70.3
Urban	3253	44.7	29.7	60.8
Wealth quintile				
Poorest	3464	28.4	23.4	33.9
Poor	2411	22.1	18.8	25.9
Middle	1796	19.6	17.4	22.0
Rich	1340	16.2	13.1	19.9
Richest	1030	13.6	11.2	16.5

rural areas (55.3%), and most were from the poorest wealth quintile (28.4%). In terms of household size, 50.3% of the preschool children belonged to households with more than five members, while the other half (49.7%) belonged to households with five or less members.

Nutritional status

Table 2 shows that 19.2% of all preschool children were underweight, with the 48-59 months old having the highest prevalence (22.4%). As for height-for-age, 30.1% of all preschool children were stunted, with the highest prevalence observed among the 12-23 months old children (36.1%). In terms of weight-for-height, only 5.6% of preschool children were wasted, with the highest prevalence manifested among the 0-5 months old age sub-group (9.4%).

Association between government programme participation and nutritional status

Table 3 shows that participation in household-level government programmes, namely household food production, awareness of iodised salt, and usage of iodised salt were associated with the nutritional status of preschool children in terms of both weight-for-age and height-for-age. On the other hand, nutritional status of preschool children in terms of weight-for-height was only associated with participation in household food production and awareness of iodised salt.

Table 4 presents the association between individual GP and the nutritional status of specific age sub-groups of preschool children. Results showed that the availing of newborn screening, participation in the national dietary supplementation programme, vitamin A supplementation, and iron supplementation were not associated with any of the nutritional status indicators. Participation in immunisation programme and growth monitoring

Table 2. Nutritional status of preschool children

Disaggregation	*Weight-for-age n (%)*			*Height-for-age n (%)*			*Weight-for-height n (%)*		
	UW	*Normal*	*AN*	*Stunted*	*Normal*	*AN*	*Wasted*	*Normal*	*OW*
Age group	2553 (19.2)	10188 (78.9)	208 (1.9)	4077 (30.1)	8714 (68.7)	156 (1.3)	770 (5.6)	11688 (90.1)	464 (4.0)
0-5 months	94 (8.7)	931 (89.9)	14 (1.4)	114 (11.9)	888 (85.3)	36 (2.9)	106 (9.4)	878 (84.6)	49 (5.2)
6-11 months	159 (13.3)	958 (86.1)	8 (0.6)	182 (15.7)	928 (83.1)	15 (1.2)	102 (8.8)	999 (88.6)	24 (2.5)
12-23 months	425 (18.5)	1836 (80.3)	29 (1.2)	832 (36.1)	1424 (62.3)	34 (1.6)	151 (5.8)	2071 (91.1)	67 (3.1)
24-35 months	500 (20.5)	1852 (78.3)	34 (1.2)	859 (34.8)	1507 (64.3)	20 (0.9)	118 (4.9)	2193 (92.3)	72 (2.6)
36-47 months	661 (21.1)	2202 (76.5)	55(2.5)	1066 (32.9)	1826 (66.1)	25 (1.0)	137 (4.2)	2645 (90.2)	127 (5.0)
48-59 months	714 (22.4)	2409 (74.7)	68(2.8)	1024 (30.4)	2141 (68.5)	26 (1.0)	156 (4.9)	2902 (89.7)	125 (4.9)

UW: Underweight; AN: Above Normal; OW: Overweight

Table 3. Association between participation in household government programmes with nutritional status of 0-59 months old preschool children

	Weight-for-age n (%)			*p-value*	*Height-for-age n (%)*			*p-value*	*Weight-for-height n (%)*			*p-value*
	UW	*Normal*	*AN*		*Stunted*	*Normal*	*AN*		*Wasted*	*Normal*	*OW*	
Household food production												
No=0	1105 (16.8)	4862(81.0)	128 (2.3)	<0.001*	1789 (27.6)	4223 (71.0)	80 (1.4)	0.015*	350 (5.0)	5459 (90.0)	269 (5.0)	0.003*
Yes=1	1451 (22.0)	5326(76.6)	80 (1.4)		2288 (32.9)	4491 (66.0)	76 (1.1)		420 (6.3)	6229 (90.7)	195 (2.9)	
Pantawid Pamilyang Pilipino Programme (4Ps)												
No=0	807 (30.9)	1978(68.3)	19 (0.8)	0.062	1209 (44.6)	1568 (54.6)	26 (0.9)	0.216	208 (7.2)	2536 (90.8)	50 (2.0)	0.117
Yes=1	551 (31.3)	1303(68.4)	8 (0.3)		866 (47.2)	978 (51.8)	18 (1.0)		146 (8.8)	1690 (90.3)	23 (0.9)	
Family development session (FDS)												
No=0	105 (34.4)	246 (65.5)	1 (0.2)	0.571	157 (46.1)	190 (52.9)	5 (1.0)	0.935	34 (11.1)	310 (87.2)	7 (1.7)	0.089
Yes=1	446 (30.5)	1057 (69.1)	7 (0.4)		709 (47.5)	788 (51.5)	13 (1.0)		112 (8.2)	1380 (91.2)	16 (0.7)	
Sustainable livelihood programme (SLP)												
No=0	1894 (26.8)	5504 (72.3)	56 (0.9)	0.513	2944 (40.2)	4430 (58.8)	79 (1.0)	0.622	527 (7.0)	6771(91.0)	138 (2.1)	0.411
Yes=1	66 (23.4)	234 (75.6)	3 (1.0)		116 (41.0)	186 (58.6)	1 (0.4)		13 (4.2)	281 (93.9)	8 (2.0)	
Awareness on iodised salt												
No=0	1165 (23.9)	3707 (74.8)	48 (1.3)	<0.001*	1806 (36.1)	3070 (62.9)	44 (1.1)	<0.001*	355 (6.5)	4434 (90.6)	124 (2.9)	0.002*
Yes=1	1388 (16.5)	6481 (81.3)	160 (2.2)		2271 (26.6)	5644 (72.0)	112(1.4)		415 (5.1)	7254 (90.2)	340 (4.7)	
Usage of iodised salt												
No=0	695 (18.4)	2941 (79.9)	59 (1.7)	0.013*	1127 (30.1)	2521 (68.7)	47 (1.3)	<0.001*	190 (5.0)	3366 (91.1)	134 (4.0)	0.224
Yes=1	691 (15.1)	3532 (82.4)	101 (2.6)		1139 (24.0)	3118 (74.6)	65 (1.4)		224 (5.2)	3879 (89.6)	206 (5.3)	

UW: Underweight; AN: Above Normal; OW: Overweight
*significant at 5% level of significance

Table 4. Association between participation in individual government programmes with nutritional status of preschool children

	Weight-for-age n (%)			*p-value*	*Height-for-age n (%)*			*p-value*	*Weight-for-height n (%)*			*p-value*
	UW	*Normal*	*AN*		*Stunted*	*Normal*	*AN*		*Wasted*	*Normal*	*OW*	
Newborn screening												
No=0	32 (12.4)	216 (86.2)	3 (1.4)	0.265	38 (16.5)	204 (79.9)	8 (3.6)	0.394	23 (8.1)	218 (89.8)	6 (2.1)	0.123
Yes=1	73 (7.6)	869 (90.9)	15 (1.5)		97 (11.5)	829 (86.1)	31 (2.5)		95 (9.2)	811 (84.5)	49 (6.3)	
With immunisation												
No=0	33 (26.8)	83 (71.3)	2 (1.9)	0.105	67 (62.5)	47 (35.0)	4 (2.5)	0.009*	16 (11.7)	96 (81.0)	5 (7.3)	0.140
Yes=1	392 (18.2)	1737 (80.6)	27(1.2)		757 (34.7)	1369 (63.7)	30 (1.5)		134 (5.6)	1960 (91.5)	62 (2.9)	
National ietary supplementation programme												
No=0	2140 (19.7)	8246 (78.5)	174 (1.8)	0.082	3519(31.8)	6931 (67.1)	109 (1.1)	0.614	580 (5.1)	9582 (91.0)	379 (4.0)	0.195
Yes=1	319 (24.4)	1011 (73.0)	20 (2.6)		444 (31.0)	895 (68.2)	11 (0.8)		84 (6.9)	1228 (89.5)	36 (3.7)	
Vitamin A supplementation												
No=0	687 (19.6)	2532 (77.9)	71 (2.5)	0.329	1140 (33.1)	2104 (65.4)	46 (1.5)	0.055	210 (5.7)	2931 (89.8)	137 (4.5)	0.316
Yes=1	1708(20.3)	6512 (78.1)	116 (1.6)		2736 (31.2)	5531 (68.0)	68 (0.8)		440 (5.2)	7621 (91.2)	267 (3.6)	
Iron supplementation												
No=0	2326 (20.1)	8850 (78.1)	185 (1.9)	0.605	3777 (31.8)	7472 (67.1)	111 (1.1)	0.506	631 (5.3)	10314 (90.8)	396 (3.9)	0.652
Yes=1	75 (22.5)	229 (75.2)	3 (2.2)		105 (27.3)	197 (71.3)	5 (1.4)		21 (6.6)	277 (90.3)	8 (3.2)	
Growth monitoring												
Checked weight												
No=0	793 (21.6)	2790 (76.7)	55 (1.8)	0.134	1288 (34.6)	2295 (63.7)	53 (1.7)	0.015*	242 (6.2)	3242 (89.6)	137 (4.2)	0.510
Yes=1	1760 (18.1)	7398 (80.0)	153 (1.9)		2789 (28.1)	6419 (70.9)	103 (1.0)		528 (5.3)	8446 (90.7)	327 (4.0)	
Checked height												
No=0	954 (20.8)	3451 (77.3)	73 (1.9)	0.227	1542 (33.0)	2865 (65.3)	69 (1.7)	0.023*	287 (5.9)	3996 (89.9)	176 (4.2)	0.582
Yes=1	1599 (18.2)	6737 (79.9)	135 (1.9)		2535 (28.3)	5849 (70.7)	87 (1.0)		483 (5.4)	7692 (90.7)	288 (3.9)	
Deworming												
No=0	1116 (18.9)	4291 (78.8)	106 (2.3)	0.023*	1847 (31.4)	3603 (67.4)	62 (1.2)	0.049*	300 (4.7)	4964 (90.4)	236 (4.9)	0.073
Yes= 1	1184 (23.2)	4008 (75.2)	80 (1.7)		1934 (35.6)	3295 (63.4)	43 (0.9)		262 (5.2)	4847 (91.8)	155 (3.0)	

UW: Underweight; AN: Above Normal; OW: Overweight
*significant at 5% level of significance

Table 5. Logistic regression analyses of government programme participation

Programmes	*Weight-for-age*			*Height-for-age*			*Weight-for-height*		
	OR adjusted	*95% CI*	*p-value*	*OR adjusted*	*95% CI*	*p-value*	*OR adjusted*	*95% CI*	*p-value*
Household food production	1.17	(0.98-1.41)	0.079	0.93	(0.75-1.16)	0.488	1.02	(0.65-1.62)	0.903
Pantawid Pamilyang Pilipino Programme	1.04	(0.61-1.78)	0.870	0.94	(0.64-1.38)	0.722	2.24	(1.11-4.53)	0.030*
Family development session	1.12	(0.62-2.03)	0.673	1.24	(0.75-2.04)	0.347	0.67	(0.37-1.20)	0.148
Sustainable livelihood programme	0.78	(0.51-1.19)	0.207	0.79	(0.51-1.21)	0.227	0.64	(0.23-1.73)	0.319
Usage of iodised salt	0.99	(0.85-1.16)	0.911	0.90	(0.82-0.98)	0.025	1.16	(0.85-1.58)	0.306
Newborn screening	0.53	(0.38-0.73)	0.002*	0.62	(0.47-0.82)	0.005*	0.80	(0.53-1.19)	0.222
Immunisation	1.22	(0.65-2.30)	0.487	0.73	(0.34-1.58)	0.370	0.91	(0.34-2.43)	0.824
National dietary supplementation programme	3.12	(0.87-11.27)	0.074	1.32	(0.50-3.51)	0.522	2.64	(0.73-9.53)	0.118
Vitamin A supplementation	1.17	(0.94-1.46)	0.134	1.11	(0.89-1.38)	0.310	0.72	(0.44-1.18)	0.162
Iron supplementation	1.63	(0.82-3.21)	0.135	0.96	(0.52-1.75)	0.868	1.35	(0.28-6.63)	0.669
Growth monitoring									
Check weight	0.71	(0.46-1.10)	0.108	0.58	(0.40-0.84)	0.010*	0.87	(0.34-2.23)	0.731
Check height	0.89	(0.49-1.64)	0.678	1.08	(0.86-1.35)	0.467	0.87	(0.41-1.84)	0.665
Deworming	0.96	(0.57-1.61)	0.849	1.63	(1.33-1.99)	0.001*	0.99	(0.47-2.11)	0.985

*significant at 5% level of significance

were associated with height-for-age only, while participation in deworming programme was associated with both weight-for-age and height-for-age.

Table 5 presents the results of the logistic regression analyses of government programmes. Results showed that 0-6 months old children who had undergone newborn screening were 47% and 38% less likely to be underweight and stunted, respectively. Among preschool children who had undergone growth monitoring, they were 42% less likely to be stunted. On the contrary, the odds of being stunted was 1.6 times higher among children who participated in deworming. Similarly, children who belonged to 4Ps households were 2.24 times more likely to be wasted.

DISCUSSION

Children in developing countries face a range of interrelated problems and child malnutrition; together with inadequate water and sanitation, consequent infections, and growth and development impairments, this remains to be an important public health problem. Poverty, food insecurity, and poor nutrition have serious detrimental impacts on health, development, and well-being of young children; and changes in child malnutrition prevalence are closely related to the countries' mortality trends (Pelletier & Frongillo, 2003). One of the most critical responsibilities of the government is to deliver and support quality healthcare to ensure optimal health among its people.

The Philippine Government created laws, programmes, and projects to ensure access to basic healthcare for Filipinos. The 1989 Philippine Constitution Article XV Section 3 and Article XIII Section 11 mandate the State to defend the right of children to assistance, including proper care and nutrition, and to make available an integrated and comprehensive approach to health development and other social services. The Philippine government acknowledges the challenges brought by health and nutrition problems, thus, consolidated efforts from the public and private sectors help provide plans and strategies to combat the health and nutrition problems of the country (National Nutrition Council, 2020).

Since improved health and nutrition in early childhood are strongly associated with long-term health and economic benefits, more interventions started to focus on the early life stages. Childhood malnutrition has its immediate, underlying, and basic determinants, which could be addressed through the implementation of health and nutrition programmes for young children and their families. These programmes also provide crucial contact with trained health workers who have been instrumental in improving health in developing countries through fostering behavioural change, supporting care practices, and improving access to health services (Ghodsi *et al.*, 2021).

Various factors could affect the impact of a nutrition or health programme on nutritional status. The success of government programmes depends on various factors, such as evidence-based innovation and interventions, rigorous monitoring and evaluation, partnerships with public and private-sector organisations, and timely information dissemination to the public, to effect behaviour change (Frieden, 2013). A systematic review on nutrition interventions in several countries showed that large-scale nutrition interventions positively impact child malnutrition in which the effectiveness depends on the context, needs of the community, and the situation at baseline. Significant differences in the rates of change in health and nutritional status between countries with and without interventions were observed (Allen & Gillespie, 2001). Social services were shown to have essentially eliminated almost all occurrences of child malnutrition, while

a programme providing an integrated approach to food and nutrition security and sustainable local food systems resulted in improved feeding practices and food security status among children (Sustainable Development Goals Fund, 2017).

In this study, household-level government programmes were identified to have an association with nutritional status were household food production and awareness and usage of iodised salt, while participation in the 4Ps demonstrated an increase in the likelihood of wasting. On the other hand, growth monitoring, immunisation, deworming, and newborn screening were the individual-level government programmes associated with nutritional status.

Household food production

Household food production programmes in the Philippines are designed to empower households to grow their own food in order to promote food security and self-sufficiency through backyard/ community gardening. The key benefits of home gardening include improved food security, increased food availability, better nutrition through food diversity, increased income and enhanced rural employment through additional or off-season production, environmental benefits from recycling water and waste nutrients, controlling shade, dust and erosion, and maintaining or increasing local biodiversity (Landon-Lane, 2011).

In this study, the benefit of household food production in the nutritional status of children was evidenced by its association to lower the prevalences of stunting, wasting, and underweight. Similar studies exhibited the potential benefit of home gardening when combined with other nutrition-specific programmes and revealed that home garden interventions can improve a child's nutritional status (Guzmán-Abril *et al.,* 2022; Petros *et al.,* 2018).

Iodised salt awareness and usage

A nutrition-specific programme associated with nutritional outcomes was the awareness and usage of iodised salt, showing an inverse relationship with the prevalences of underweight, stunting, and wasting. Iodine is an essential trace element required in the synthesis of thyroid hormones, which are necessary for normal growth and cognitive development. The use of iodised salt in the prevention of iodine deficiency disorder is recognised as efficient and cost-efficient. The Republic Act 8172 or the Act for Salt Iodisation Nationwide requires iodised salt to be sold/distributed in the Philippines, whether locally produced or imported, shall conform with the standards formulated by the Bureau of Food and Drugs.

A local study on the effect of iodine status and cognitive performance of Filipino school children showed that salt iodisation accompanied by adequate intake of energy, protein, thiamin, and riboflavin contributed to improved cognitive performance in children. The long-term factors identified which contributed to the improvement were normal iodine status and reduction in protein energy malnutrition (Amarra *et al.*, 2007). In this study, awareness of iodised salt was significantly associated with weight-for-age, height-for-age, and weight-for-height. Similarly, the usage of iodised salt was also significantly associated with weight-for-age and height-for-age.

Non-usage of adequately iodised salt among households was associated with a higher prevalence of child malnutrition and mortality in neonates, infants, and children under 5 years of age (Semba *et al.*, 2008). Education and raising awareness on iodised salt have a positive impact on iodised salt consumption among hard-to-reach, marginalised communities (Lowe *et al.*, 2015)

Pantawid Pamilyang Pilipino Programme (4Ps)

The 4Ps was developed by the national government to provide conditional cash grants among households/families with children aged 0-18 years and pregnant women to improve their health, nutrition, and education. In this study, the nutrition-sensitive programme was found to increase the likelihood of wasting, contrary to the study of Orbeta, Melad & Araos (2021), which found that participating in 4Ps had no significant impact on underweight and wasting as wasting is considered to be an acute illness, while underweight may possibly occur due to stunting or wasting. The increased odds of being wasted among children who belonged to 4Ps households may be attributed to the fact that households targeted by the 4Ps are those belonging to the poorest of the poor. Those who belong to the lower wealth quintile have limited access to resources, limited knowledge on health and nutrition, limited access to health care, and poor environmental conditions – all of which may have negative effects on nutritional status.

Growth monitoring

Child growth is considered an important indicator of the nutritional status and health of a population. For growth monitoring, only height-for-age was significantly associated with the regular monitoring of weight and height. The Operation Timbang Plus (OTP) is an annual weighing and height monitoring effort among infants and preschool children to provide information about their nutritional status.

Early detection of undernutrition also translates to early response of interventions. Growth monitoring can suggest an entry point to preventive and curative health care and serves as a constituent nutrition-specific programme in line with significant reductions in malnutrition and mortality (Irwanto, 2010). The proper recording and charting of a child's data on the growth chart allow for an appropriate comparison of the child's growth to the reference and this could aid in the early detection of growth faltering (Ashworth, Shrimpton & Jamil, 2008). The main aims of growth monitoring are to provide a diagnostic tool for health and nutrition surveillance, educate mothers, caregivers, and health workers on healthy food choices and care practices, provide regular contact with primary healthcare services, and encourage utilisation. Two major advantages of growth monitoring are frequent contact with health workers and a conduit to child health interventions (Ashworth *et al.*, 2008).

Growth monitoring is a strategy for the promotion of health, which creates awareness among mothers about growth or the lack of it in their children and serves as a guide to assure continued growth and optimal health. It is an efficient strategy to track physical growth and also serves as a measure to determine the efficacy of treatment and interventions (Kuwabara & Urakami, 2018). When addressing problems on the nutritional status of a child, health workers respond with targeted promotion activities based on growth trend, including the provision of nutritional supplements, treating underlying disease conditions, making referrals to health providers, and provision of nutrition counselling (Liu, Long & Garner, 2017).

Immunisation

One of the prevailing nutrition-sensitive measures to reduce child morbidity is immunisation, which is measured with reference to basic vaccination. The Philippine's expanded programme on immunisation aims to protect infants and children against diseases including tuberculosis, poliomyelitis, diphtheria, tetanus, pertussis, and measles through vaccination. Basic vaccination is considered "complete" if all eight basic vaccines [Bacillus Calmette–

Guérin (BCG), measles, polio 1-2-3, and Diphtheria-Tetanus-Pertussis (DTP) 1-2-3] have been received by a child. In this study, immunisation was found to be associated with height-for-age and the results were consistent with the Demographic and Health Surveys data showing that incomplete vaccination among children was associated with poor nutritional status. A significantly higher prevalence of underweight was found among children with incomplete vaccination schedules in seven countries, while wasting and stunting were frequently observed in under-vaccinated children in four countries (Solis-Soto, Deepak & Nicoli, 2020). Similarly, a recent study in Thailand showed that children with incomplete vaccination coverage were more likely to be stunted, wasted, and overweight (Shinsugi & Mizumoto, 2021). This suggests that immunisation not only helps prevent specific diseases, but also leads to overall improvements in health.

Deworming

Soil-transmitted helminth infections are among the most common infections in humans, caused by a group of parasites such as roundworms, whipworms, and hookworms. Those living in poverty are the most vulnerable to infection that can impair nutritional status by causing internal bleeding, which can lead to anaemia, intestinal inflammation and obstruction, diarrhoea, and impairment of nutrient absorption. Preventive chemotherapy or deworming done annually or biannually is an important strategy to prevent morbidity brought about by soil-transmitted helminths among at-risk population groups. However, the long-term solution to helminthic infections is addressing other factors such as water, sanitation, and hygiene (WHO, 2019).

Every month of January and July, mass deworming is carried out by the Department of Health in partnership with local government units, distributing anti-helminthic drugs to address the problems of intestinal parasites. Preschool-age children are at risk of having intestinal worms due to their daily activities and playtime, and improper handwashing techniques promotes the survival of these parasites. In this study, deworming showed a positive association with weight-for-age and height-for-age of children 12-60 months old, indicating improvement in their nutritional status. Conversely, deworming also resulted to higher odds of stunting. Mass deworming is proven effective to improve the weight and appetite of preschool-age children; however, it is ineffective for the height and cognitive abilities of preschool-age children (Welch *et al.*, 2017). On the contrary, deworming showed consistent association with reduced risk of stunting in another study (Lo *et al.*, 2018). In terms of anaemia, a decrease in prevalence was observed through deworming in partnership with regular hygiene and supplementation of iron and retinol (Girum & Wasie, 2018). In a study conducted in Nepal, it was found that undernutrition was linked less to hygiene-related risk factors and more to the low socioeconomic status of households and poor nutrition. The study results also showed that improved nutritional status of children was indirectly linked to water, sanitation, and hygiene practices as indicated by increased likelihood of children having parasitic infections and diarrhoea when there is poor sanitation and hygiene (Shrestha *et al.*, 2020). These results demonstrated that deworming, coupled with other nutrition and health interventions, helps in the improvement of the overall health and nutrition of a child.

Newborn screening

The Philippine National Comprehensive Newborn Screening System identifies development, genetic and metabolic conditions that can affect a child's long-term health or survival. This includes

blood, hearing, and heart screenings. Although newborn screening itself does not have a direct impact on nutritional status, it plays a crucial role in improving long-term nutritional outcomes through early detection of metabolic disorders, which demands special dietary recommendation and nutrition counselling. In this study, newborn screening programme decreased the likelihood of underweight and stunting. Similar findings were found wherein higher weight-for-age and height-for-age mean z-scores were observed among children who underwent newborn screening, thus improving nutritional outcomes in early childhood (Schütz *et al.*, 2022).

Nutrition programmes have indeed an important role in improving food and economic security, dietary intake, health, and child development. Results of this study could validate if our local policies and programmes on health and nutrition are indeed contributing significantly to the uplifting of the nutritional status of children during their crucial years of growth and development. Since government agencies have limited capacity and resources, it is crucial that they maximise limited resources by delivering effective programmes, which improve population-level health outcomes. All programmes should be backed-up with updated policies and closely monitored and evaluated to ensure that the health and nutrition services received by households and children are timely and appropriate. In the 4Ps, for instance, results of this study could possibly be used as science-based evidence in improving the existing modules used in Family Development Sessions by strengthening the focus on health and nutrition, and provide more nutrition-specific interventions to those identified with poor nutritional status. The same is true for the other programmes discussed in this study, which all have important roles in improving children's nutritional status. The results could be used by these programmes as a scientific basis for identifying the most vulnerable groups, increasing budget allocation to expand coverage and improve services, increasing the involvement of healthcare providers, and crafting policy recommendations to further support and sustain programme implementation.

CONCLUSION

For household-level programme participation, household food production, awareness of iodised salt, and usage of iodised salt were significantly associated with weight-for-age and height-for-age. Weight-for-height, on the other hand, was only associated with participation in household food production and awareness of iodised salt. As for individual-level GP, participation in immunisation programme and growth monitoring were associated with height-for-age only, while participation in deworming programmes was associated with nutritional status of preschool children in terms of both weight-for-age and height-for-age. For the strength of association, it was found that preschool children who underwent growth monitoring were less likely to be stunted. For preschool children who underwent newborn screening, they were less likely to be underweight and stunted. On the contrary, children who participated in deworming programmes were more likely to be stunted and children belonging to 4Ps households were more likely to be wasted.

There were several limitations to be taken into consideration in this study. Firstly, causal inference cannot be claimed from the results since data were obtained from a cross-sectional survey. The effects of confounding variables that may have influenced nutritional outcomes of preschool children cannot be ruled out despite adjusting for sex, wealth quintile, and urbanity. Another major limitation was that data on participation were mainly self-reported

by the respondents and their actual attendance or involvement was not verified. Future research is needed to further validate the results of this study and understand the impact of GP on the nutritional status of children. Other factors/variables not covered in this study should also be analysed.

Government programmes, whether nutrition-specific or nutrition-sensitive, are designed to improve the health and nutritional well-being of target populations. Understanding the association between nutritional status and government programme participation can serve as scientific basis in tailoring targeted intervention specifically in nutrition and health education, identifying vulnerable areas to be given prioritisation, increasing advocacy efforts and resource allocation, and fostering collaboration with more healthcare providers.

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Authors' contributions

Arias FPS, principal investigator, conceptualised and designed the study, prepared the draft of the manuscript and reviewed the manuscript; Ferrer EB, performed statistical data analysis and interpretation, reviewed the manuscript.

Conflict of interest

All authors declare no conflict of interest in the conduct of this secondary data analysis study as the survey is government funded.

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