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All articles must be accompanied by an abstract of 200 words and keywords of not more than ten words, and must use gender-fair language.

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Editorial Notes

Welcome to the first issue of Silliman Journal 2021! The six full articles and two notes featured in this issue seem to revolve around the theme of interconnectedness between humans and many different systems.

The first full article investigates the use of pesticides in farming. Jose Edwin C. Cubelo and Teodora A. Cubelo explore the extent of farmers' use of pesticides and how these leave residues in the vegetables, soils, and water samples in the province of Negros Oriental.

The next article is by Khris June L. Callano who notes a gap in research in the Philippines. In his paper, he makes a phytochemical study on eggplants and their wild relatives.

The third article is a collaborative research by academics in Cebu City. Kristine Mae L. Jumonong, Angela C. Barliso, Mariejayn C. Lempio, Henry Clint D. Ricaborda, Jake Joshua C. Garces and Jay P. Picardal do a floristic inventory and survey the distribution of trees in the urban streets of Cebu. They contend that doing these leads to more efficient planning and designing of a sustainable city.

Climate change is among the big topics in the high school curriculum. In the fourth article, Kenneth B. Pael explores high school

students' level of knowledge and behavioral responses to climate change so informed instructional interventions can be made.

The fifth article talks about gastro diplomacy, a concept that examines closely the relationships formed around and propagated by food. Jason Troy F. Bajar and Renia F. Dela Peña examine the socio-demographic factors that affect the attitudes toward gastrodiplomacy among local government employees.

The last full article of the issue analyzes the complaints lodged against health workers with the Professional Regulation Commission. In their paper, Alvin B. Caballes, Ivy D. Patdu, and Joel U. Macalino attempt to describe the complaint patterns, identify the source of complaints, among others.

The notes section features the articles of Joseph and Corazon Padilla and Jan Antoni Credo. In their paper, Joseph and Corazon review an article on communicative language teaching in the postmodern era. Jan's article, on the other hand, talks about the applicability of western political theories in the Philippine context.

The cover art for this issue is courtesy of Rodney Meg Fritz Balagtas, a teacher in Hanoi, Vietnam. The picture, which he shot using his phone, captures the boatmen in Hanoi at dusk. He said that the dramatic shot was a result of good timing, as he was able to take it when "the boatmen and their vessel aligned with the dying light of the sun."

Warlito S. Caturay Jr., PhD
Editor

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Detection of Pesticide Residues in Vegetables, Soil, and Water Samples from Four Vegetable-Producing Areas of Negros Oriental, Philippines

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A survey was conducted among vegetable farmers in four vegetable growing areas in the province of Negros Oriental, Philippines, to examine the extent of pesticide use by farmers and to determine the presence of pesticide residues in vegetables, soils, and water samples. One hundred nineteen (119) freshly harvested samples of Cabbage, Chinese pechay, cauliflower, broccoli, eggplant, and ampalaya, and 22 soil and 17 water samples were collected from randomly selected farms. These were sent to the National Pesticide Analytical Laboratory (NAPL), Bureau of Plant Industry in Quezon City, to determine whether these were positive for organophosphates, organochlorines, and pyrethroids residues through Gas-Liquid Chromatography. The survey results show that insecticide use was pervasive among the surveyed vegetable farmers, with pesticide application averaging more than ten (10) applications per cropping season. The most frequently used group of insecticides were pyrethroids, phenoxy-derivatives, and organophosphates. Results of the multi-residue analysis indicated that 28 of 119 vegetable samples tested showed positive readings for the presence of profenofos, chlorpyrifos, and lambdacyaholothrin residues, with eight samples containing residue levels that exceeded the Maximum Residue Limit (MRL). A water sample obtained from one of the farms also showed a positive reading for malathion residues, while a soil sample also tested positive for the presence of difenoconazole. Thus, evidence of pesticide contamination on vegetables, soil, and water samples from the surveyed farms existed at the time of the study.

Keywords: Pesticides, pesticide residues, pesticide contamination

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FROM FOUR VEGETABLE-PRODUCING AREAS OF NEGROS ORIENTAL, PHILIPPINES

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INTRODUCTION

Agriculture has always been one of the primary economic sectors in the Philippines, contributing about 9.2 % of the gross domestic product (GDP). In 2019, crops comprised nearly 53% of the total Philippine agricultural industry and have contributed more than 968 billion pesos to the country's national income (PSA, 2020). From 2015-2019, vegetables contributed about 8.8% of the total agricultural output of the Philippines while using only about 5% of the country's agricultural area. The vegetable sector played a crucial role in achieving food security, developing trade, and generating income and livelihood opportunities for people in the countryside.

The increasing importance of the vegetable-producing sector in the Philippine economy has raised demands for farmers to improve productivity and quality of produce. For this reason, vegetable farmers have embraced many agricultural innovations, including the use of hybrids and improved varieties of planting materials, synthetic fertilizers, and pest management practices that prevent and control destructive pests. Despite the existence of many alternative pest control measures that minimize the use of pesticides, most farmers have adopted pesticides as a principal pest control strategy. For many years now, the use of pesticides for crop protection against destructive pests has contributed to the enormous growth in agricultural production in many parts of the world (Ahmed et al., 2011).

According to Loevinson and Rola (1998), total pesticide use in the Philippines increased from 3,738 tonnes in 1977 to 10,773 tonnes in 1991. Pesticides were applied to rice, banana, and vegetables, with rice having the most considerable total use of pesticides in the country due to the large area under rice production. However, pesticide use was more intensive in vegetable crops (Rola et al., 1999). Among the pesticides, insecticides are the dominant pesticide used in Philippine farms (Fabro & Varca, 2012). Pesticides have significantly benefitted agriculture by decreasing or preventing crop losses due to pests. However, these substances are poisonous that, if misused or used without sufficient knowledge of their side effects, can endanger humans, animals (Rola et al., 1999), and other non-target organisms (Travisi et al., 2006). The potential hazards to human health and wildlife can be residues from persistent pesticides. These can

cause a build up in the food chain and subsequent contamination of the environment (Fabro & Varca, 2012). Although growers in the Philippines are switching to less toxic pesticides, the majority of those in use are highly toxic to fish. In general, the terrain and climate of the Philippines could also exacerbate the problem of off-site migration and the adverse impact of pesticides. Steep slopes and heavy rains lead to severe flooding, large run-off events, and high soil erosion rates – factors that favor off-site migration of pesticides so that the risk of contaminating water resources is relatively high (Fabro & Varca, 2012).

Of paramount concern in recent times is the safety of vegetables for human consumption after reports on widespread and indiscriminate use of pesticides in many parts of the world (Badii et al., 2013; Baral, Jeyanthi, & Kombairaju, 2005; Rola et al., 1999; Lu, 2010). These concerns are not unfounded as cases of pesticide contamination in harvested vegetables resulting from the widespread use of pesticides in vegetable farms have been reported in different parts of the world (Armah, 2011; Rola et al., 1999; Lu, 2011). To ensure that pesticides will have the least negative impact on human health and the environment, these chemicals are manufactured following strict quality control measures and regulatory processes. However, despite adhering to strict manufacturing protocols, there are still grave concerns about the health risks brought about by pesticide residue accumulation in food (Armah, 2011). A high degree of toxicity has been observed with most pesticides. Improper and persistent use of these hazardous chemicals pose risks of harm to humans, non-target organisms, and the environment. Documenting the extent of pesticide use in vegetable farms and assessing the presence of pesticide residues in vegetables, soils, and water were the targets of this study.

METHODOLOGY

The survey was conducted in four major vegetable-producing areas in the province of Negros Oriental, Philippines. A pre-tested interview schedule administered by trained field enumerators was used to obtain information on pesticide use in vegetable farms from 151 randomly selected farmers in the municipalities of Valencia, Bacong, Sibulan, and the City of Canlaon, Negros Oriental, Philippines.

One hundred nineteen (119) freshly harvested samples of Cabbage, Chinese pechay, cauliflower, broccoli, eggplant, and ampalaya were collected from randomly selected farms in the target municipalities. The samples were then submitted to the National Pesticide Analytical Laboratory (NAPL), Bureau of Plant Industry in Quezon City, Manila, for the analysis of organophosphates, organochlorines, and pyrethroids residues.

Method of Analysis

The main method of analysis used in this study was gas chromatographic method for the determination of pesticide residue in vegetables, soil, and water using Gas-Liquid Chromatography, Agilent Model 6890 equipped with Electron Capture Detector (ECD) and Flame Photometric Detector (FPD) or Nitrogen Phosphorous Detector (NPD).

Analytical Procedure for Vegetables Adopted by NPAL for this Study

Sample processing. This study adapted the Codex Maximum Residue Limit (MRL) for the the portion of the raw agricultural commodity used as the analytical sample for the determination of pesticide residues. One (1) kilogram of the vegetable, after removing stem or decomposed or withered parts, was homogenized before extraction. From this representative sample, two (2) replicates were taken for analytical determination.

Extraction. The analytical sample was homogenized with acetonitrile. Sodium chloride was added to improve the extraction efficiency by reducing the solubility of pesticides in water and forming an emulsion. Sodium sulfate was then added to the extract to get rid of excess water from the sample. An aliquot was taken and concentrated to dryness. The resulting residue was dissolved with n-hexane.

Clean-up. The solution was loaded into the interconnected (pre-conditioned) graphitized carbon and silica solid-phase extraction (SPE) cartridges. This was then eluted with a mixture of acetone and n-hexane. The collected solution was concentrated to dryness and dissolved in acetone.

Instrumental Analysis

Preparation of standard. Mixed standard solutions containing 26 pesticides (i.e., mevinphos, dimethoate, diazinon, isazophos, methyl parathion, fenitrothion, Malathion, chlorpyrifos, phenthoate, profenofos, triazophos, lindane, heptachlor, aldrin, heptachlor epoxide, alpha-endosulfan, 4,4-DDE, beta-endosulfan, endosulfan sulfate, lambda-cyhalothrin, permethrin, cyfluthrin, cypermethrin, fenvalerate, deltamethrin, and difenoconazole) were prepared. A five (5) point calibration curve was plotted by injecting 0.1, 0.05 0.02, 0.01, and 0.005 mg/kg mixed standard solutions of organophosphates, organochlorines, and pyrethroids.

    System suitability test. The linearity of response for pesticide residues to be analyzed was demonstrated by plotting the standard pesticide response against the concentration of the relevant analytes. Using regression analysis, a linear trend line was fitted to the data without forcing through zero. For each analyte, the correlation coefficient between concentration and peak area is no less than 0.99.

    Sample analysis. The sample solution was injected into the gas chromatograph, equipped with an electron capture detector and a flame photometric detector. The minimum detection limit of the instrument was 0.005 mg/kg. The end of quantification (LOQ) for organophosphates, organochlorines, and pyrethroids is 0.01 mg/kg.

    Calculations. The concentration of the residue found was determined using the slope formula.

$$\text{ppm found (mg/kg)} = (\text{peak area} - b) / m$$

RESULTS AND DISCUSSION

The vegetable crops included in this study, namely cabbage, Chinese cabbage, broccoli, cauliflower, ampalaya, and eggplant, were considered by all the surveyed farmers to be highly vulnerable to attacks by different types of pests. Insect pests were regarded by practically all (97%) of the surveyed farmers as the most destructive of all crop pests. To prevent and minimize losses due to pests, the vast majority (88%) of the farmers adopted the use of pesticides, particularly insecticides and fungicides, as a principal pest control strategy.

All 132 pesticide users applied insecticides on their vegetable crops, while only 13 farmers (9.8%) used fungicides. Twenty-nine farmers (22%) used a bio-pesticide, with Bacillus thuringensis as a component mainly intended to control insect pests such as diamondback moths, armyworms, and other insect pests attacking crucifers such as cabbage, cauliflower, broccoli, Chinese pechay, and others.

Insecticides Used by Vegetable Farmers

The surveyed vegetable farmers applied a variety of insecticides on their vegetable crops. The number of insecticides used per farmer per vegetable crop per cropping season ranged from one to four, with an average of about two insecticides. These insecticides belonged to 13 chemical families or subgroups (Figure 1). Among the chemical groups of insecticides, Pyrethroids such as beta-cypermethrin, cypermethrin, fenvalerate, lambda-cyhalothrin, esfenvalerate, and etofenprox, were used by the majority of the surveyed farmers (78 farmers or 59%). Two of the most widely-used pyrethroids were cypermethrin and lambda-cyhalothrin. These were applied by 44 and 30 vegetable farmers, respectively. Pyrethroid insecticides appeared to be the pesticide of choice among farmers in other parts of the country, so was the case among farmers in Lucban, Quezon, and Pagsanjan, Philippines, who, irrespective of crops grown, used pyrethroids for insect pest control as was reported by Fabro and Varca (2012). Cypermethrin and lambda-cyhalothrin were used by majority of the farmers to control insect pests such as cabbageworm, cutworm, fruitworm, diamondback moth, and melon worm in vegetable crops. It appears that chemical brands bearing these active ingredients are popular among farmers.

Moreover, 46 farmers (34.8%) applied insecticides belonging to the Phenoxy-pyridaloxy derivative group on their vegetable crops. On the other hand, 37 farmers (28%) used Organophosphates such as Chlorpyrifos, Diazinon, Fenithrothion, Malathion, Metamidophus, and Profenofos for insect pest control. Among these, Malathion was used by more farmers, followed by chlorpyrifos and profenofos.

Seventeen farmers (12.9%) used chemicals belonging to the Carbamate group, such as Carbaryl, Carbosulfan, and Methomyl. Fewer farmers used the combined group Organophosphates + Carbamate (15 farmers), Nereistoxin

Analogues (14 farmers), and Carboxamide (6 farmers). Very few farmers used chemicals belonging to the organophosphates + pyrethroid group (6 farmers), Neonicotinoids, Daiamides, Organochlorine, and others.
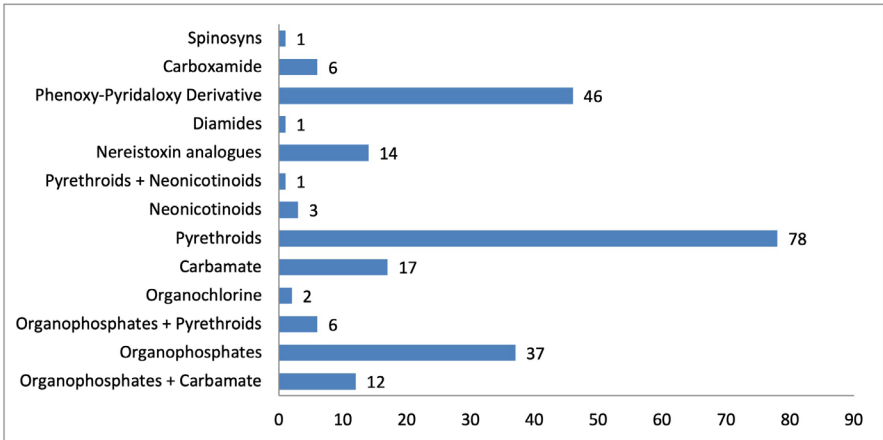
Figure 1. Subgroups of insecticides and the number of vegetable farmers using them

Toxicity Profile of Insecticides

In terms of the toxicity profile of the insecticides used, none of the surveyed farmers applied Category I pesticides, classified as highly toxic and severely irritating chemicals, on their vegetable crops. Consistent with the findings of Fabro and Varca (2012), who indicated that farmers in some parts of Luzon, Philippines, were shifting to less toxic chemicals, the current study reveals that most of the farmers applied pesticides Categories IV and III. For instance, 106 of the farmers (80.3%) used category IV insecticides, including Malathion, cypermethrin, etofenprox, flufendyamide, spinosad, thiamethoxam, lambda-cyhalothrin +thiamethoxam, spinosad, mancozeb, tebuconazole, difeconazole, thiopanate methyl 6, and the biopesticide Bacillus thuringensis. On the other hand, 77 farmers (58.3%) utilized category III insecticides on their crops, such as cartap hydrochloride, profenofos, carbaryl, pyridalyl, and propineb.

Sixty-six farmers (51.1%) applied Category II chemicals, such as chlorpyrifos, diazinon, fenitrothion, methamidophos, chlorpyrifos + BMPC,

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chlorpyrifos +cypermethrin, endosulfan, carbosulfan, lambda-cyhalothrin, esfenvalerate, beta-cypermethrin, and methomyl. This category is considered the second most toxic and irritating pesticide.

As shown in the data, farmers used more than one chemical brand of pesticides and applied them separately or in combinations. Therefore, farmers may have also combined chemicals with different levels of toxicity. Combining more than one pesticide, especially those with varying trade names but the same common name and thus the same active ingredient, is not a good idea because the mixing of pesticides can alter their chemical properties. This practice increases pesticides' detrimental effects on farmers' health (Salameh et al., 2004) (Chitra Grace et al., 2006).
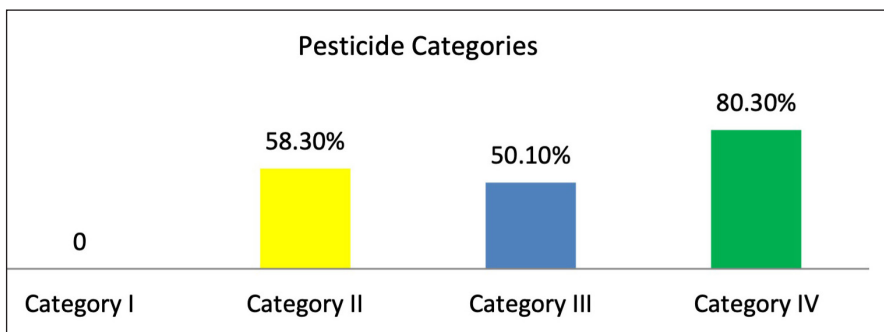
Figure 2. Toxicity category of pesticides and the percentage of farmers using them

As was observed in the current study, farmers did not generally keep records of the chemicals they sprayed. The present study's findings demonstrated that farmers used a wide range of chemicals at different dosages and frequencies of application. This is contrary to the observation of Fabro and Varca (2012). They noted that farmers located in a particular barangay used the same type of pesticides, and only the dosage and frequency of application varied.

The Extent of Pesticide Use

Table 1 presents some indicators of the extent of pesticide use among the surveyed farmers. Pesticide users applied pesticides on their vegetable

crops one to four times per week, with an average of 1.6 weekly applications. Regardless of the type of vegetable grown, the total number of pesticide applications per crop per growing season ranged from 3 to 16, with an average of 10.8 applications. On the other hand, the reported interval between applications was 3 to15 days, with an average of 5.65 days (SD=2.43). The gap between the last pesticide application and harvest date is called the pre-harvest interval. This can last for around 1 to 30 days, or one week on the average. It is noteworthy that there were many reported instances when crops were harvested a few days after pesticide application because of the availability of a ready buyer who may have offered a reasonable price. Studies revealed that when pesticide was sprayed shortly before harvesting, there was an increased risk of pesticide residue on produce (Jeyanthi & Kombairaju, 2005).

Irrespective of crops grown and the pesticide used, the average doses of liquid chemicals and solid chemicals per sprayer load with 16-liter capacity were 24.57 ml/load and 25.03 g/load, respectively. The number of sprayer loads per application regardless of crops grown and chemicals used ranged from 4 to 73 loads with an average of 18.3 loads per hectare per application.

Table 1

Pesticide Application Practices of Surveyed Vegetable Farmers

Pesticide Application Practices	Range	Mean	Standard Deviation
Frequency of pesticide application per week	1-4	1.60	0.64
Frequency of pesticide application per day	1-4	1.20	0.57
Number of days interval between pesticide applications	3-15	5.65	2.43
Interval (days) between last pesticide application and harvest	1-30	7.0	4.94
Number of sprayer loads/application/hectare	4-73	18.3	13.09
Mean dose of liquid chemicals (ml/load)	2-105	24.57	16.16
Mean dose of solid chemicals (g/load)	4-52.5	25.03	12.56

Pesticide Residues in Vegetable Samples

Some samples of each of the six types of vegetables included in this study yielded positive results for the presence of pesticide residues. Data in Table

2 show that of the 119 vegetable samples tested, 28 (23.5%) contained pesticide residues that exceeded the Limit of Quantification (LOQ) of 0.01 ug/L. Among the six vegetable types included in the study, Chinese Cabbage had the highest number of samples with residues of 0.01 mg/kg or higher. On the other hand, eggplant samples had the least number of samples with detected pesticide residue levels.

Specifically, results show that 16 of the 26 (61.5%) Chinese pechay samples had pesticide residue levels ranging from 0.01 to 1.67 mg/kg. On the other hand, around 0.01 to 0.13 mg/kg of residue was seen in five out of 30 (16.67%) cabbage samples. In like manner, two out of 12 (16.67%) Brocolli samples were also found to have pesticide residues at 0.06 mg/kg per sample. Also testing positive for the presence of pesticide residues were two ampalaya samples (0.12-0.59 mg/kg), one cauliflower (0.05 mg/kg), and two eggplants (0.25 to 0.59 mg/kg).

Table 2

Number and Percent of Vegetable Samples with Pesticide Residues Greater than LOQ

Vegetable Samples	Number of Samples Tested	Number of Samples with pesticide residues > 0.01 ug/L (LOQ)	Percent
Chinese pechay	26	16	61.50
Cabbage	30	5	16.67
Brocolli	12	2	16.67
Amplaya	17	2	11.80
Cauliflower	10	1	10.00
Egg plant	24	2	8.30
Total	119	28	23.52

Table 3 presents the group of chemicals detected from the tested vegetable samples and the quantity of the specific pesticides belonging to each group. Most of the 28 samples which tested positive for pesticide residues contained chemicals belonging to the organophosphates group. In particular, residues detected on cabbage samples belong to the organophosphates and pyrethroids groups of chemicals. Among the organophosphates, Chlorpyrifos residues were detected in two samples (0.05 and 0.13 mg/kg),

while one sample contained both Chlorpyrifos (0.03 mg/kg) and Profenofos (0.01 mg/kg). On the other hand, of the five pyrethroids, only Cypermethrin residues were found in two samples (0.03 mg/kg and 0.04 mg/kg).

Pesticide residues in Chinese pechay samples also belonged to the Organophosphates and Pyrethroids. Under the former, three samples contained profenofos residues ranging from 0.50 to 1.67 mg/kg, while seven samples had chlorpyrifos residues, which ranged from 0.01 to 0.07 mg/kg. One sample contained 0.08 mg/kg of Lambda-cyhalothrin residues, a kind of Pyrethroids. There were four other Chinese pechay samples, each containing two types of pesticide residues belonging to the same two groups of chemicals.

Brocolli (2) and eggplant (2) samples, testing positive for the presence of pesticide residues, contained traces of profenofos, which ranged from 0.06 mg/kg to 0.59 mg/kg. Only one sample of ampalaya tested positive at 0.59 mg/kg for the presence of organochlorines endosulfan residue. Another sample contained Lambdacyhalothrin residues (0.12 mg/kg).

In sum, 23 of the 28 vegetable samples which tested positive for pesticide residues contained organophosphates such as either chlorpyrifos or profenofos, or both. Seven samples contained residues of pyrethroids such as Cypermethrin or Lambdacyhalothrin residues. Only one sample contained endosulfan (organochlorine) residues.

Comparing the level of pesticide residues detected on vegetable samples with the Maximum Residue Limit (MRL), results show that eight (6.7 %) of the vegetable samples contained pesticide residues that exceeded the MRL for profenofos (7 samples) and Lambda-cyhalothrin (1 sample). In particular, four Chinese pechay samples, two eggplants, and one broccoli contained residues of profenofos that exceeded the MRL. On the other hand, one ampalaya sample contained Lambdacyhalothrin residues beyond the MRL, and another one had 0.59 mg/kg of endosulfan. However, there was no available data on the MRL of the latter. None of the cabbage and cauliflower samples that contained pesticide residues exceeded the MRL.

The data show that the current level of pesticide use by many of the surveyed farmers has resulted in the contamination of some vegetable samples with pesticide residues at levels considered unsafe for human consumption. This situation has the potential to put consumers' health at risk. According to Willis (1988, as cited in Rola et al., 1999), the acceptable

daily intake for an individual is "the level of pesticide residue intake below which the health risks are too small to be of concern." This means that the amount of a chemical consumed every day by an individual in his/her entire life must result in no harm.

The incidence of vegetables getting contaminated with toxic levels of pesticide residues in the Philippines appears to be a recurring phenomenon. Citing results of past studies in the 1980s and the 1990s, Rola et al. (1999) presented evidence of high pesticide residues in lowland vegetables especially string beans harvested in the 1980s, as well as string beans, eggplant, and tomatoes in 1995. They reported that 3.5% of the 168 vegetable samples analyzed within the Laguna area exceeded the MRL for methomyl, diazinon, and triazophos. Pesticides that were found to have high residues were monocrotophos and endosulfan. The current study found a higher percentage (7/119=6.7%) of vegetable samples with pesticide residues exceeding the MRL. These findings suggest that farmers' level and extent of pesticide use now and in the past may not have changed that much, considering that the reported incidences of vegetables turned out unsafe due to excessive pesticide residue levels, with the present study even reporting a higher percentage of the occurrence. Jeyanthi and Kombairaju (2005) propounded that the most damaging ecological disturbance of injudicious use of pesticides is a high concentration of pesticide residues in the food chain. This encompasses cereals, pulses, vegetables, fruits, milk, and milk products (including mother's milk), fishes, poultry, meat products, and water.

Table 3

Classification and Level of Pesticide Residues Detected in Vegetable Samples

Vegetables	Detected Pesticide Residues		Quantity of Residue (mg/kg)	Number of samples	MRL mg/kg
	Classification	Active Ingredient			
Cabbage	Organophosphates	Chlorpyrifos	0.05	1	1.0
			0.13	1	
			0.03	1	
		Profenofos	0.01	1	1.0
	Pyrethroids	Cypermethrin	0.03	1	1.0
			0.04	1	

Chinese Pechay	Organophosphates	Profenofos	0.50*	1	0.05
			1.43*	1	
			1.67*	1	
		Chlorpyrifos	0.01	1	1.0
			0.02	4	
			0.04	1	
			0.07	1	
	Organophosphates and Pyrethroids	Chlorpyrifos & Cypermethrin	0.04 and 0.05	1	1.0
			0.02 and 0.04	1	
		Profenofos & Cypermethrin	0.58	1	0.05
			0.02		
Cauliflower	Pyrethroids	Cypermethrin	0.05	1	1.0
Brocolli	Organophosphates	Profenofos	0.06*	2	0.05
Ampalaya	Pyrethroids	Lambdacyhalothrin	0.12*	1	0.05
	Organophosphates	Endosulfan	0.59	1	No Data
Eggplant	Organophosphates	Profenofos	0.59*	1	0.05
			0.25*	1	

* Residue level exceeds the MRL

Pesticide Residues in Water and Soil Samples

Seventeen (17) water samples were obtained from streams, rivers, or wells close to the vegetable growing sites and 22 from soil samples from the vegetable-growing areas to ascertain the potential impact of pesticide use in vegetable farms on the environment. The samples were subjected to multi-pesticide residue testing to determine whether residues of pesticides used in farms had contaminated these natural resources.

The test results show that one out of 17 water samples (5.9%) obtained from the four municipalities was contaminated with pesticide residues. Only traces of Malathion (0.17 mg/kg), a type of organophosphate was found. On the other hand, one out of 22 soil samples (4.5%) also tested positive for pesticide residues. However, unlike the residues found in vegetable samples, the soil sample did not contain a detectable quantity (LOQ of 0.01 mg/kg) of any of the 25 pesticides covered in the multi-residue tests. The only chemical found was traces (1.28 mg/kg) of Difenoconazole, a fungicide which belongs to the Triazoles group of pesticides. Though few in occurrence, theses traces indicated that pesticide use resulted in the contamination of water and soil resources in farms where pesticides were used. These findings confirm the statement of Knight and Norton (1989)

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(as cited in Jeyanthi & Kombairaju, 2005) that pesticide use could result in water pollution endangering human health and non-target species. As reported, environmental contamination from pesticides disrupted natural water, air, and soil functions. Environmental contamination altered the ecosystem, resulting in detrimental effects on nutrient cycles or the toxicity of non-target organisms (Jeyanthi & Kombairaju, 2005).

Table 5

Classification and Level of Pesticide Residues Detected from Soil and Samples

Sample	Number of Samples Tested	Samples with pesticide residues > 0.01 ug/L (LOQ)	Pesticide Residue	Level of Residue mg/kg	Classification of pesticide
Soil	17	1 (5.9%)	Difenoconazole	1.28	Triazoles (Fungicide)
Water	22	1 (4.5%)	Malathion	0.17	Organophosphates

However, it is noteworthy that many farmers used many other chemicals that did not belong to the three groups covered in the tests. These include those classified as Carbamates, Pyridalyl, and Nereistoxin analogs, which could not have been detected even if present. Hence, subsequent studies testing pesticide residues in vegetables, water, and soil should be expanded to include those pesticides that were widely used but were not covered in the present tests.

CONCLUSIONS

Pesticide application on vegetables is a pervasive practice among the surveyed farmers. Pesticides were applied at high frequencies and short intervals between applications. The current level of pesticide use by the majority of the surveyed farmers resulted in the contamination of some vegetable samples with pesticide residues. The frequent use of a wide range of insecticides and short pre-harvest intervals may have made some vegetables unsafe for human consumption. The multi- pesticide residue analysis revealed that more than one-fifth (23.5%) of the vegetable samples

collected from the survey sites contained pesticide residues exceeding the Limit of Quantification (LOQ) set by the NPAL. Eight of these vegetable samples had residues of profenofos (7 samples) and lambda-cyhalothrin (1 sample), which exceeded the MRL for vegetables considered safe for human consumption.

Pesticide use in farms also resulted in cases of pesticide residue contamination of water and soil resources. This was shown by a water sample that tested positive for the presence of malathion (0.17 mg/kg) and a soil sample where residues of fungicide difenoconazole (1.28 mg/kg) were also found.

RECOMMENDATIONS

Findings call for local government units to draft and implement local policies that will regulate the sale and use of pesticides in farms. It is recommended that these policies will include the creation of incentives for reduced pesticide usage and set-up mechanisms for regular monitoring of the level of pesticide contamination in vegetables, farm soils, and groundwater resources. Information and educational campaigns on the effects of pesticide use on human health, food safety, and environmental quality are also recommended.

Pesticide residue tests in succeeding studies should not be limited to the detection of 26 insecticide residues belonging to three chemical families: pyrethroids, organophosphates, and organochlorines. Tests should encompass the detection of a phenoxy pyridaloxy derivative group of chemicals used by the largest number of the surveyed farmers, carbamates, and nereistoxin analogs.

ACKNOWLEDGMENTS

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Total Antioxidant Activity, Total Phenolic and Flavonoid Contents of Eggplant *(Solanum melongena L.),* and Six of its Wild Relatives in the Philippines

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In the Philippines, phytochemical study on eggplant and its wild relatives has not yet been explored. The total phenolic and flavonoid contents as well as the total antioxidant capacity of seven *Solanum* species in the Philippines were assessed through Folin-Ciocalteau assay, aluminum chloride colorimetic method and 2,2-diphenyl-1-picrylhydrazyl (DPPH) assay, respectively. *S. americanum* and *S. melongena* were noted to produce the highest amount of phenols (96.43 and 74.38 mg GAE/g DW, respectively) and flavonoids (33.58 and 31.61 mg RUE/g DW, respectively) in their fruits. These two *Solanum* species also revealed the highest radical scavenging activity (8.61% and 6.85%, respectively). On the other hand, *S. capsicoides* was observed to produce low amount of phenols (54.31 mg GAE/g DW) and flavonoids (12.54 mg RUE/g DW), and eventually showed weak radical scavenging activity (3.76%). Correlation analysis suggested that the antioxidant capacity of the seven *Solanum* species was positively correlated to their total phenolic and flavonoid contents.

Keywords: *Antioxidant, Flavonoids, Phenolics, Radical Scavenging Activity, Solanum species*

INTRODUCTION

The family *Solanaceae* is constituted of about 3,000 to 4,000 species (Gebhardt, 2016), which are significant sources of phytochemicals. This particular plant family includes eggplant (*Solanum melongena L.*) and its wild relatives. Eggplant is a high yielding vegetable crop in Asia,

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which is well adapted to various environmental conditions. With this unique environmental adaptability, the vegetable remains affordable for the consumer all year round. In the Philippine setting, it is one of the major vegetable crops with relatively high production rate because of its demand as a staple vegetable in every Filipino household (PSA, 2019).

Over the past decades, one of the top priorities of plant breeders has been the improvement of the agronomic characteristics of eggplant to generate high yielding varieties with pest and insect resistance (Rotino et al., 1997; Chattopadhyay et al., 2012; Plazas et al., 2016). However, the increased health consciousness of the growing population has shifted some researchers' interests towards the discovery and enhancement of the phytochemical compositions of potential eggplant accessions (Boubekri et al., 2012; Salerno et al., 2014; Djouadi & Boubekri, 2016).

It was reported that the whole eggplant fruit possesses antioxidant activity (Akanitapichat et al., 2010; Noda et al., 2000; Somawathi et., 2014). On the other hand, its wild relatives such as *S. aethiopicum* (Nwanna et al., 2019), *S. diphyllum* (Hossain et al., 2009), *S. mammosum* (Wetwitayaklung & Phaechamud, 2011), *S. nigrum* (Gbadamosi & Afolayan et al., 2016; Veerapagu et al., 2018; Aryal et al., 2019) and *S. torvum* (Rahman et al., 2013; Abdulkadir et al., 2016; Khatoon et al., 2018) were also found to produce weighty amount of antioxidants in their fruits. According to Nisha et al. (2009), the antioxidant level in eggplant varies according to its variety, fruit shape and size, and even according to its production management system. Furthermore, it is postulated that the antioxidant capacity of eggplant is positively correlated to its phenolic content (Okmen et al., 2009, Chumyam et al., 2013; Plazas et al., 2013).

Phytochemicals are thoroughly studied for human health benefits as well as for drug discovery and development (Koulora et al., 2014). The wide array of vegetable and its related species worldwide hold a great number of bioactive compounds. These compounds can be a great source of natural antioxidants which are perceived to be a less toxic, healthier, and cheaper alternative to synthetic ones (Krishnalah et al., 2011). In fact, countries like Turkey (Okmen et al., 2009), United States of America (Singh et al., 2009), Sri Lanka (Somawathi et al., 2014), Italy (Salerno et al., 2014), Puerto Rico (Zambrano-Moreno et al., 2015), Algeria (Djouadi and Boubekri, 2016), and India (Khatoon et al., 2018) have already initiated basic researches on the phytochemical potential of different eggplant varieties. This study was thought

out to initiate phytochemical study on eggplant and its wild relatives found in the Philippines.

This study aimed to assess the total phenolic and flavonoid contents as well as the total antioxidant capacity of eggplant and its wild relatives found in the country.

MATERIALS AND METHODS

Plant Samples

Matured fruits of *S. aethiopicum*, *S. americanum*, *S. capsicoides*, *S. diphyllum*, *S. mammosum*, *S. melongena* and *S. torvum* (Fig. 1) were gathered from the collection garden at Barangay Batong Malake, Los Baños, Laguna for phytochemical analyses. These *Solanum* species were collected from various places in the country (Table 1). The fruits were collected from three different plant samples (replicates) of each *Solanum* species.

Sample Preparation

The fruits (peel and flesh) were cut into pieces and oven dried at 45°C for two days. The dried samples were pulverized and eventually utilized for different phytochemical analyses.

Phytochemical Contents

A total of 50 mg of pulverized samples were added to 10 mL 50% methanol (1:1 vol/vol absolute methanol: distilled water). The mixture was immediately vortexed at medium speed of 3 minutes. It was then centrifuged at 3000 rpm for about three minutes. The supernatant was thoroughly collected and utilized for the determination of total phenolic and flavonoid contents as well as two 2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging activity assays.

Determination of Total Phenolic Content (TPC)

Total phenolic content was determined using Folin-Ciocalteau assay (Velioglu et al., 1998). A total of 2.9 mL distilled water was added to 100 μL

methanol extract. Then, 1 mL of 0.2 M sodium carbonate and 0.2 mL of 50% Folin-Ciocalteau reagent were added to the solution. The solution was mixed properly using a vortex mixer. The samples were thereafter placed in a water bath for 20 minutes. The absorbance was measured using spectrophotometer at 710 nm. Total phenolic contents in the studied Solanum species were expressed as percent gallic acid equivalent (GAE).

Determination of the Total Flavonoid Content (TFC)

Total flavonoid content was estimated using aluminum chloride colorimetic method (Chang et al., 2002). About 2.0mL dH20 was added in 0.5mL methanolic extract. After that, 7.5μL 5% NaNO2 was added to the methanolic extract and was left to stand for 5 minutes. Then, 7.5μL 10% AlCl3 was added in the mixture and was left again to stand for 6 minutes. Finally, 50μL 1.0 M NaOH was added in the mixture before the absorbance was determined. The absorbance of the mixture was measured at 510 nm, and the results were stated as Rutin equivalent (mgRUE/gDW).

Determination of the Total Antioxidant Activity (% Radical Scavenging Activity)

The antioxidant activity was estimated using the 2,2-diphenyl-1-picrylhydrazyl (DPPH) assay (Brand-Williams et al., 1995). The DPPH assay was dissolved in 100 mL of absolute methanol for a final concentration of 10-4 M DPPH. About 2.9 mL aliquot of the DPPH solution was transferred in test tubes and eventually mixed with 25 μL of H2O. The solution was thoroughly mixed and incubated in the dark room at 300C for 40 minutes Absorbance reading was finally done at 517nm. The total antioxidant activity was expressed using % radical scavenging activity (%RSA).

STATISTICAL ANALYSES

Analysis of Variance (ANOVA) was used to statistically analyze the data. Tukey's HSD test was done to find out which specific group means were different. In addition, Spearman Correlation Analysis was conducted to

determine the correlation between the total antioxidant activity and total phenolic content, and total antioxidant activity and total flavonoid content.

RESULTS AND DISCUSSION

Total Phenolic Content (TPC)

Figure 2a presents the total phenolic content of seven *Solanum* species. As noticed, *S. americanum* (96.43 mg GAE/g DW) showed the highest amount of total phenolic content followed by *S. melongena* (74.38 mg GAE/g DW), *S. torvum* (mg GAE/g DW), *S. aethiopicum* (60.35 mg GAE/g DW), *S. mammosum* (58.47 mg GAE/g DW) S. capsicoides (54.31 mg GAE/g DW) and *S. diphyllum* (52.51 mg GAE/g DW). The variation observed in the total phenolic content among the studied fruit samples was quite expected since the samples utilized in the analysis were of different species. Okmen et al. (2009) Djouadi and Boubekeri (2016) and Aryal et al. (2019) witnessed the same results while assessing the phenolic contents of different eggplant cultivars and some of its wild relatives in Turkey, Algeria, and Nepal, respectively. Apparently, these observations suggest that the total phenolic content of a certain plant sample can be governed by several factors. It was well-documented by Antolovich et al. (2000), Griffith and Collison (2001), Robbins (2003), Lee et al. (2004), Naczk and Shahidi (2004), Achouri et al. (2005) and Luthria (2006) that the quantity and quality of phenolic compounds present in fruits and vegetables were significantly influenced by cultivar, environment, soil type, and growing and storage conditions. Furthermore, it may even depend on the extraction procedures used (Luthria et al., 2010).

The growing significance of phenolic compounds in plant species is primarily attributed to its antioxidant capacity (Salerno et al., 2014). This particular phytochemical is one of the most important classes of secondary metabolites mostly found in plants with diverse structures (Cheynier, 2012; Tungmunnnithum et al., 2018). Polyphenol components commonly found in plant extracts are capable of protecting a system against free radicals that are associated with abnormal aerobic cell metabolism (Enein et al., 2009; Brewer, 2011; Tiong et al., 2013). These compounds are among the greatest electron donors that can secure the conversion of H2O2 and H2O in a short period. Hence, they are referred to as the powerful chain-breaking

antioxidants (Bendary et al., 2013). Nonetheless, phenolic compounds are crucial for plant's growth and reproduction, which are produced as a response to environmental factors and to defend injured plants (Valentine et al., 2003).

Total Flavonoid Content (TFC)

Based on the analysis, the seven *Solanum* species exhibited different levels of flavonoid content (Fig. 2b). *S. americanum* (33.58 mg RUE/g DW), and *S. melongena* (31.62 mg RUE/g DW) were observed to be the top flavonoid producing species followed by *S. diphyllum* (29.51 mg RUE/g DW), *S. aethiopicum* (28.38 mg RUE/g DW), *S. torvum* (25.63 mg RUE/g DW), *S. mammosum* (21.61 mg RUE/g DW), and S. capsicoides (12.54 mg RUE/g DW). Trend wise, the *Solanum* species (i.e. *S. americanum* and *S. melongena*) that revealed the highest amount of phenols were the same species that produced a high amount of flavonoids. This particular trend was also witnessed from previous *Solanum* researches (Gbadamosi & Afolayan, 2016; Khatoon et al., 2018; Aryal et al., 2019). The observed trend might only be coincidental and not true to all plant species. According to Cotelle (2001), the production of phenols is not directly involved in the production of flavonoids; hence, there is no direct relationship between these two phytochemicals. Despite the various role of flavonoids in plant system, these phytochemicals are not understood completely yet (Abdulkadir et al., 2016). However, there are already few authors who reported that these phytochemicals were involved in plant-microorganism communication (Rice-Evans et al., 1996), plant's stimulation and protection (Wink, 2010), and even pigment and flavor expression (Harborne, 1976).

Total Antioxidant Activity (% Radical Scavenging Activity)

The total antioxidant activity of the seven *Solanum* species was expressed using percent radical scavenging activity (%RSA) (Fig. 2c). Remarkably, *S. americanum* (8.61%) and *S. melongena* (6.85%) exhibited the highest percentages of RSA. These results were consistent with the findings of Gbadamosi and Afolayan (2016), Veerapagu et al. (2018), and Aryal et al. (2019). On the other hand, *S. diphyllum* and *S. capsicoides* were found to express the lowest percentages of RSA (3.72% and 3.67%, respectively). The

% RSA of *S. torvum*, *S. mammosum* and *S. aethiopicum* showed no significant variation (4.79%, 4.67% and 4.58%, respectively) as far as statistical analysis was concerned.

The purple colored fruit of *S. melongena* (Fig. 1e) and *S. americanum* (Fig. 1f) is one of the primary reasons for their high antioxidant activities. In 2009, Nisha et al. reported that the purple fruits of *Solanum* species can express higher antioxidant capacity than other *Solanum* fruit types because of the presence of anthocyanin. Over the years, Singh et al. (2009), Akanitapichat et al. (2010) and Boubekeri et al. (2012) have proven that nasunin (delphinidin-3-p-coumaroylrutinoside-5-glucoside), the most common anthocyanin in *Solanum* species, is the key player in their total antioxidant activity.

Naturally, plant species can synthesize a variety of antioxidants that are efficient in neutralizing or even recycling free radicals. Phytochemistry wise, eggplant was ranked among the top ten vegetables with high antioxidant capacity (Cao et al., 1996; Nisha et al. 2009 ; Singh et al., 2009; Akanitapichat et al., 2010). However, like the phenolic compounds, the total amount of these phytochemical compounds varied according to variety, fruit shape and size, and even to the method of extraction (Medina et al., 2014). Moreover, antioxidant capacity and phenolic acid content in eggplant cultivars are positively correlated with each other (Okmen et al., 2009; Chumyum et al., 2013; Plazas et al., 2013).

Correlation between Total Antioxidant Activity and Total Phenolic Content, and Total Antioxidant Activity and Total Flavonoid Content

Phenolic and flavonoid molecules are important plant components that are responsible for deactivating free radicals based on their ability to donate hydrogen atoms. These molecules also have an ideal structural characteristic for free radical scavenging activity, which is the innate responsibility of antioxidants (Amarowicz et al., 2004). To further analyze the roles of phenolic and flavonoid compounds in the antioxidant activities of the studied *Solanum* species, correlation analysis was done.

Spearman correlation analysis was done to measure the degree of association between the total phenolic content (TPC) and antioxidant activity, and total flavonoid content (TFC) and antioxidant capacity of the seven

Solanum species. Figure 3a clearly displays a very strong, positive monotonic correlation between total antioxidant activity and TPC (rs=0.98; n=21; p< 0.0001). There was also a very strong, positive monotonic correlation between total antioxidant activity and TFC (rs=0.65; n=21; p<0.0023). It is worth noting that *S. americanum* and *S. melongena* which were observed to produce the highest amount of phenols and flavonoids were also the ones that showed the highest antioxidant capacity among the other studied species. On the other hand, S. capsicoides which was noticed to produce the least amount of phenols and flavonoids expressed a relatively low antioxidant capacity. Based on the results, the antioxidant capacity of the seven *Solanum* species was directly correlated to their total phenolic and flavonoid contents. This means that the antioxidant level of the studied *Solanum* species is a straight reflection of their phenolic and flavonoid contents. Previous studies in tart cherries (Wang et al., 1999) cranberry (Wang & Stretch, 2001), onion (Yang et al., 2004), guava (Kriengsak et al., 2006) and purslane (Aryal et al., 2019) have also demonstrated a strong association between their total phenolic content and antioxidant activities. Nevertheless, Shreshta and Dhillion (2006), Sharififar et al.(2009) and Abdulkadir et al. (2016) have also elaborated the involvement of flavonoids in the antioxidant activities of fruits, vegetables, herbs, and even medicinal plants.

The phytochemical activities of plants are unique to a particular plant species or group, consistent with the concept that the combination of secondary products in a particular plant is taxonomically distinct (Parekh et al., 2006).

CONCLUSION

The total phenolic and flavonoid contents as well as the total antioxidant capacity of *Solanum aethiopicum*, *S. americanum*, *S. capsicoides*, *S. diphyllum*, *S. mammosum*, *S. melongena* and *S. torvum* were successfully assessed. As observed, all studied *Solanum* species contained different amount of phytochemicals.

Among the seven *Solanum* species, *S. americanum* and *S. melongena* were noted to produce high amount of phenols (96.43 and 74.38 mg/GAE/g DW, respectively) and flavonoids (33.58 and 31.62 mgRUE/gDW, respectively). Eventually, these species were also detected to exhibit high

antioxidant capacity (8.61% and 6.85%, respectively). This particular finding was believed to be influenced by the presence of nasunin in their purple fruit peel. Variously, *S. diphyllum* and *S. capsicoides*, as recorded, produced the least amount of phenols (52.51 mg/GAE/g DW) and flavonoids (12.54 mgRUE/gDW), respectively. *S. diphyllum* and *S. capsicoides* also showed weak antioxidant capacity (3.72% and 3.67%, respectively) as far as radical scavenging activity was concerned.

The values reported in the study were for uncooked fruits of eggplant and its wild relatives. If these were used for dietary purposes, the effect of processing on the compounds investigated must be taken into consideration.

Generally, the antioxidant capacity of the seven *Solanum* species was detected to be correlated to their total phenolic and flavonoid contents. These findings are instrumental in the selection of putative parent materials to be used in the improvement of the antioxidant activity of eggplant through breeding.

It is recommended that other wild *Solanum* species, which is also reported to be present in the country, be included in the future phytochemical research endeavors.

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Table 1

List of the Solanum species used in the phytochemical analyses

SCIENTIFIC NAME	COLLECTION SITE	TYPE
S. aethiopicum L.	Brgy. Balindog, Kidapawan City	Wild
S. americanum Mill.	Los Baños, Laguna	Wild
S. capsicoides Allioni	Pasar, Leyte	Wild
S. diphyllum L.	Pob. Compostela, Compostela Valley	Wild
S. mammosum L.	Brgy. Katangawan, General Santos City	Wild
S. melongena L.	San Fernando, La Union	Landrace
S. torvum Sw.	Brgy. Binoligan, Kidapawan City	Wild

Figure 1. Fruits of a) *Solanum aethiopicum* L., b) *S. capsicoides Allioni*, c) *S. diphyllum* L., d) *S. mammosum* L., e) *S. melongena* L., f) *S. americanum* Mill. and g) *S. torvum* Sw.
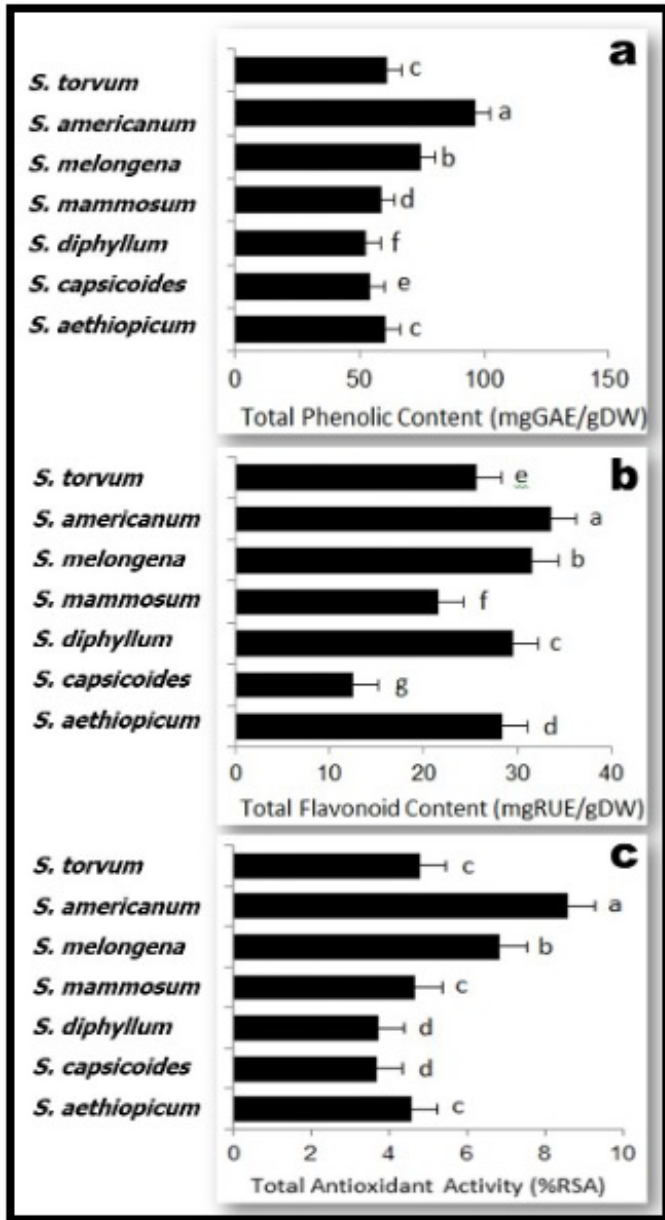
Figure 2. a) Total Phenolic Content b) Total Flavonoid Content and c) Total Antioxidant Activity of *Solanum aethiopicum* L., S. *americanum* Mill., *S. capsicoides Allioni*, *S. diphyllum* L., *S. mammosum* L., *S, melongena* L. and *S. torvum* Sw. (The values with error bars follow ed by different letters are statistically different at P< 0.0001).

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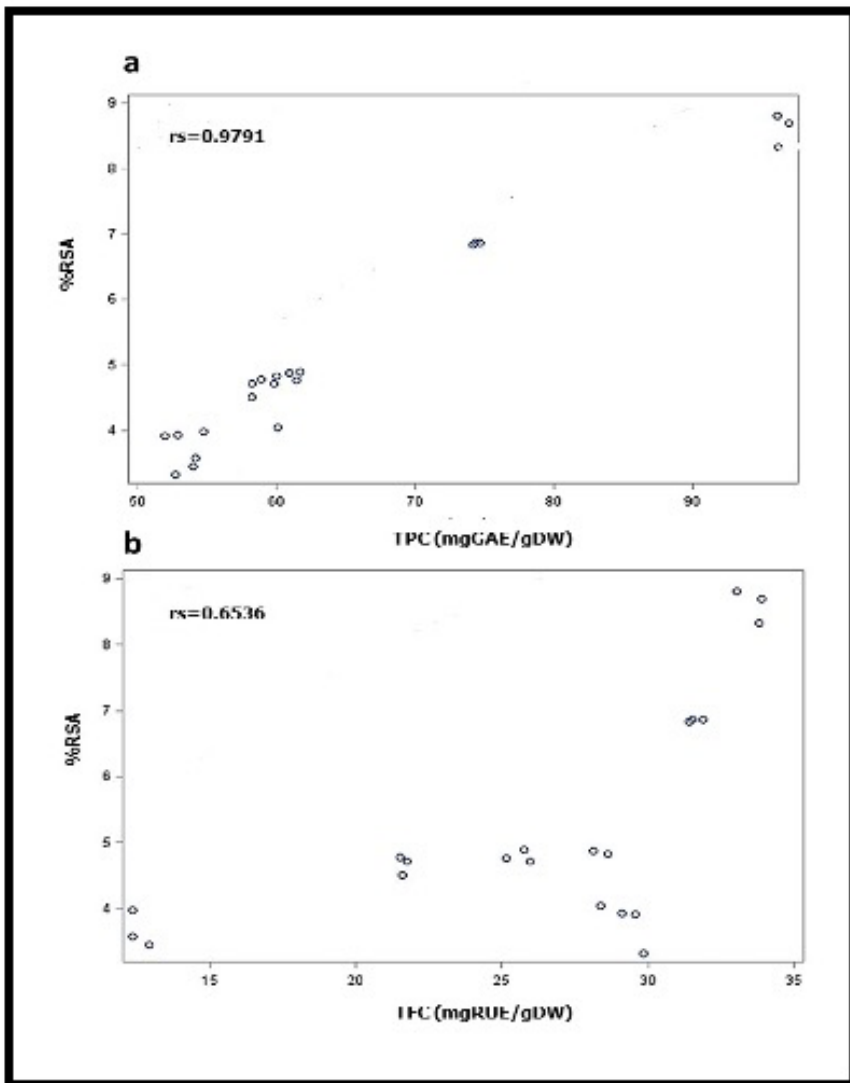
Figure 3. Correlation between (a) Total Antioxidant Activity (%RSA) and Total Phenolic Content (TPC) and, (b) Total Antioxidant Activity (%RSA) and Total Flavonoid Content (TFC) of *Solanum aethiopicum* L., *S. americanum* Mill., *S. capsicoides Allioni*, *S. diphyllum* L., *S. mammosum* L., *S, melongena* L. and *S. torvum* Sw.

Floristic Inventory and Distribution of Trees Along Urban National Streets and Roads in Cebu City, Philippines

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In urban landscapes, understanding the diversity of roadside vegetation is essential for better planning and designing of sustainable cities. The city of Cebu, located in central Visayas Philippines, is considered an urban tree biodiversity hotspot due to threats from continuous infrastructure development, road widening, and anthropogenic activities. To provide an update on tree diversity, as well as to determine the ecological status of the remaining trees thriving in Cebu City's urban corridors, a floristic inventory and tree distribution survey (i.e. five national streets /roads) were conducted. Following a standard protocol for urban tree inventory, a tree distribution map was created using GIS, and information on urban corridors' name, BDH of each tree, wire conflict, and tree condition were provided. Data showed 2,203 trees (45 genera and 27 families) were listed from these roadsides, with the proportion of alien trees higher (84.75%) than native trees (15.25%). Among these trees, 12.94% were in excellent tree condition, with narra (*Pterocarpus indicus*) and Manila palm (*Adonidia merrillii*) as the most abundant native tree, and mahogany (*S. macrophylla*) as the most exotic species. The distribution of trees by DBH classes along the five national roads showed that most trees belonged to the range of ≥ 70 cm, suggesting that mature trees dominated five urban corridors. In terms of tree protection and management, most trees in Cebu City were recommended for silvicultural treatment to salvage mother trees from further damage. Baseline data gathered in this study may serve as

guide for urban planners for a responsible and sustainable urban tree conservation and management.

Keywords: floristic inventory; urban trees; alien trees; native trees; Cebu City

INTRODUCTION

Cultivation and conservation of urban trees is a global initiative (Pearlmutter et al., 2017). All over the world, major cities acknowledge that they are at the forefront of battle against climate change – as the most vulnerable area to feel its impact, but with the highest potential to mitigate its effect. Recent call from the United Nations' Sustainable Development Goals [UN-SDG] Partnership Platform invites all mayors of major urban metropolis to undertake a "Trees in Cities Challenge," whereby pledges on planting specific number of trees are recorded under a defined monitoring scheme (UN-SDG, 2019). This program has been instrumental in helping cities to attain most of the sustainable development goals established by the United Nations (Turner-Skoff & Cavender, 2019), particularly SDG 11 focusing on sustainable cities and communities (UN, 2015). In the Philippines, similar initiatives have already been implemented across regional scales since the start of the National Greening Program in 2011. These initiatives encouraged communities to establish and manage arboretum of trees, including those in highly-urbanized areas (DENR-FMB, 2015).

Urban trees comprise the most essential component of urban greenspaces (Wolf et al., 2020) where they are commonly distributed across public domains (e.g. national highways, parks, recreation areas and riverbanks) (Konijnendijk et al., 2006) and private properties (e.g., schools, residential areas, gardens and industrial zones) (Tyrväinen et al., 2005). Aside from shrubs and underground vegetation, trees in cities provide an array of benefits and various forms of ecosystem services to make cities livable to humans and other life forms. While various species of trees ensure that watersheds can provide a steady supply of fresh water for domestic and industrial use, prevent flooding, and cool the air, they also provide socio-economic, psychological, visual, and sensory benefits as well as symbolic functions valued by humans (Dwyer et al.,1992; Good, 2010). Most importantly, they provide habitat for urban wildlife, thus ensuring a relatively diverse ecosystem (Roy et al., 2012). However, various

anthropogenic activities in major cities have been noted to cause decrease of tree covers (Ejares et al., 2016), and as tree cover deteriorates in cities, so will the availability and access to associated ecosystem services, thereby affecting environmental quality and human health. Thus, it is imperative that current tree diversity status in major Philippine cities be assessed to address this urgent concern.

Cebu City is one of the six congested and polluted cities in the Philippines. In 2010, 93.5% of Cebu City's total population lived in urban barangays, and these were localities where infrastructure development have increased rapidly in the last few years. Despite massive industrial developments, patches of tree vegetation still thrive in Cebu City where they are scattered among parks and recreation areas, building structures, street lanes and residential spaces (Flores et al., 2020). Cebu City is also home to an immense number of endemic trees that are considered indispensable for maintaining urban biodiversity (Cebu Biodiversity Conservation Programme [CBCP], 2017). As of 2014, trees in Cebu City were reported to cover an area of 15,674,341.8 m2, or 25.11% of the city's urban barangays, citing Brgy. Talamban (37.95%), Lahug (31.29%) and Guadalupe (25.70%) to have the three highest percentage of tree cover among the lowland barangays (Ejares et al., 2016). However, current knowledge on the diversity of trees in the city is scant, and previous studies on Cebu city trees focused only on carbon sequestration (Pansit, 2019; Parilla et al., 2018) and tree canopy mapping using LiDAR (Ejares et al., 2016).

There is a need to assess whatever remaining old-age trees flourishing in Cebu City because the greatest challenge now is to focus on managing urban ecosystems, which may include direct and indirect ecosystem services that urban dwellers can avail freely. Trees located along the urban corridors such as street roads and highways are an important component of urban greening because the combined area is much larger than the green spaces and formal parks alone (Shackleton, 2016). It has also been noted that trees in urban areas are rarely monitored, are disappearing at alarming rates, and are not documented sufficiently (Babalola et al., 2013). Except for the inventory of trees to be cut down for Bus Rapid Transit (BRT) and other road widening projects, few tree inventories have been undertaken in Cebu City to date. This study reports the current list of remaining trees on the selected urban corridors (national streets/roads) in Cebu City. A distribution map of each

tree located along the selected urban corridors was also produced to show how each tree in the selected urban corridors of Cebu City is distributed, highlighting its abundance, conservation status, and tree condition. Wire conflict, tree protection initiatives, and tree management were also discussed.

MATERIALS AND METHODS

Site Identification

The study was conducted in five selected urban corridors (national streets/roads) that were densely populated by trees based on the researchers' ranking of national streets/roads in Cebu City with their respective existing length: (1) N. Bacalso Avenue: 2.472 km - (10.288838 and 123.866707 E), (2) Cebu South Road (C. Padilla-Bulacao) : 2.550 km - (10.279706 N and 123.855548 E), (3) Osmeña Boulevard: 2.035 km - (10.304312 N and 123.895168 E), (4) Rama V. Street: 3.050 km - (10.312346 N and 123.886167 E), and (5) Salinas Drive: 0.896 km - (10.312346 N and 123.886167 E).
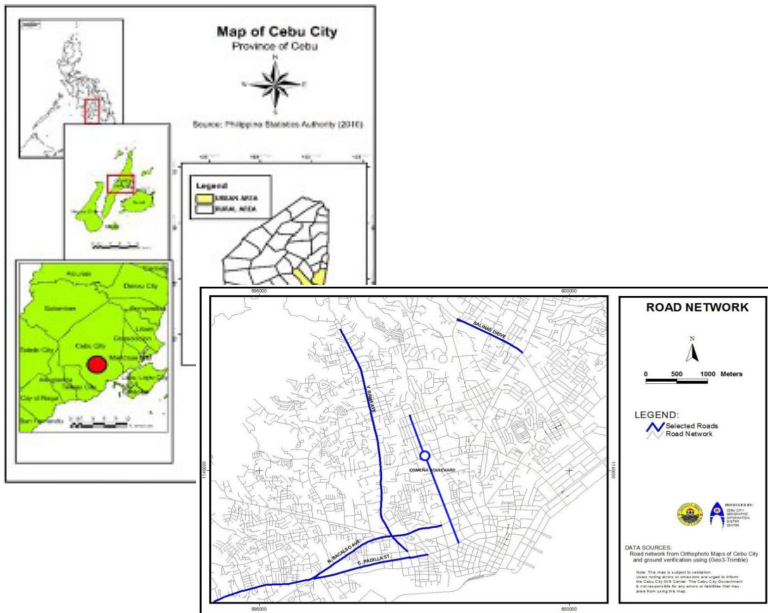
Figure 1. Map of Cebu City (first box figure) and map of the selected national streets/roads, namely: (1) N. Bacalso Avenue, (2) Cebu South Road (C. Padilla-Bulacao), (3) Osmeña Boulevard, (4) Rama V. Street and (5) Salinas Drive

Data Collection and Analysis

The method for roadside tree inventory and tree risk assessment was based on the study of Sreetheran et al. (2011). The inventory was conducted from October 2018 to April 2019, following a descriptive survey design. Roadside trees were selected through purposive sampling, making sure that both sapling and mature trees were included in the inventory. Mapping of tree distribution was produced by using the handheld GPS, where the coordinates were inputted to a GIS-based software (Manifold System).

Data were collected as follows. Once a tree is encountered along the selected urban corridor, the following information were noted: GPS coordinates, local name/common name, diameter at breast height, wire conflict (e.g., presence and absence of overhead utility wires), characteristic vegetation and tree condition. Characteristic vegetation may either belong to (a) residential gardens, (b) grassland, (c) scrubland, (d) plaza/park area, or (e) near buildings such as schools, business edifices, residential houses, and churches. Meanwhile, tree condition was derived from a general observation from ground level up, and was rated either as excellent, good, fair, poor or very poor, following the criteria of Sreetheran et al. (2011). 'Excellent' trees are characterized by sound and solid tree structure and composition, absence of pests, and full and balanced crown development. 'Good' and 'Fair' trees, however, can be distinguished, by their missing bark sections one major/several dead, broken, or missing minor limbs, in terms of tree structure; presence of one or more pests, in terms of tree condition; and full but unbalanced crown development. 'Poor' and 'Very Poor' trees can be recognized by either an extensive decay or hollowness in terms of tree condition; two or more dead, broken, or missing major limbs, in terms of tree structure; presence of two or more pests; and full but unbalanced crown development. The conservation status of each tree species was determined based on International Union for the Conservation of Nature (IUCN) guidelines ("The IUCN Red," 2021) .

Taxonomic identification of trees was done by utilizing primary reference materials for native trees, namely, Philippine Native Trees: Up Close and Personal Series 101, 202 and 303 published by Green Convergence for Safe Food Healthy Environment and Sustainable and Hortica Filipina Foundation, Inc. Philippines. Verification of exotic trees' ID was done using

Plants of the World Online (POWO), an online database maintained by the Royal Botanic Gardens, Kew, Richmond, UK as well as Co's Digital Flora of the Philippines. Photos of each tree encountered were also taken, including the most essential parts such as leaves, trunk, whole stature of trees, flowers and fruits, if present. Initial identification suggested by parataxonomists and gardeners were also noted, especially for those trees that were not recognize on the spot. Data were collated, cleaned, and analyzed using descriptive statistics, such as means and frequency function of MS Excel.

RESULTS AND DISCUSSION

Tree Composition

A total of 2,203 trees with 50 species under 45 genera from 27 families were encountered in the five selected national roads in Cebu City (see Table 1). Natalio Bacalso National Road had the highest number of trees (654 trees) followed by Cebu South Road (591 trees), Osmeña Boulevard (583 trees), Vicente Rama national road (315 trees) and Salinas Drive (131 trees) (see Figure 2). N. Bacalso had the most diverse tree composition with 35 genera (Fig.3), and this is reflected in the distribution pattern observed in the data of N. Bacalso Road (see Figure.4). Considering that Vicente Rama national road was the longest site in the study, the data may suggest that the length of a national road/street is not directly proportional to the diversity and number of trees planted.

Table 1
List of Urban Trees (Family, Species and Local Name), Abundance, Conservation Status and Origin in Five Selected National Roadside/s or Road/s in Cebu City, Philippines

Family	Species	Local Name	Abundance	IUCN Status*	Origin	Location/s
Anacardiaceae	*Mangifera indica* L.	Manga	5	DD	Native	Cebu South Road, N. Bacalso, Osmeña Blvd, and V. Rama
Annonaceae	*Annona squamosa* L.	Atis	11	LC	Alien	Cebu South Road, N. Bacalso, Osmeña Blvd, and V. Rama

	Annona muricata L.	Guyabano	11	LC	Alien	Cebu South Road, N. Bacalso, Osmeña Blvd, and V. Rama
	Polyalthia longifolia Benth. & Hook.	Indian mast pine tree	34	NE	Alien	All selected national roads
Apocynaceae	*Alstonia scholaris* L.	Dita	1	LC	Native	Osmeña Blvd.
	Cascabela thevetia L.	Yellow oleander	4	LC	Alien	Cebu South Road and N. Bacalso
	Plumeria rubra L.	Kalachuchi	7	NE	Alien	Cebu South Road, N. Bacalso, Osmeña Blvd. and V. Rama
Arecaceae	*Adonidia merrillii* Becc.	Manila plam	117	NT	Native	All selected national roads
	Wodyetia bifurcata A.K. Irvine	Foxtail palm	11	LC	Alien	Cebu South Road and N. Bacalso
	Arenga pinnata (Wurmb.) Merr.	Kaong	1	LC	Native	V. Rama
	Cocos nucifera L.	Coconut tree	2	NE	Alien	Osmeña Blvd.
	Corypha utan Lam.	Buri	1	LC	Native	N. Bacalso
	Roystonea regia (Kunth) O.F. Cook	Royal plam	13	NE	Alien	Salinas Drive
Asparagaceae	*Cordyline australis* (G. Forst.) Endl.	New zealand cabbage tree	2	NE	Alien	N. Bacalso
Bixaceae	*Bixa orellana* L.	Achuete	2	LC	Alien	V. Rama
Caricaceae	*Carica papaya* L.	Papaya	6	DD	Alien	Cebu South Road, N. Bacalso and Osmeña Blvd
Casuarinaceae	*Casuarina equisetifolia* L.	Agoho	3	LC	Native	Cebu South Road, N.Bacalso and Osmeña Blvd.
Combretaceae	*Terminalia catappa* L.	Talisay	7	LC	Native	N. Bacalso and Osmeña Blvd.
Cycadaceae	*Cycas rumphii* Miq.	Pitogo	1	NE	Native	N. Bacalso
Dipterocarpaceae	*Hopea plagata* (Blanco) S.Vidal	Yakal	1	CR	Native	N. Bacalso
Euphorbiaceae	*Macaranga grandifolia* (Blanco) Merr.	Binuñgang malapad	1	VU	Alien	Cebu South Road
	Melanolepis multiglandulosa (Reinw. Ex Blume) Rchb. & Zoll.	Alim	5	LC	Native	N. Bacalso, Salinas Drive and V. Rama

Fabaceae	*Acacia propinqua* A. Rich	Acacia	2	NE	Alien	Osmeña Blvd and Salinas Drive
	Caesalpinia decapetala (Roth) Alston	Mysore thorn	4	LC	Alien	Cebu South Road and N. Bacalso
	Leucaena leucocephala (Lam.) de Wit	Ipil-ipil	7	CD	Native	N. Bacalso, Cebu South Road, Salinas Drive and V. Rama
	Tamarindus indica L.	Sambag	7	LC	Alien	Cebu South Road, N. Bacalso, and Osmeña Blvd.
Lamiaceae	*Gmelina arborea* Roxb. ex Sm.	Gmelina	31	LC	Alien	All selected national roads
	Premna odorata Blanco	Abgaw	1	LC	Native	N. Bacalso
	Vitex parviflora A. Juss.	Tugas	5	LC	Native	N. Bacalso
Lauraceae	*Persea americana* Mill.	Avocado	1	LC	Alien	V. Rama
Leguminosae	*Pterocarpus indicus* Willd.	Narra	1704	EN	Native	All selected national roads
Malvaceae	*Ceiba pentandra* (L.) Gaertn.	Duldul	4	LC	Alien	Cebu South Road and N. Bacalso
Meliaceae	*Azadirachta indica* A. Juss.	Neem tree	5	LC	Alien	Cebu South Road and V. Rama
	Swietenia macrophylla King	Mahogany	90	VU	Alien	Cebu South Road, Osmeña Blvd, N. Bacalso and Salinas Drive
Moraceae	*Artocarpus heterophyllus* Lam.	Nangka	10	NE	Alien	Cebu South Road, Osmeña Blvd and N. Bacalso
	Ficus septica Burm.f.	Lagnob	45	LC	Native	V. Rama, Cebu South Road and Osmeña Blvd
	Ficus benjamina L.	Dakit	45	LC	Alien	V. Rama, Cebu South Road, N. Bacalso and Osmeña Blvd
	Ficus religiosa L.	Sacred fig tree	45	NE	Alien	V. Rama, Cebu South Road, N. Bacalso and Osmeña Blvd
	Morus rubra L.	Wild berry/ red berry	1	LC	Alien	N. Bacalso
Moringaceae	*Moringa oleifera* Lam.	Malunggay	4	NE	Alien	Cebu south Road and N. Bacalso

Muntingiaceae	*Muntingia calabura* L.	Mansanitas	4	NE	Alien	N. Bacalso, Cebu South Road and Osmeña Blvd.
Myrtaceae	*Psidium guajava* L.	Bayabas	4	LC	Alien	N. Bacalso and Cebu South Road
	Syzygium cumini (L.) Skeels	Lomboy	16	LC	Alien	Cebu South Road, N. Bacalso, Osmeña Blvd and V. Rama
	Syzygium aqueum (Burm.f.) Alston	Tambis	16	NE	Alien	Cebu South Road, N. Bacalso and V. Rama
Oxalidaceae	*Averrhoa bilimbi* L.	Iba	5	NE	Alien	Cebu South Road, N. Bacalso and V. Rama
Rhizophoraceae	*Carallia brachiata* (Lour.) Merr.	False kelat	2	NE	Alien	Cebu south Road and N. Bacalso
Rubiaceae	*Morinda citrifolia* L.	Noni tree	1	NE	Native	V. Rama
Sapotaceae	*Chrysophyllum cainito* L.	Kaimito	5	NE	Alien	Osmeña Blvd.
	Manilkara zapota (L.) P. Royen	Chicos	5	NE	Alien	V. Rama, Cebu South Road and N. Bacalso
Strelitziaceae	*Ravenala madagascariensis* Sonn.	Traveler's palm	1	NE	Alien	Osmeña Blvd

Legend: *NE- Not evaluated, DD-Data deficient, LC-Least concerned, NT- Near threatened, VU-Vulnerable, EN-Endangered, CR-Critically endangered, EW- Extinct in the wild, CD-conservation dependent ("The IUCN Red List," 2021). The conservation dependent category is part of the IUCN 1994 Categories & Criteria (version 2.3), which is no longer used in evaluation of taxa, but persists in the IUCN Red List for taxa evaluated prior to 2001, when version 3.1 was first used. Using the 2001 (v3.1) system these taxa are classified as near threatened, but those that have not been re-evaluated remain with the "conservation dependent" category (IUCN, 2016).

The current study also found that about 77.3% of the street trees belonged to the Leguminosae family (see Table 2). It is also evident in the distribution map that trees belonging to this family were widely distributed among the five selected national roads (see Figure 6). Trees from this family are hardier and more resilient to harsh roadside environment and possess the ability to fix nitrogen (N2) into usable forms (nitrate) (Tyrväinen, 2001; Sreetheran et al., 2011). This species is followed by family *Arecaceae*, which had been planted widely in the city because of its exotic appearance and fast development, with a spectacular display of flowers after a dry spell. These trees are well known for their great heights, exclusive foliage, conspicuous inflorescences, and big seeds (Nowak et. al., 2015).

The frequencies of individual tree genus (see Table 3) showed an

overwhelming dominance of four main genus *Pterocarpus* (77.35%), *Adonidia* (5.39%), *Swietenia* (4.09%), and *Ficus* (2.04%), which constituted about 88.87% of the total tree population. *Pterocarpus*, a deciduous native tree in the Philippines, is the most abundant and is known for its hardiness, rapid growth, and pest resistance. This tree is commonly found all over the Philippines and is known to provide good quality of wood and shade. Its roots are fibrous that help keep the soil intact and prevent landslides caused by flood or even earthquakes (Sanders, 1981). Aside from its inherent abilities, *Pterocarpus* species such as *P. indicus* (narra), as it is locally known, are recognized for its aesthetic values as it blooms with yellow flowers that cover the tree's entire crown foliage and produce a good smelling fragrance. For quite a long time, this tree has been a preferred choice as urban tree among foresters for its array of benefits. The Head of the Parks and Playground Commission in Cebu City noted that "narra has been mostly planted here in Cebu as early as Spanish colonization, and these trees were used as the main material for constructing boats during the time" (L. Macaraya, personal communication, April 12, 2019). The dominance of narra as a heritage street tree was observed in Thailand, sharing 42% of the total street tree population in Bangkok (Thaiutsa et al., 2008) as well as in Yogyakarta, Indonesia, where it is commonly used as a shading tree in most main roads of the city (Syahbudin et al., 2018).

Meanwhile, Adonidia species like *Adonidia merrillii*, locally known as Manila palm, are commonly planted along the streets for its aesthetic value due to its splendid structure and colorful fruits that are edible to some birds. Since these trees are native to the Philippines, they enrich local biodiversity, thus benefitting other organisms in terms of food and habitat. Recent publications have claimed that Manila palm is native to Palawan (i.e., grows on karst limestone cliff) and neighboring islands in the Philippines, as well as to the coast of Sabah, Malaysia (Dransfield et al., 2008). The use of Manila palm as a popular ornamental plant along roadside, parks and gardens in the Philippines is due to its adaptability to tropical climate, favoring sunny areas under a well-drained, fertile soil. Recently, it has been used extensively for landscaping and interior design in shopping malls and atria (Lim, 2012).
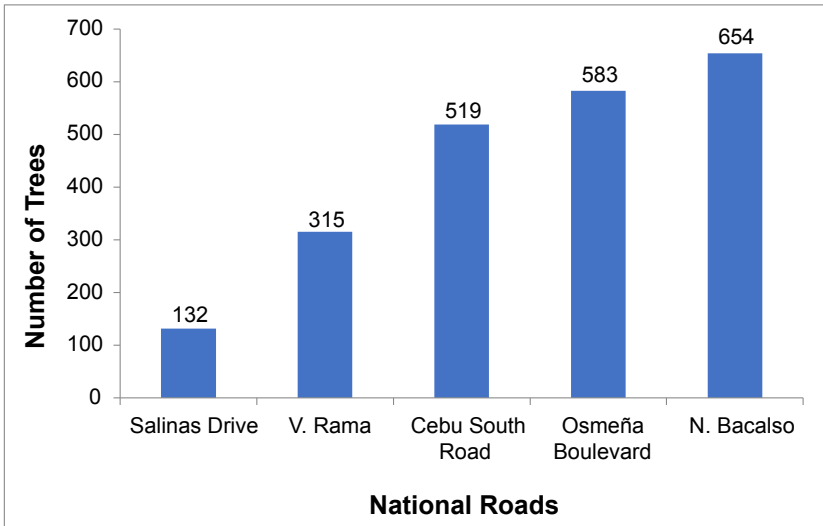
Figure 2. Number of trees encountered in each selected national road

Genus *Swietenia* coexisted with the native trees along the national roads due to its unintentional introduction to our indigenous flora (see Table 1 and Table 3). The species that belongs to this genus include *Swietenia macrophylla*, locally known as mahogany which is easily distinguishable due to its wide range of seed dispersal. Wind easily spreads the seeds of these trees because the seeds of *S. macrophylla* is samara (has a wing like structure). Previous studies on Cebu's urban trees reported that mahogany, being dominant in the city (Flores et al., 2020), had a potential use for carbon sequestration (Parilla et al., 2018; Pansit, 2019). Similar findings were reported by Nagendra and Gopal (2010) where mahogany was also one of the ten most commonly planted street trees in Bangalore, India. The same paper also highlighted that since mahogany was considered medium-sized tree with large canopies, it was more suitable to be planted among narrow roads with minimal sidewalk space. In Indonesia, mahogany trees were also favored in huge urban centers, considering that its cooling effect could effectively mitigate urban heat island (i.e. an urban area that is significantly warmer than its surroundings due to anthropogenic activities) (Ihsan & Rosleine, 2020).

The fourth dominant genus among the selected national roads was Ficus. It is composed of relatively common species namely, *F. septica* (local name: lagnob, a native tree), *F. benjamina* (local name: dakit/balete, an alien

tree), and *F. reliogiosa* (local name/ common English name: sacred fig tree, an alien tree) which were easily determined by the researchers based on the morphology of their leaves, trunks, flowers, fruits, and bark texture (see Table 1). Sacred fig trees were observed in four national roads due to their versatile plant habit. When young, the fig tree is an epiphytic, climbing plant that attacks tree species, walls, and sidewalk strips. When it reaches maturity, it develops into a huge tree. Despite the detrimental effect of *Ficus* spp. As an invasive plant in urban landscapes (Corlett, 2006), its leaves can capture heavy metal particles from atmospheric dusts in urban areas (F. benjamina, Reyes et al., 2012). Most importantly, a majority of its species are essential tropical frugivores (Shanahan et al., 2001) and are hence labeled as "keystone resource" in tropical forests and urban landscapes (Corlett, 2006).
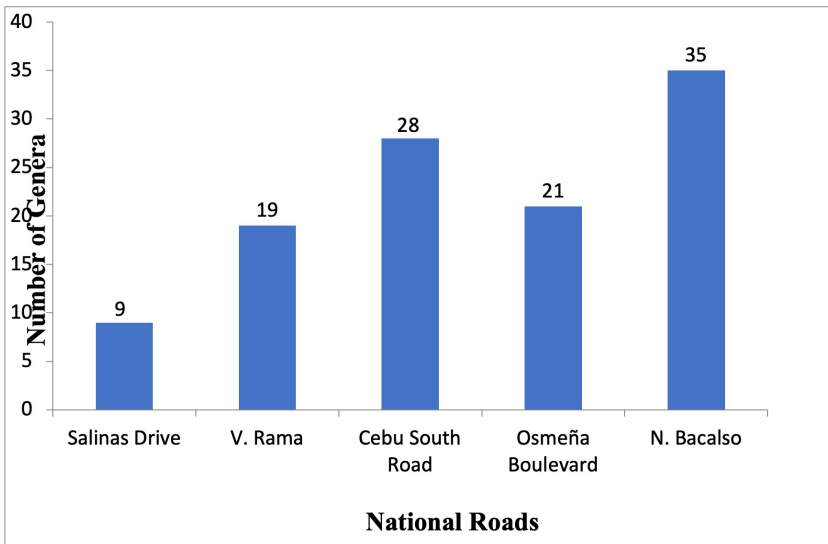
Figure 3. Number of tree genera identified in each selected national road

Table 2

Frequency of Individual Tree Family Found in Selected Urban Roadsides/ Roads in Cebu City, Philippines

No.	PLANT FAMILY	FREQUENCY	%
1	Strelitziaceae	1	0.05
2	Lauraceae	1	0.05
3	Rubiaceae	1	0.05
4	Cycadaceae	1	0.05

5	Dipterocarpaceae	1	0.05
6	Bixaceae	2	0.09
7	Asparagaceae	2	0.09
8	Rhizophoraceae	2	0.09
9	Casuarinaceae	3	0.14
10	Muntingiaceae	4	0.18
11	Malvaceae	4	0.18
12	Moringaceae	4	0.18
13	Anacardiaceae	5	0.23
14	Oxalidaceae	5	0.23
15	Caricaceae	6	0.27
16	Euphorbiaceae	6	0.27
17	Combretaceae	8	0.36
18	Sapotaceae	10	0.45
19	Apocynaceae	12	0.54
20	Fabaceae	20	0.91
21	Myrtaceae	20	0.91
22	Lamiaceae	37	1.68
23	Annonaceae	45	2.04
24	Moraceae	56	2.54
25	Meliaceae	95	4.31
26	Arecaceae	149	6.76
27	Leguminosae	1,703	77.3

Table 3

Frequency of individual tree genus found in selected urban roadsides/ roads in Cebu City, Philippines

No.	PLANT GENUS	FREQUENCY	%	ORIGIN
1	Alstonia	1	0.05	Native
2	Ravenala	1	0.05	Native
3	Arenga	1	0.05	Alien
4	Morinda	1	0.05	Native
5	Persea	1	0.05	Alien
6	Corypha	1	0.05	Native
7	Cycas	1	0.05	Native
8	Hopea	1	0.05	Native
9	Morus	1	0.05	Alien

10	Premna	1	0.05	Native
11	Macaranga	1	0.05	Alien
12	Acacia	2	0.09	Alien
13	Cocos	2	0.09	Alien
14	Bixa	2	0.09	Alien
15	Carallia	2	0.09	Alien
16	Cordyline	2	0.09	Alien
17	Casuarina	3	0.14	Native
18	Caesalpinia	4	0.18	Alien
19	Cascabela	4	0.18	Alien
20	Ceiba	4	0.18	Alien
21	Moringa	4	0.18	Native
22	Muntingia	4	0.18	Alien
23	Psidium	4	0.18	Alien
24	Areca	4	0.18	Native
25	Chrysophyllum	5	0.23	Alien
26	Mangifera	5	0.23	Native
27	Averrhoa	5	0.23	Alien
28	Azadirachta	5	0.23	Alien
29	Manilkara	5	0.23	Alien
30	Melanolepis	5	0.23	Native
31	Vitex	5	0.23	Native
32	Carica	6	0.27	Alien
33	Plumeria	7	0.32	Alien
34	Tamarindus	7	0.32	Alien
35	Terminalia	7	0.32	Native
36	Leucaena	7	0.32	Alien
37	Artocarpus	10	0.45	Alien
38	Annona	11	0.5	Alien
39	Wodyetia	11	0.5	Alien
40	Roystonea	13	0.59	Alien
41	Syzygium	16	0.73	Alien
42	Gmelina	31	1.41	Alien
43	Polyalthia	34	1.54	Alien
44	Ficus	45	2.04	Alien
45	Swietenia	90	4.09	Alien
46	Adonidia	117	5.39	Native

| 47 | Pterocarpus | 1,704 | 77.35 | Native |
| TOTAL | | 2,203 | 100 | |

Tree Condition

During the inventory, the researchers observed the urban trees' trunk condition, structure, presence and absence of insects and disease, and crown development. All of these characteristics served as bases for categorizing them according to a specific tree condition (i.e., excellent, good, fair, poor and very poor). These arboricultural tree condition ratings are commonly used to determine the overall health status of planted trees in urban landscapes (Roman et al., 2013). Overall, 12.94%, 34.18%, 52.38%, 0.41% and 0.09% of trees were in excellent, good, fair, poor, and very poor conditions, respectively (see Table 4). Data also show that the five selected urban corridors contained trees that were mostly in excellent, good, and fair conditions. However, N. Bacalso had a number of trees in poor condition (i.e., 52 trees), and this may imply that these trees were given less attention by the city management due to its distant location from the city.

Table 4

Number of Trees under Each Condition Class Surveyed in Selected Urban Roadsides of Cebu City, Philippines

Condition Class	Osmeña Boulevard	V. Rama Street	Cebu South Road	N. Bacalso Street	Salinas Drive	Total
Excellent	111	26	57	78	13	285
Good	217	55	175	238	68	753
Fair	255	229	284	335	51	1 154
Poor	0	5	2	52	0	9
Very Poor	0	0	1	1	0	2
Total	583	315	519	654	132	2 203

In this study, it was found that trees under excellent condition were vigorous and completely clear (i.e., free of any signs of pest or insect infestations and symptoms of disease, defects or cavities). Crown development was full and balanced. Trees that were in good condition had minor structural defects especially on trunks and branches in which peripheral parts were damaged by

parasites or from the previous pruning. Some defective parts of the tree had a 10% lack in natural symmetry. Leaf development became deficient and other observable pest issues and damage on other parts could be observed. Trees under fair condition revealed a moderate branch dieback. Shoot elongation showed stressed growing conditions, and obvious pest problems could be observed, and these contributed to the trees' 30% crown decline and low life expectancy. Evidence of surface root and trunk damage with decay was present, and lack of full crown development contributed to the scoring system.

Trees under poor condition indicated major damage in all parts of the tree. Trunk structure had a major defect, and 50% of the trunk had been missing. The formation of branches that were structurally important were broken and dead, and had poor attachments. Overall, the apparent stress of the tree could be observed in its stature. There were severe infestations by insects, and disease and human intervention caused the major decay and hollow sections of the tree. This condition suggests that the life expectancy of the tree was low. Trees under very poor condition were found to have an extensive damage in the whole tree structure, indicated by 75% structural defects that can make a trees' health become weaker and put an end to its existence.

In other countries, researchers found that more urban trees were rated as having poor conditions when cultivated in the warmest areas of the city (i.e., with more impervious cover) (Dale & Frank, 2014). Impervious pavements and compacted soil surfaces reduces the access of trees to fertile soil, thus increasing their level of stress due to drought, temperature changes, and herbivory (Meineke et al., 2016; Just et al., 2019). Related studies have also suggested that regardless of latitude where the city was located, herbivore abundance increased as urbanization also increased (Koslov et al., 2017). Moreover, one of the best approaches to keep urban trees in good condition is to reduce these impervious surfaces and provide more access to fertile soil (Just et al., 2019).

Tree Structure

The distribution of trees according to diameter at breast height (DBH) classes in the five national roads shows that most trees belonged to a range of 90 to 110 cm DBH, suggesting that the five urban corridors were dominated by mature trees (see Figure 4). Mature trees' diameter ranged from 70 cm and

above (Sreetheran et al., 2011). In Figure 5, the highest mean tree diameter belonged to the genus Acacia followed by genus Gmelina, Cordyline, Hopea, and Mangifera. These trees' diameter measured >70 cm, and in the inventory, the population of these trees did not exceed 5% (see Figure 4 and Figure 5). Although there were only two large Acacia trees found in all the five sampling sites, the canopy size of these trees were remarkable and dominant.
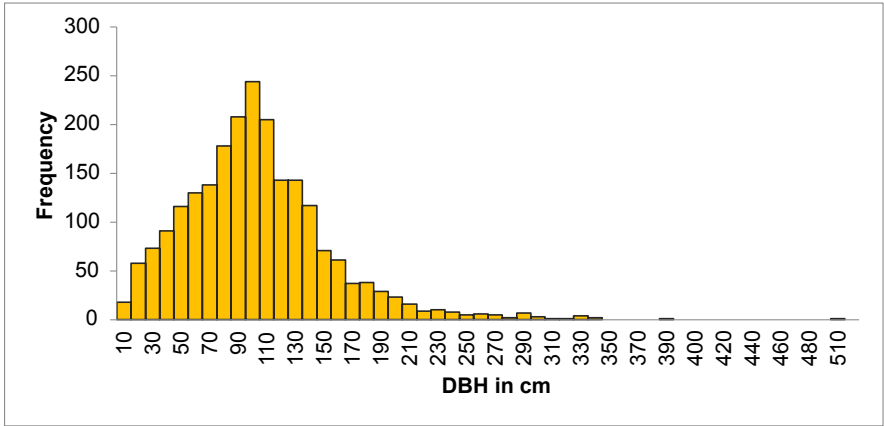
Figure 4. Distribution of DBH Classes of Trees Being Surveyed in the Five Urban Street Corridors
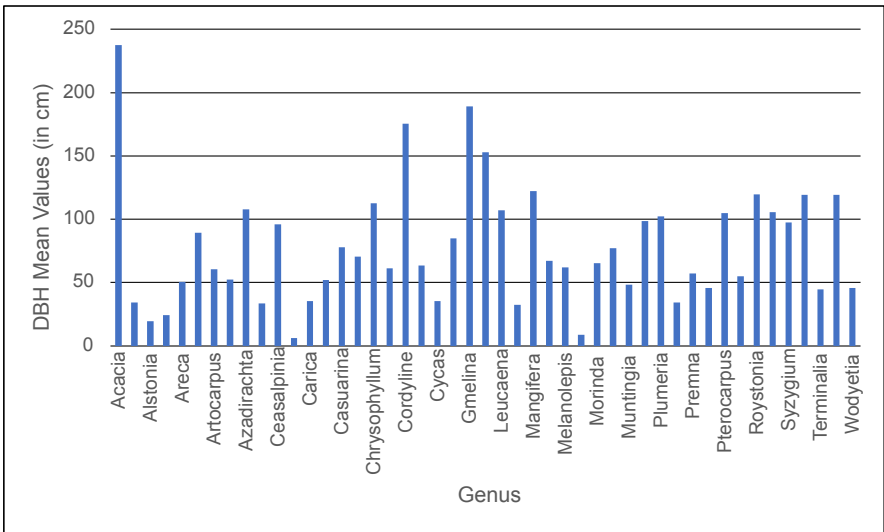
Figure 5. Distribution of DBH Mean Values by Genus of the Street Trees Distributed in Five Urban Street Corridors

Table 5 shows the tabulated mean diameter and relative standard deviation of the trees grouped according to the national roads where they were located. The results show that among the five selected national roads, trees on Salinas National Road had the highest mean tree diameter. Salinas National Road was dominated by genus Swietenia that comprised 44% of the total tree population in the area. This was followed by Osmeña Boulevard which was dominated by genus Pterocarpus, constituting 85% of the total tree population in the area. Natalio Bacalso national road ranked third as most of the trees encountered during the inventory had <70 cm diameter. Moreover, this road had the highest tree population. It can also be observed in the data that most trees on the urban corridors with high mean tree diameter were old or fully mature, while most trees on N. Bacalso street and Cebu South Road were replacements of the old ones, and thus registered lower tree diameters. Compared to Osmeña Boulevard which was developed during the American period, N. Bacalso and Cebu South Road were developed more recently (early 1980s). Moreover, aside from being selected as a tree of choice for urban sidewalk tree planting, *P. indicus* (narra) had actually been recorded even during the pre-American occupation (1886) as existing in the central part of Cebu Island, together with molave which was the most dominant tree species at the time (Abella, 1886, as cited by Seidenschwarz, 1988).

Table 5

Mean Tree Diameter Tabulated by Road

National Road/Street	Mean tree diameter (in cm) ± RSD
Osmeña Boulevard	101.57 ± 66.4
Salinas	114.06 ± 41.1
V. Rama	94.59 ± 43.6
N. Bacalso	96.18 ± 46.7
Cebu South Road	95.92 ± 44.3

The importance of measuring tree diameter using standardized biometrics cannot be overemphasized because the social, economic, and ecological valuation of trees depends on this measurement. Diameter at breast height (DBH) is a core element of forest trees surveys because of its convenience and simplicity of use (Maragik et al., 2020). Previous studies

utilized DBH for a variety of purposes, such as defining trees (Beech et al., 2017), quantifying ecosystem services (McHale et al., 2009), measuring radial stem growth (Evans et al., 2015), estimating biomass and carbon (Chave et al., 2005), and estimating standing volumes of timber (Oderwald & Johnson, 2009).

Ecological Status

There were about 1,867 native trees which were mostly *Pterocarpus* and *Adonidia*. The rest were 336 alien trees which were mostly *Swietenia* and *Ficus*. However, alien trees were represented in more genera (31 genera) compared to native trees (16 genera) (see Table 3). A graphical representation in Figure 6 shows the ecological status composition of each tree along the national roads. It can be observed that except for Salinas Drive, all four other urban roadsides registered a higher number of native species, with N. Bacalso having the highest number of native tree species (549 individuals) planted. Photographs of native and alien trees are shown in Figure 7 and Figure 8, respectively.

Trees surveyed were located 2.62 m to 3 m from the road's white strip indicating pedestrian boundaries from the road. All these trees were located along the national roads with a code E characteristic vegetation (i.e., all trees surveyed were found along the roadsides, near buildings or infrastructures in general). In these five selected urban corridors, trees were either planted on elevated concrete plant boxes/plots or on designated plots surrounded with cement on the roadsides. The area of the tree plots were not collected, but it can be observed that in these areas, weeds which were ephemeral were growing along with the trees. Traces of animal litters and human garbage (single-used plastics) were also evident in trees along the urban corridors.

Presently, there are approximately 3,600 native trees found in the Philippines, 67% of which are country endemic (Green Convergence & Horta Filipina Foundation, Inc., 2012). However, majority of floristics conducted in Cebu were based on forest inventories, typically Key Biodiversity Areas (KBAs). Previous survey shows that *Ficus* spp. was the most abundant in both Cantipla and Tabunan forest (Cadiz & Buot, 2010). While there are records from upland barangays of Cebu City on native tree diversity, there is still a dearth of published information on native trees in the highly urbanized portion of Cebu City.
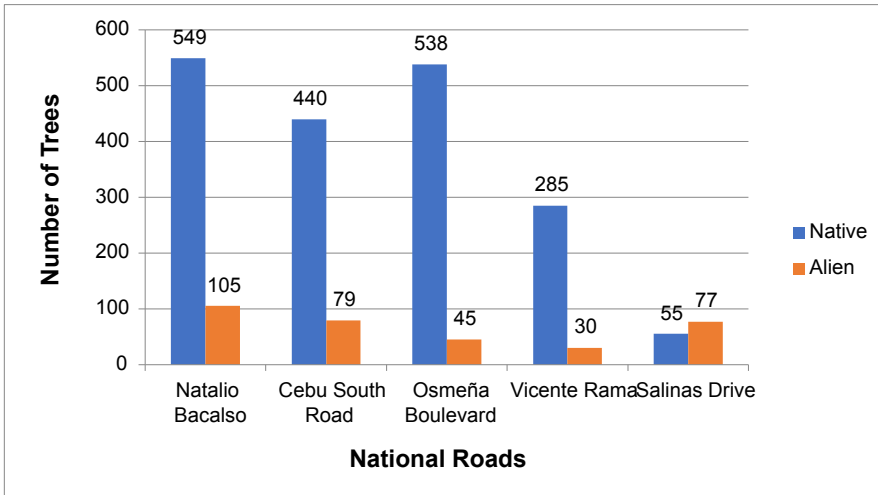
Figure 6. Ecological status of trees in urban roadsides/roads
of Cebu City, Philippines

Wire Conflicts, Tree Protection, and Management

Wire conflicts have been frequent concerns of urban communities most especially during calamities (Clatterback & Simpson, 1914). In many areas in Cebu City, electrical wirings are also considered a primary threat to tree growth and development. In this research, Figure 9 shows that national roads, such as N. Bacalso, Cebu South Road, Osmeña Boulevard, and Vicente Rama, had serious wire conflicts, exposing the trees to many anthropogenic activities such as pruning, removing of the tree crown, and getting rid of some parts so that electrical wirings can be installed. During the conduct of the study, the researchers were informed that the city management office conducted scheduled pruning for the trees located along the urban corridors for the safety of the public. Electric companies' perspective concurred with the idea of pruning but in a risky manner because they wanted to cut only those branches that might affect the wirings (i.e., branches that found at the center crown of the tree). In urban areas where trees can cause serious conflicts, many anthropogenic activities are progressing that can compromise urban vegetation. For instance, improper pruning of trees has resulted in serious injuries, and cutting down trees are often disregarded by most households, especially if those trees are outside of their property. However, such practices are deleterious to the trees themselves because removing their crown makes

them more susceptible to any diseases and termites which might feed on them (Most & Weissman, 2012).

Figure 7. Photographs of native trees encountered along the five (5) urban roadsides of Cebu City presented in duplicate (close up photo & photo taken from a distance)

1: *Vitex parviflora* A. Juss. (Tugas), 2: *Terminalia catappa* L. (Talisay), 3: *Pterocarpus indicus* Willd. (Narra), 4: *Melanolepis multiglandulosa* (Reinw. ex Blume) Rchb. & Zoll. (Alim), 5: *Mangifera indica* L. (Manga), 6: *Leucaena leucocephala* (Lam.) de Wit. (Ipil-ipil), 7: *Hopea plagata* (Blanco) S. Vidal (Yakal), 8: *Corypha utan* Lam. (Buri), 9: *Casuarina equisetifolia* L. (Agoho), 10: *Arenga pinnata* (Wurmb) Merr. (Kaong), 11: *Alstonia scholaris* L. (Dita), and 12: *Adonidia merrillii* Becc. (Manila Palm).

Figure 8. Photographs of alien trees encountered along the five (5) urban
roadsides of Cebu City presented in duplicate (close up photo & photo taken
from a distance)

1: *Annona squamosa* L. (Atis), 2: *Annona muricata* L. (Guyabano), 3: *Artocarpus
heterophyllus* Lam. (Nangka), 4: *Averrhoa bilimbi* L. (Iba), 5: *Azadirachta indica*
A. Juss. (Neem tree), 6: *Carallia brachiata* (Lour.) Merr. (False Kelat), 7: *Carica
papaya* L. (Papaya), 8: *Cascabela thevetia* L. (Yellow Oleander), 9: *Caesalpinia
decapetala* (Roth) Alston (Mysore Thorn), 10: *Chrysophyllum cainito* L. (Caimito),
and 11: *Cocos nucifera* L. (Coconut Tree).
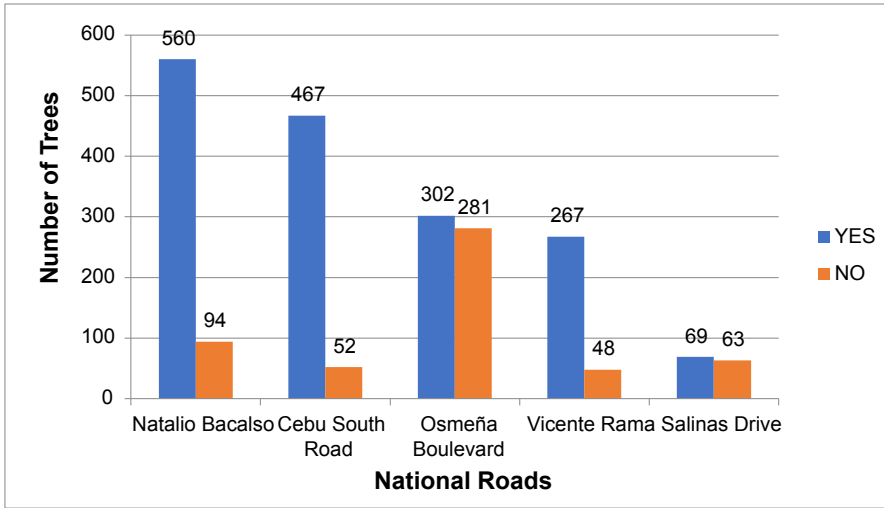
Figure 9. Number of trees that needs recommended pruning
or reorganization of electrical wirings

Urban street trees are also susceptible to road widening that is very evident in developing countries, to decongest streets during busy days. The concept of road-widening has been employed since the Japanese occupation. During those times, they used braces or brackets to support trees that were being moved. These braces or brackets are still present along the national roads of N. Bacalso, Cebu South Road and V. Rama. In accordance to Executive Order No. 23, series of 2011, the DENR permits the DPWH to cut trees that might be affected by road widening. Earth balling is also practiced by the DENR to preserve trees that are affected by road widening, but the chances of those trees to survive is slim. These anthropogenic activities determine the chance of survival of urban trees (Konijnendijk, 1997). In Cebu City, trees growing along the urban corridors are also regarded for their aesthetic value during seasonal events like Christmas, election of public officials, and the annual Sinulog festival. Oftentimes, many trees incur severe injuries and scars because they are used as posting areas, where printed materials containing information and announcements are posted using sharp nails and push pins. The researchers were informed by residents that in some occasions, buntings were tied to street trees during various festivities.
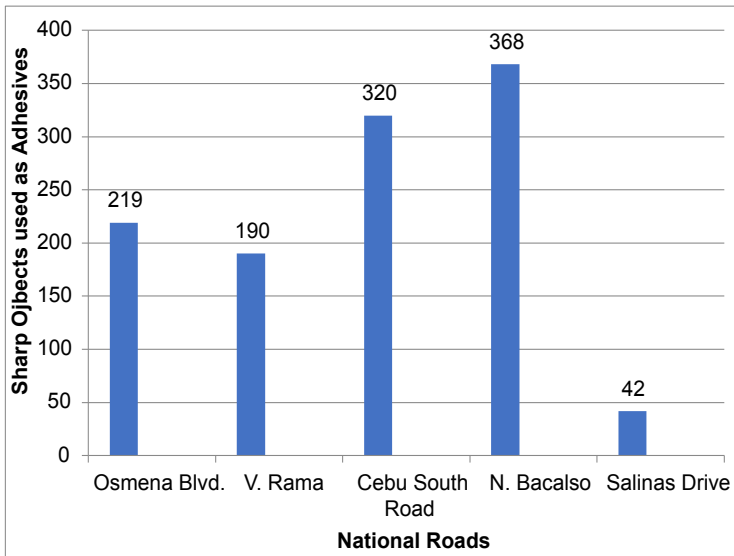
Figure 10. Number of trees that need silvicultural treatment

Trees in cebu city generally require silvicultural treatment, albeit at varying scale. These treatments are usually given to trees to change or maintain their overall condition. Shown in Figure 10 are the data indicating the number of trees that need urgent care and attention in the five study areas. Here, trees growing at N. Bacalso St. needed the most attention, while those from Salinas Drive were likely taken care of by residents and local government officers. These two highways are not comparable in terms of the number of users (e.g., passageway for vehicles) and residential houses nearby. N. Bacalso is a busy street and is more strategic, for people use roadside trees for a variety of purposes. However, all of the five roadside streets recorded a significant number of trees that must be given attention. In this study, narra trees along Osmeña Boulevard were treated for tree cavities, had their damaged stems removed, and were regularly maintained by streetsweepers. Canopy trimming was also noted along V. Rama Avenue, particularly those trees whose branch put heavy weight on roofs of residential houses or were at risk of hurting daily commuters. As of today, domestication of urban trees in the Philippines has not been reported in scientific literature, except the paper of Aguilos et al., (2020) which observed an early growth performance of commercially-important native tree species under domestication. Silvicultural treatment of urban trees, however, had

been observed in Yogyakarta, Indonesia where damage to root areas and tree pots were addressed and tree canopy was maintained (Syahbudin et al., 2018).

CONCLUSION

The researchers had successfully achieved the objectives of the study, generated the list and distribution map, and identified the ecological status of each tree encountered in the study. Based on the findings, it can be concluded that Cebu City's urban corridors, specifically the national streets/ roads included in this study, were rich in terms of the number of tree genera and families. There were more than two thousand trees encountered during the field survey, and this signifies that Cebu City had never neglected the importance of trees as part of the city's green infrastructure program. The study had also evaluated the condition class of each tree; however, the evaluation was only limited to the superficial structure of the tree and was solely based on the researchers' observations. Moreover, although the study had gathered the DBH to estimate the size and age of each tree, the researchers were not able to collect the total height of each tree since doing so could pose a risk to the researchers, considering that the trees were located along the streets, and the researchers did not have any alternative method to gather the height of each tree. Height was an important biological component in the study as it could help determine the urban forest stand. Another limitation acknowledged in this study is that the field survey only included trees that were publicly available and excluded those trees that were along the streets but were fenced. This implies that counting the actual number of trees (i.e. fenced+non-fenced) in Cebu City may generate a higher number of trees compared to the numbers mentioned in this study. Furthermore, while it is known that trees offer direct and indirect ecosystem services to organisms, this study, unfortunately, cannot arrive at a conclusion on the importance of urban trees to organisms, specifically to the people residing in the city, despite the cited evidence of urban people's abusive treatment of the remaining trees along the streets/roads. Tree inventory such as this research is very important in determining and monitoring the city's tree status; however, due to insufficient data available to date, this study cannot conclude whether the status of trees in Cebu City has improved or not.

Nonetheless, this study may still serve as a guide or basis for protocol for future annual urban tree monitoring activities. Significantly, the record that will be produced from this kind of monitoring will help the locals, landscape planners, and experienced arborists to formulate an effective course of action in order to underscore the significance of urban trees in the city's future urban biodiversity investment.

ACKNOWLEDGMENT

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Climate Change Knowledge and Behavioral Response of Negros Oriental High School Grade 12 Students

Kenneth B. Pael

The study aimed to determine the knowledge level and the affective and behavioral response of senior high school students to climate change. The results of the study served as a basis for teachers to develop instructional interventions that would strengthen the students' knowledge and response on environmental education. An adapted questionnaire was administered to grade 12 students (male $n = 91$, female $n = 150$) of Negros Oriental High School in the school year 2019–2020. The results of the study showed that a larger number of students have "average" knowledge level on climate change. Furthermore, the students also exhibited "agreeable" affective and behavioral response to the actions related to climate change. For the sources of information regarding climate change, social media ranked first. Moreover, the senior high school teachers provided positive response to the results of the study as basis for their instructional material development.

Keywords: *environmental education, climate change, knowledge level, behavioral response*

INTRODUCTION

The healing of the environment is the ultimate goal of environmental education (Bennett, 1989). Classroom instruction is one way of teaching environmental education. Students have the capacity to be directly involved in the improvement of the environment. Climate change is perceived as the leading multigenerational problem mankind is facing in the twenty-first

century. With the advent of modern technology and industrial activities, the scientific community recognizes that profound impact of these activities on the earth's climate (Anderson, 2012). This global temperature rise is a phenomenon that is within our immediate future, and it greatly concerns the children of today as they are considered to be the most vulnerable group. In recent studies, in the country and abroad, students have been afflicted with the lack of knowledge and misunderstanding about climate change (Çimer, Çimer & Ursava, 2011; Awusi & Asare, 2016; Akrofi, Antwi & Gumbo, 2019; Lopez, & Malay, 2019). Needless to say, one's knowledge on climate change is a key factor in order to start working on a possible solution to the problem or find ways for adaptation. Truthfully, climate disruption can be evitable with sufficient and appropriate climate education (Gaillard, 2012).

Climate change and its effects present the greatest challenges for mankind and the planet they live in. This ongoing phenomenon has been a threat to global development (UNDP, 2007). Although climate change is caused by naturally occurring events, man-made causes like industrial pollution, combustion of fossil fuels, and deforestation have certainly contributed to the significantly rapid growth of this problem. The increase of greenhouse gas release into the atmosphere can be attributed to human activities such as fossil fuel combustion and industrial by-products (IPCC, 2007).

Meanwhile, deforestation is considered as a primary factor in weakening the carbon dioxide adsorption in the environment. The effects of climate change are explicitly observed today: extinction of animal and plant life, sea level rise, extreme weather conditions, and shifting of agricultural patterns (Pitpitunge, 2013). Thus, climate change has become a global concern not just for international organizations, and government and educational institutions but also for the common people going about their everyday lives (Ochieng & Koske, 2013; Zerrudo, Salain, & Salain, 2017).

With these current issues in mind, there is a need to know the real-time scenario of the students who will continue the fight towards a healthier planet. This is possible with the aid of educators who take it as their ardent task to impart sufficient knowledge to students in order to guide their actions and perceptions.

The general objective of the study was to determine the knowledge level, and the affective and behavioral response to climate change of Negros

Oriental High School grade 12 students in the school year 2019–2020. The results of the study served as a basis for instructional material development of teachers in the aforementioned school. Specifically, the study aimed to achieve the following:

1. determine the knowledge level of students regarding the basic concepts of climate change and its causes, effects, and mitigation;
2. measure the level of affective and behavioral response of students to climate change;
3. identify the most prevalent sources of climate change information among the students; and
4. gather instructional plans from senior high school teachers, as response to the collected data.

The advent of the twenty-first has uncovered a variety of scientific and technical complexities on the issues that adversely affect the natural environment. Thus, public literacy on these threats is a high necessity, and through dissemination of information, the general public can make informed and accurate decisions about environmental issues. Education is one of the highly recommended avenues to find answers to this climate change dilemma (Sheffield et al., 2017; Vargas-Callejas, et al., 2018). Climate change education contributes to the development of students' knowledge and competence to find solutions, and respond and adapt to the problem.

Nonetheless, students play a crucial role in the propagation of information regarding climate change, and primarily, the students rely on their own acquired knowledge to explain somehow complex scientific terms and constructs to the people in their community and beyond. Self-understanding and self-awareness are also achieved when students participate in environmental education activities (Harker-Schuch & Bugge-Henriksen, 2013; Cacundangan & Garcia, 2017).

The primary question in environmental education is one's relationship to the environment (Ojomo et al., 2015). The essence of this relationship is shown in the way people act as well as the choices and decisions that they make pertaining to their environment. The crucial factor leading to these actions and decisions is one's values, which also reflect one's cognitive processes, and social and ethical development. As an interdisciplinary subject, environmental education focuses on the varied instructions that are

created inside the classroom. The cognitive, behavioral, and affective aspects of education are subsumed under environmental education. The basis of the theoretical premises linking these three aspects is examined in this paper.

The following excerpts are an exemplification of how the concept of building values among students has remained a key element within environmental education:

> *Environmental education is the process of recognizing values and clarifying concepts in order to develop skills and attitudes necessary to understand and appreciate the interrelatedness amongst people, their culture and biological and physical surroundings. Environmental education also entails practice in decision making and self-formation of a code of behavior about issues concerning environmental quality. (IUCN, 1970)*

> *Environmental education aims to provide opportunities to acquire the knowledge, values, attitudes, commitment and skills to protect and improve the environment; encourage pupils to examine and interpret the environment from a variety of perspectives; arouse pupils' awareness and curiosity about the environment and encourage active participation in resolving environmental problems. (NCC, 1990)*

Based on these definitions, it is clear that environmental education can contribute to the preservation and protection of the environment. All the aforementioned definitions highlight the importance of values as the center of environmental education. The emphasis on values formation of the students during classroom instruction is highly observable. This supports the idea that environmental education helps learners to acquire a personal view enhanced by moral perspectives which affect the way they act and behave towards their environment. Hines, Hungerford, and Tomera (1987) proposed environmental education as a technique to modify behavior among students in terms of responding to and acting on their environment.

The behavioral change model suggests that if people were better informed, such knowledge would lead them to become more aware of environmental problems and would motivate them to act in an environmentally responsible manner (Akintunde, 2017). This model promotes the notion of a direct link between knowledge and attitudes, and attitudes and behaviors. Simply put,

when knowledge is increased, good attitude towards the environment is also developed (Figure 1).

Figure 1. Behavioral Change Model

Reid (2019) expressed that climate change education is vital in order to reconstruct teaching and learning in response to the climate emergency the planet is facing today. He focused on the fundamental questions on climate change education: (1) What should and should not happen with climate change education? (2) Who is responsible for ensuring quality climate change education takes place? (3) How can change in educators' practices be brought about to ensure climate change education is educational, fit for purpose, and effective. These questions suggest that it is not enough to simply provide information about the changes in the environment, but it should also important that the information provided complements with the students' acquisition level. Oversby (2015) drew evidence from a European network and its activities with schools across nations, assessing the situation of climate change education in the curriculum. He found that science teachers were using innovative pedagogy in delivering lessons on environment and climate change. Rocha (2019) conducted a theoretical analysis of the relationship between environmental education, education for sustainable development, and education on climate change. The results of the study showed that "quality education" and "action against climate change" were two primary themes in environmental education since the teachers shared that they had difficulties in incorporating lessons regarding climate change. The inclusion of environmental education in the classroom discussion across subjects was necessary in order to strengthen the knowledge and response of the students.

Ojomo et al. (2015) examined the knowledge and attitude of university students and government officials about the causes and effects of climate change as well as the priority given to this issue in Nigeria. The findings

revealed that 90% of the participants believed that human activities were a primary driver of climate change, with no statistically significant difference between the perceptions of the students and the officials. Kabir et al. (2016) conducted a cross-sectional survey by administering a structured questionnaire to 6,720 participants in Bangladesh. The results showed that majority of the participants (91.9%) had observed changes in rainfall patterns in the last decade, while 97.8% stated that their health care expenditure had increased due to extreme weather events. Lubos and Lubos (2019) assessed the knowledge, attitudes, practices, and actions of settlers along the river banks of Cagayan De Oro, consisting of 22 villages. The results of the study indicated that the settlers had moderate knowledge of climate change. However, this knowledge did not translate to the conservation, protection, and sustainability of their immediate environment.

Harker-Schuch and Bugge-Henriksen (2013) investigated the influence of people's knowledge on their opinions regarding climate change through a survey conducted with 188 adolescents aged 16–17 in Austria and Denmark. The results showed a statistically significant relationship between knowledge and construction of opinion about climate change. Students with higher number of correct answers opined that humans had a significant role in causing climate change and that both the people and government should work together to minimize its causes and mitigate its effects. Rahman et al. (2014) investigated the role of different demographic profiles and academic attainment on the level of "informedness" of Bangladesh high school students. Through the constructed Climate Awareness Index, the survey results indicated that socioeconomic factors such as quality and type of school, gender, religion, and academic achievement influenced the students' knowledge regarding climate change. Furthermore, Sulistyawati et al. (2018) conducted a cross-sectional study among 508 Yogyakarta adolescents through a structured questionnaire to provide evidence on climate change and health knowledge among adolescents. The study revealed that the students had "low and inconsistent understanding" of the concepts related to climate change and its impact on health.

METHODOLOGY

The study employed an adapted survey questionnaire (Lopez & Malay, 2019). The three-part survey was used to determine the (1) knowledge level; (2) affective and behavioral engagement of students towards climate change; and (3) the common sources of information regarding climate change. The first part was a 20-item true or false quiz divided into four major topics: basic concepts of climate change, and its causes, effects, and mitigations. The second part was a 10-item, 4-point Likert scale that aimed to test the affective and behavioral engagement of students with the issue of climate change (i.e., strongly agree [4], agree [3], disagree [2], and strongly disagree [1]). The third part was also a 10-item 4-point Likert scale used to determine the most common sources of climate change information among the students (often [4], sometimes [3], rarely [2], and never [1]).

The respondents of the study were grade 12 students of Negros Oriental High School in the school year 2019–2020. The students were from the different senior high school tracks and strands (Table 1). The grade 12 students had taken the subject courses Disaster Readiness and Risk Reduction, Earth and Life Sciences, Understanding Culture, Society, and Politics, and other areas that include climate change-related discussions. Before the administration of the questionnaire, permission was obtained from the school principal of Negros Oriental High School–Senior High School Curriculum. Parental consent was also obtained prior to the administration of the questionnaire to all grade 12 students. A confidentiality agreement was conducted between the researcher and respondents. The collected data were tabulated and interpreted using item analysis, frequency and percentage, and total weighted mean.

Table 1

Demographic Profile of the Grade 12 Students in NOHS SY 2019–2020

Track and Strand	Sex		Age					Total
	M	F	16	17	18	19	≥20	
S-AD	6	11	0	9	7	1	0	17
TVL	19	23	0	21	12	5	4	42
ABM	14	36	0	30	19	1	0	50
GAS	28	13	0	16	16	7	2	41

HUMSS A	9	24	0	19	10	2	2	33
HUMSS B	10	25	0	21	14	0	0	35
STEM	5	18	1	13	9	0	0	23
Total	91	150	1	129	87	16	8	241

S-AD Sports and Arts and Design, TVL Technical-Vocational Livelihood, ABM Accounting and Business Management, GAS General Academic Strand, HUMSS Humanities and Social Sciences, STEM Science and Technology, Engineering, and Mathematics

After the collection of data from the respondents, the senior high school teachers (n = 5) who taught climate change topics were then interviewed to gather their feedback and response in regards to the identified knowledge level and behavioral response of the grade 12 students to climate change. The responses gathered from the teachers were considered as the instructional interventions needed in order to improve the knowledge level and affective and behavioral response of the students to the present global problem.

RESULTS AND DISCUSSION

Table 2 shows that based on the 60 percent criterion reference for the 20-item test observed in the school, 16.60% (n = 40) of the students had "below average" (score of 11 and below) knowledge level regarding climate change, 41.08% (n = 99) had "average" (score of 12 to 14), 28.63% (n = 69) had "above average" (score of 15 to 17), and 13.69% (n = 33) had "excellent" (score of 18 to 20) knowledge on the issue. The results showed that the knowledge level of the larger number of students was moderate. Some local and foreign studies had also shown that many teenagers had average knowledge level of climate change (Çimer, Çimer & Ursava, 2011; Awusi & Asare, 2016; Akrofi, Antwi, & Gumbo, 2019; Lopez, J., & Malay, C., 2019). These findings suggest that adolescents need further instruction and exposure with regard to environmental education.

Table 2

The Frequency of Grade 12 Students (N = 241) across Knowledge Levels

Description	Score Interval (%)	Frequency	Percent	Mean	SD
Below average	<59–59	40	16.60	10.05	3.83
Average	60–73	99	41.08	13.02	0.82
Above average	74–87	69	28.63	15.86	0.82
Excellent	88–100	33	13.69	18.61	0.71

Out of the 20 items, based on percentage, students who scored between 12 and 14 were classified as having average level knowledge. The data implied that a larger number of students had moderate intellectual understanding of the concepts associated with climate change. The results suggest that the knowledge absorption of students on climate change-related topics was insufficient in order for them to be active participants in finding solutions to this present problem (Akrofi, Antwi & Gumbo, 2019). It could be noted, however, that a number of students still showed a poor level of knowledge regarding the causes, effects, and mitigations of the case at hand. This number, if taken into a wider spectrum, could mean that a significant portion of the population in the community within and outside the school did not have ample knowledge regarding climate change (Ojomo et al., 2015). Nonetheless, there was also a good percentage of students who had above-average to excellent levels of knowledge regarding the concepts revolving climate change.

The following sections provide an analysis of the scores of the students as regards their knowledge levels. The 20-item quiz was divided into four parts, each of which containing the following five items: (1) basic concepts, (2) causes, (3) effects, and (4) mitigations. Table 3 shows the number of students who responded correctly to statement under the "basic concepts" section. When viewed individually, item 17 of the "basic concepts" got the lowest turnout with only 31.76% (*n* = 91) of the students who answered "False." This could imply that the students had limited knowledge of the different sources of renewable energy (Sheffield, 2017). Renewable energy is essential in lessening the use of carbon-emitting materials in the production of electricity and other energy-dependent activities.

Table 3

The Frequency of Students (N = 241) Answering Correctly on the Climate Change Questionnaire

Statements	Freq.	Percent
Basic Concepts		
1. The weather is always changing, especially over the short term, while climate is the average of weather patterns over a longer period of time.	233	96.68
5. Global warming is an increase in the Earth's average surface temperature from human-made greenhouse gas emissions.	209	86.72
9. Emissions refer to greenhouse gases released into the air that are produced by numerous human activities.	214	88.80
13. Fossil fuels are sources of nonrenewable energy.	179	74.27
17. Unrenewable energy is energy that comes from naturally replenished resources, such as sunlight, wind, waves, and geothermal heat.	91	37.76
Causes		
2. Methane is a hydrocardon gas highly active in decreasing the greenhouse effect in the atmosphere.	76	31.54
6. Increased release of carbon dioxide and nitrous oxide lessen the effects of climate change.	143	59.34
10. Burning of fossil fuels like coal and oil can decreases the concentration of atmospheric carbon dioxide.	154	63.90
14. Volcanic eruptions are natural phenomena that contribute to climate change.	200	82.99
18. Chlorofluorocarbons contribute to the protection of the ozone layer.	103	42.74
Effects		
3. The planet's average surface temperature has risen about 2.0 degrees Fahrenheit over the past decades.	192	79.67
7. Glaciers and ice sheets are melting and hence have decreased in mass.	190	78.84
11. The increase in atmospheric temperature has minimal effect on plants.	119	49.38
15. Droughts and heat waves (periods of abnormally hot weather lasting days to weeks) everywhere are projected to become less intense.	133	55.19
19. Hurricane-associated storm intensity and rainfall rates are projected to increase as the climate continues to warm.	187	77.59
Mitigations		

4.	Access to low and zero carbon energy solutions, such as solar, wind, and geothermal energy can help lessen the causes of climate change.	210	87.14
8.	Investing in sustainable transport can reduce emissions of greenhouse gases.	191	79.25
12.	Targeting the sources of deforestation ensures forests continue to provide environmental, social, and economic benefits.	159	65.98
16.	Increasing GHG emissions from landfills can lessen the effects of climate change.	118	48.96
20.	Promoting practices that reduce land degradation issues can reduce greenhouse gas emissions.	216	89.63

Meanwhile, in the "causes" category, item 2 had the least number of correct answers, as only 76 (31.545) of the students answered "False." This result suggests that the students were not aware what methane gas was and what effects it could create (Falsario, 2014). Items 6 and 18 also generated poor turnout. Both of these items had cited gases that contribute to climate change. It could be noted that with the number of gases present in the atmosphere, students had a hard time distinguishing gases that contribute to climate change.

Furthermore, item 11 of the "effects" section garnered only 49.38% ($n = 119$) of students plotting "False." The poor turnout in this item could mean that the students were not aware of the effects of climate change to other organisms aside from human beings (Gaillard, 2012). Moreover, the grade 12 students also had difficulties in realizing the adverse effects of climate change to the weather system as the results in item 15 illustrates. The effects of climate change to the natural sources and environment had been an untapped topic as the bulk of the delegated information regarding climate centered on its effects on human beings and the immediate and concrete environment.

Nonetheless, in the "mitigations" category, item 16 only received 48.96% ($n = 118$) of students identifying it as false. Despite the constant use of climate change-related terms, the results could imply that the students were still unfamiliar with such scientific terms or unaware of products that may increase the release of harmful gases to the atmosphere (Bangay & Blum, 2010; Osama et al., 2017). This result implied that the grade 12 students needed stronger vocabulary and understanding of terms that are related to climate change in order for them adjust their actions and eventually be more environment-friendly.

An item analysis showed that the average number of students who correctly answered the "basic concepts" category was 185.2 (76.85%). Significantly, only 135 (56.10%) of the students answered the "causes" category correctly. Then, 164.2 (68.13%) and 178.80 (74.19%) of the students correctly plotted the "effects" and "mitigations" categories, respectively. Among the four sections, the questions pertaining to the causes and effects of climate change were not correctly answered by a significant number of students. It could be further shown that almost half of the students were not able to identify the causes of climate change. This implies that the students were unknowingly contributing to climate change without giving further thoughts to their actions (Harker-Schuch & Bugge-Henriksen, 2013; Ogunsola, Araromi & Adeshina, 2018). Moreover, one-third of the student population was not able to identify the effects of climate change. Thus, these students were highly vulnerable to the effects of climate change due to the lack of precautionary measures (Falsario, Muyong & Nuevaespania, 2014). Moreover, one-fourth of the students were not able to identify the mitigating activities that can minimize the causes of climate change. This number may be reflective of the human contribution to climate change-driving activities (Falsario, Muyong, & Nuevaespania, 2014).

Table 4 presents the affective and behavioral responses of the grade 12 students on climate change. Overall, the students were found to moderately agree to all the climate change-related statements. The results indicate that most of the students believe that climate change is a real phenomenon. On the other hand, the students had suggested that climate is a new occurrence when, in fact, climate change has been an ongoing phenomenon (Rosidin & Suyatana, 2017). The response in item 3 generated a "strongly agree" category, which implies that the students were willing to take actions in order to mitigate the causes of climate change. Furthermore, the students also expressed a strong desire to take immediate actions to counter climate change (Oruonye, 2011). They also showed a strong sense of social responsibility as they were not only concerned about themselves but also the welfare of their fellow human beings. With regard to the behavioral engagement of the students, they had shown a strong desire to ask questions to better inform themselves about climate change. The grade 12 students also exhibited initiative to learn updates, current news, and information about climate change. They also displayed carefulness in disseminating information regarding climate change

and would not promote fake and unverified information. The students also showed strong willingness to participate in advocacies aiming to lessen the effects of climate change (Chang & Pascua, 2017; Zerrudo, Salain & Salain, 2017; Ogunsola, Araromi & Adeshina, 2018).

Table 4

Affective and Behavioral Response of the Grade 12 Students to Climate Change

Statements	Weighted Mean	SD	Description
1. I believe that the effects of climate change are real.	3.93	1.35	SA
2. I believe that climate change is a new societal and environmental problem.*	1.72	1.23	SA
3. I am hopeful that there are actions that we can implement to lessen the effects of climate change.	3.83	1.28	SA
4. I believe that immediate actions should be done about climate change.	3.71	1.23	SA
5. I will ignore the signs of climate change until I can experience it firsthand.*	3.56	1.19	SD
6. I always ask questions about climate change.	3.51	0.94	SA
7. I read news and updates about climate change only if my teacher will tell me.*	2.73	0.93	DA
8. I spread information about climate change without verifying.*	3.02	0.93	DA
9. I am seriously concerned with climate change and its effects.	3.80	1.13	SA
10. I will participate in climate change-related advocacies and activities.	3.72	1.07	SA
Overall	**3.08**		**A**

*The statements are interpreted oppositely from the weighted mean range as the ideal response should be scale 1.

Scale	Description	Weighted mean range
1	Strongly Disagree	1.00–1.75
2	Disagree	1.76–2.5
3	Agree	2.51–3.25
4	Strongly Agree	3.26–4.00

Overall, the respondents had exhibited ideal responses to the ongoing problem. The students had given great importance to equipping themselves with correct and verified information regarding the causes, effects, and

mitigating measures of climate change. Today's youth are very vital to the advocacy of mitigating the causes of climate change and spreading adaptation activities to lessen its effects.

Table 5 illustrates the grade 12 students' common sources of information on climate change. It could be noted that most of the media and materials listed scored high in terms of their availability to the students (Anderson, 2012; Falsario, Muyong & Nuevaespania, 2014; Ojomo et al., 2015). Notably, "social media" ranked first among the students as the primary source of information regarding climate change. This may be caused by the social media revolution in this Generation Z. The high output across all media and materials may suggest that climate change and its related concepts are abundant in the real-time scenarios whether in the outer world or online (Oruonye, 2011; Rosidin & Suyatana, 2017).

Table 5

Common Sources of Information on Climate Change

Mediums/materials	Weighted Mean	SD	Description
Classroom	3.57	1.02	Often
Television	3.81	1.23	Often
Social Media	3.83	1.24	Often
Internet Browsing	3.77	1.18	Often
Books and journals	3.31	0.97	Often
Magazines	2.92	0.94	Sometimes
Newspapers	3.38	1.08	Often
Family and relatives	3.20	0.94	Sometimes
Peers and friends	3.00	0.95	Sometimes
Movies	3.12	0.93	Sometimes

Scale	Description	Weighted mean range
1	Never	1.00–1.75
2	Rarely	1.76–2.5
3	Sometimes	2.51–3.25
4	Often	3.26–4.00

Below are the vignettes from science teachers (n = 3) and teachers handling climate change-related subjects (n = 2) responses. These illustrate the possible actions that the teachers in NOHS are going to implement in order to improve the knowledge level of students. The interview questions gauged the response of the teachers to the current scenario of the students

through instructional material formulation and classroom instruction delivery (Ochieng, 2010; Ochieng & Koske, 2013; Osama, et al., 2017; Trendell, 2017).

Science Teachers:

1. Construct instructional materials with data, simulations, and models
2. Teach climate literacy with the use of ICT devices
3. Conduct symposiums
4. Enhance the visual instructional materials used in the classroom
5. Immerse the students in communities hit by calamities
6. Let the students take an advocacy campaign
7. Present current statistics on climate change

Teachers handling climate change-related subjects:

1. Present a documentary or video showing the effects of climate change to the class
2. Conduct a research activity or science investigative projects
3. Integrate climate change even if it is not stated in the curriculum guide
4. Expose students to firsthand observation like field trips when possible
5. Tap speakers and organizations where students can volunteer to do activities related to climate change
6. Administer peer group discussions and brainstorming activities

The results of the interview showed that both groups of teachers had given great importance to improving the knowledge level of the students regarding climate change (Bangay & Blum, 2010; Boon, 2016). The teachers also showed a positive response to the challenge of enhancing their instructional materials and delivery in order to strengthen the students' knowledge and behavioral response to climate change (Dal et al., 2015; Herman, Feldman & Vernaza-Hernandez, 2017; Monroe, 2017).

CONCLUSIONS AND RECOMMENDATIONS

Overall, a considerable number of students showed "average" knowledge level regarding climate change. However, almost half of the total population had difficulty identifying the causes of climate change. The students had exhibited agreeable responses towards their willingness to take part in mitigating the effects of climate change and identifying adaptation activities. The various media and materials were found to be common sources of information regarding climate change, with "social media" as the most common source. The senior high school teachers of NOHS had shown positive responses to the results of the research and will use them as basis for improving instructional material development.

Based on the results of the study, the researcher would recommend the following:

1. The students should utilize all sources of climate change information in order for them to be more knowledgeable with the terms and constructs related to climate change. It is also suggested that the students take initiative in participating in climate change reduction advocacies and programs.

2. The teachers handling climate change-related subjects should devise instructional interventions that can build the knowledge level of the students, especially in the following areas: (1) non-renewable energy and their sources; (2) atmospheric gases that contribute to climate change and their sources; (3) the effects of climate change on plants and other living organisms and on the weather systems; and (4) the by-products of human activities that contribute to climate change. Moreover, the teachers should also provide a timeline of the climate change data since the start of the industrial revolution. Lastly, the teachers should make use of social media platforms as a way of disseminating climate change information; nevertheless, they should teach the students how to verify information they get from online sources.

3. The school heads and administrators must promote the integration of climate change in the delivery of classroom discussion. They

should also encourage the teachers to develop instructional materials geared towards the improvement of the knowledge level of students pertaining to climate change.

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Socio-Demographic Factors Affecting Attitude towards Office Gastrodiplomacy among Local Government Employees

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The meaning of food is redefined. Human development witnessed the politicization of food and how key messages were relayed through the food we share or what we simply call "gastrodiplomacy." This study was conducted to determine the socio-demographic factors that affect attitude towards office gastrodiplomacy among employees of a local government unit in the Philippines. This is a descriptive-relational study that employed a one-shot survey among 327 respondents. Data were collected using a two-part questionnaire that included questions on: a) socio-demographic characteristics consisting of age, sex, educational attainment, length of service, monthly income, and nature of job position; and the b) researcher-made instrument on attitude towards office gastrodiplomacy. It was found out that respondents had a generally 'high positive attitude' towards office gastrodiplomacy, although only age and length of service were significantly related. The findings of this study provide a breakthrough on research on office gastrodiplomacy in the Philippines, where such practice is prevalent yet understudied or has not been tackled at all as of writing.

Keywords: *Office gastrodiplomacy; office relations; office management; personnel management; office food; office politics; public administration*

INTRODUCTION

Food is a basic need, a necessity for our survival. It is present in our day-to-day activities. We eat food primarily to nourish ourselves, satisfy our cravings, celebrate special occasions such as birthdays, anniversaries, and

the like. Eating is also a common activity between friends and companions. This act of sharing food allows peers to build harmonious relationships with each other (Chapman & Goodwin, 2001).

Paul Rockower, a scholar of public diplomacy, popularized the term gastrodiplomacy, which he defines as 'winning the hearts and minds through stomachs' (Rockower, 2011). Though a relatively new term, gastrodiplomacy already appeared in the February issue of the magazine The Economist in 2002 by an unknown author (Anon, 2019).

Researchers of gastrodiplomacy looked closely at how relationships are founded and propagated on and around food. Spence (2016) proposed a comprehensive definition of gastrodiplomacy as the 'use of food to convey a specific message to others' (Spence, 2016).

Psychologists highlighted how food modifies psychological processes when the physical self has ingested something through the bodily systems. Several researchers have provided enlightenment on how food affects intrapersonal aspects of the mind structure, such as how food and taste preference affects attitude and personality traits (Sagioglou & Greitmeyer, 2012; Robinson, 2012; Herz, 2011; Macht & Mueller, 2007). Further, substantive scientific evidence has also shown correlations on how food shapes interpersonal relationships, thus eliciting complex psycho-social behaviors such as social familiarity and acceptance, affiliation, social cohesion, etc. (Spence, 2016; Davey, 2016; McCouat, 2014; Williams & Bargh, 2008; Rozin et al., 1999).

Scholars of organizational studies revealed a positive relationship of food with the different work-related processes and mechanisms. Among them is the capacity of food to improve office relations between employees and supervisors and among employees themselves (McCouat, 2014; Gallo, 2014; Williams & Bargh, 2008). Provision of office food was also found out to be related to work productivity (Kniffin et al., 2015; Taylor, 2014; Balachandra, 2013; Kozinski, 1993). In addition, employees also reported that office food make employees feel more valued and appreciated by the organization (Taylor, 2014; Baldoni, 2013), increases their job satisfaction (Malcolm, 2016; Taylor, 2014), and improves employee retention (Taylor, 2014). Lastly, post-modern literature has also provided evidence on the causality of office food provision and work engagement and motivation

(Ariely, 2016; Wooley & Fishbach, 2016; Rot et al., 2015; Schwarts & Porath, 2014; Baldoni, 2013; Halvorson & Rudelius, 1977).

Despite evidently widespread literature in support of office gastrodiplomacy, there are no studies to cite by far to show public's feelings, behavior, and views towards gastrodiplomacy or people's attitude towards this practice, more so its relationship with socio-demographic characteristics. Herein, the researcher compiled all relative works of literature that associate socio-demographic characteristics with gastrodiplomacy.

Socio-demographic Characteristics and Gastrodiplomacy

Unlike the younger population, older people have a lesser preference for food. Researchers contend that food perception is different between these two groups. According to Browning et al. (2019), older people tend to perceive food and eating rituals as an essential component of the enjoyment of a happy old age (Browning et al., 2019). They revealed that it is primarily because food-related experiences are quite different between the two groups. This is supported by the findings of Edfors and Westergren, who argued that current views of food and meals are greatly influenced by past life experiences (Edfors & Westergen, 2012).

There is vast literature investigating the differences in the views and perceptions of men and women over food. Relevant literature includes salient discussions centered on how women view food more critically than men in terms of health, dietary practices, and preferences. Mannippa et al. (2017) reported that compared to men, women responded differently to food cues in the environment on the behavioral and neural level. This means that women undergo a more evaluative process whether they intend to eat or not.

Some researchers also investigated how one's level of education influences perceptions toward food. One of them is the study of Bartkiene et al. (2019). They revealed that education is a significant factor influencing perceptions of healthy eating. They reported that higher education groups tended to have a lower tolerance of perceptions and believed healthy diet and eating claims more strongly (Bartkiene et al., 2019). The same is true in the study of Li and Powdthavee (2015), who supported the same finding stating that level of education leads to better health habits which includes one's eating activities. They further stated that the level of education could

lead to better health habits which includes one's eating activities (Li & Powdthavee, 2015).

Brandon (2018) has contended that the length of time is a particular factor that influence food habits. According to him, exposure to certain food-related practices eventually leads people towards developing a habit that they will hardly notice later on (Brandon, 2018). Meanwhile, in a study by Hicks (2018), income was found to be a significant predictor of one's eating habits. She revealed that study participants who were from low-income families tended to have poorer health choices. According to Fadulu (2019), there exists an inequality in eating habits between the wealthy and the poor, which is actually worsening. Fudulu has pondered that income gap is a precursor to healthy eating gap. Among the reasons he identified were the price of healthier food, access to healthy alternatives, and transportation concerns.

In a study conducted by the U.S. Department of Agriculture (USDA) – Economic Research Service (ERS) (2019), it was found that situational factors affected people's food choice as well as eating and health habits. These factors included the affordability of food prices, location and accessibility of food resources, length of time between meals, and number of hours spent working, to name a few (USDA-ERS, 2019). Because of hectic schedules, people who work beyond office hours, bringing their work home, may prefer fast foods to lessen the burden of food preparations (USDA-ERS, 2019). Indeed, unlike those who work beyond office hours like people who have technical jobs (e.g., teachers, lawyers, and accountants), employees who undertake day-to-day tasks in the office or hold clerical and staff positions may have relatively different eating patterns.

Local Literature

As overwhelming as it may seem, gastrodiplomacy is an unexplored research agenda in the Philippines. Meanwhile, there is existing literature which may not explicitly describe gastrodiplomacy in exact terms but nevertheless tackles how food shapes people's cultural distinctiveness or even non-distinctiveness (Zappia, 2015). As stated by Manalasan (2013), Filipino food has undergone diasporic development shaped by people's associations with nearby geographic neighbors and by historical and cultural traditions, especially during the era

of colonization. However, though these are interestingly compelling topics that deserve much discussion, they do not offer perspectives similar to the focus of the present investigation. As such, pieces of literature like these (e.g., the history of Filipino cuisine or the authenticity of Filipino food) are excluded in this review, but only those that benefit the study to support further analysis of the dimensions of food studied are discussed. Indeed, there are many dimensions of food research, but they do not address the gaps identified in this study. The author maintains that there is no established scholarship in office gastrodiplomacy in the Philippines. This paper's ultimate task is to provide groundwork in this area, which perhaps would eventually be used by future scholars who aim to envision embracing the same intellectual interest. Hereunder are pieces of literature that help frame the analysis of the field.

In the article of Florendo (2019), he analyzed the symbolic value of food in Filipino society, particularly in the formation of culture, values, and philosophy of Filipinos as a people. According to Florence, various cultural practices of the Filipino people reveal the Filipino philosophy (Florendo, 2019). Indeed, the value of food in culture can never be overstated. Food is one of the material aspects of culture inherent to a specific social community. Food conveys a symbolic message and may also a medium of communication (Florendo, 2019).

Office gastrodiplomacy is widely practiced in almost all offices in the Philippines, both in public and private. This can be associated with the contentions of Mayuga (2017) that Filipinos, indeed, are food lovers. Food is essentially embedded Filipino culture. We can even cite the earliest accounts in history wherein Philippines' ties with the West were built around food, eventually leading to the famous blood compact with the Spanish colonizers (Agoncillo, 1990).

In Filipino culture, food plays a vital role in promoting solidarity or 'oneness' in a particular politico-social unit (Zappia, 2015; Manalasan, 2013). This was demonstrated in the discussion of Fernandez (1994) on how Filipino food reflected the relations among his fellowmen. She provided a description of a usual street food alley where Filipino's use of sawsawan (sauce) is imminent. According to her, the use of sawsawan reveals a communal and participatory relation. She argues that Filipino food manifests a democratic nature and an undiscriminating attitude towards his/her fellowmen (Fernandez, 1994).

Food-sharing or gastrodiplomacy is generally part and parcel of every Filipino comradeship. Though the law, particularly the Code of Ethics for Public Officials (RA 6713), does not explicitly approve this, it did not implicitly prohibit the same. Office gastrodiplomacy is a customary practice in whichever organizational culture exhibited, most especially during inter-agency collaborations. Gastrodiplomacy, eventually, has become a standard operating procedure among public officials who intend to send a cordial message and has been a vital element that enhances organizational cohesiveness, strength, and participation, among others.

Gastrodiplomacy is an unexplored research agenda in the Philippines. No local literature (as to the extent that the researcher conducted his review) can empirically support the same contentions as those famously revealed by foreign researchers.

Moreover, existing studies examined office gastrodiplomacy primarily only within the context of the private sector and among private office relationships. Little research has been conducted from the perspective of the public sector, hence, the conduct of this study.

OBJECTIVES OF THE STUDY

This study sought to determine whether socio-demographic factors affect attitude towards office gastrodiplomacy among employees of a local government unit in the Philippines. Specifically, this study aimed to do as follows:

1. describe the socio-demographic characteristics of the respondents in terms of the following:
   a. age;
   b. sex;
   c. educational attainment;
   d. length of service;
   e. monthly income; and
   f. nature of job position;
2. determine the city government employees' attitude towards office gastrodiplomacy;

3. determine if there is a significant relationship between the city government employees' socio- demographic characteristics and their attitude towards office gastrodiplomacy;

4. determine if there is a significant relationship between the city government employees' socio-demographic profile and their attitude towards office gastrodiplomacy.

Hypotheses

This study endeavored to test whether there is no significant relationship between the city government employees' socio-demographic characteristics (i.e., age, sex, educational attainment, length of service and nature of job position) and their attitude toward office gastrodiplomacy.

METHODS

Research Design

This study is a descriptive-correlational study that employed a one-shot survey design. This non-experimental design was used to determine the factors that may affect the attitudes of employees of a local government unit (LGU) in the Philippines towards office gastrodiplomacy.

Study Population

The target population consisted of all regular and full-time staff employees. The LGU profiled 1,788 for which sample size was determined using the Slovin's formula at 327 respondents with the margin of error at 5%. Stratified random sampling was then used to determine the number of respondents per department.

Ethical Considerations

A letter of informed consent was attached to each questionnaire to get the respondent's consent to voluntarily participate in the study. The researcher explained the nature, purpose, and objectives of the study, and

the respondents were assured that the data gathered from them would be kept confidential and would be used solely for this study. The respondents were further informed that their participation was voluntary and that they had the right to refuse to answer the questionnaire if they were not willing to participate in the study.

Research Instrumentation

The research instrument consisted of two parts. Part I determined the socio-demographic characteristics of the employees which included their age, sex, level of educational attainment, length of service, monthly income, and nature of job position. Part II was a researcher-made questionnaire that contained 21 statements about attitude towards office gastrodiplomacy. One (1) point was given for every statement with a "yes" answer and zero (0) for "no". The raw score was added, and the sum was categorized as follows:

Category	Raw Score
Positive Attitude	10 – 21
Negative Attitude	0 – 9

Validity and Reliability of the Questionnaire

The questionnaire was submitted to a panel of experts in the field of research for validation. Comments and recommendations of the panel members were included in the final version of the questionnaire. The revised instrument was pilot tested among employees of another LGU with almost the same characteristics. Ten percent (10%) of the total sample size was included as participants of the pilot study, which constituted 33 respondents.

The Cronbach's Alpha was calculated to measure internal consistency and scale reliability. Reliability coefficient for attitude towards office gastrodiplomacy was at 0.914.

Data Collection

A letter of permission stating the purpose of the study was sent to the LGU Administrator. The letter also served as an endorsement approval presented to the heads of the different offices and departments. The researcher

personally gathered the intended data. Respondents were briefed on the purpose and content of the study and the questionnaire that they would answer. Further, the physical presence of the researcher was of paramount importance in assisting the respondents whenever they had questions and clarifications relating to the items. The respondents were given ample time to answer the questionnaire from the time they voluntarily decided to participate in the study. At the request of the respondents, the researcher collected the answered questionnaire a week later.

Upon collection of the answered questionnaire, the researcher double-checked each item to ensure the completeness of responses. Questionnaires with incomplete answers were returned to the respondents for completion. Data were coded, tabulated, and processed with the aid of the computer.

Statistical Treatment and Analysis

Data gathered were processed and analyzed using the Statistical Package for Social Sciences (SPSS) version 23. Descriptive statistics such as mean and frequency distribution were calculated for all variables. For inferential statistics, the following were utilized:

Chi-Square test. This was used to determine whether there was a significant relationship between two nominal variables and between nominal and ordinal variables.

Cramer's V. This was used to determine the degree of relationship between two nominal variables and between nominal and ordinal variables.

RESULTS AND DISCUSSION

Socio-Demographic Characteristics of Respondents

The socio-demographic profile of the respondents was categorized according to age, sex, educational attainment, length of service, monthly income, and nature of job position. The profile is presented in Table 1 below.

Table 1

Socio-demographic Characteristics

A. Socio-demographic Profile of Respondents	f	%
Age		
24 – 35 years old	97	29.7
36 – 45 years old	104	31.8
45 – 60 years old	126	38.5
Total Mean = 42.3 years old	**327**	**100.0**
Sex		
Male	125	38.2
Female	202	61.8
Total	**327**	**100.0**
Educational Attainment		
Undergraduate	44	13.5
College Graduate	237	72.5
Postgraduate	46	14.1
Total	**327**	**100.0**
Length of Service		
1 – 10 years	208	63.6
11 – 25 years	91	27.8
26 – 40 years	28	8.6
Total Mean = 11.2 years	**327**	**100.0**
Monthly Income		
P8,000 – 16,000	164	50.2
16,001 – 30,000	92	28.1
above 30,001	71	21.7
Total Mean = Php 22,311.3	**327**	**100.0**
Nature of Job Position		
Sub-professional	140	42.8
Professional	187	57.2
Total	327	100.0

On average, the respondents were 42.3 years old. Out of 327 respondents, 29.7% were 24-35 years old, 31.8% were 36-45 years old, and 38.5% were 46-65 years old. Female respondents (61.8%) outnumbered male respondents (38.2%). In terms of educational attainment, at least one in ten was an

undergraduate (13.5%), at least seven in ten were college graduates (72.5%), while there were at least one in ten on the postgraduate level (14.1%). The data in Table 1 further reveals that the respondents had an average of 11.2 years of experience. The distribution further shows that more than half (63.6%) had 1-10 years of experience, almost one-third (27.8%) had 11-25 years of experience, and barely one-tenth (8.6%) had 26-40 years of experience. Meanwhile, data on the monthly income shows that the respondents, earned an average of Php 22,311.3. At least half of them were low-income earners, within the bracket Php 8,000 – Php 16,000. Nearly one third (28.1%) were middle-income earners, within the bracket Php 16,001 – Php 30,000. The remaining one-fourth (21.7%) were high-income employees, earning above Php 30,001. Finally, as to the nature of job position, professional employees constituted 57.2% of the total respondents which was closely followed by sub-professional employees consisting 42.8% of the total respondents.

Attitude towards Office Gastrodiplomacy

Table 2

Attitude towards Office Gastrodiplomacy

Office Gastrodiplomacy	Yes	
	F	**%**
Positive Attitude	267	81.7
Negative Attitude	60	18.3
Total	**327**	**100.0**

Table 2 shows the overall attitude of the respondents towards office gastrodiplomacy. As shown in the data, eight out of ten (81.7%) employees had positive attitude towards office gastrodiplomacy. This is consistent with the contentions of Mayuga (2017) that Filipinos generally loved to eat food. In addition, this reflects that Filipino culture, values, and philosophy are built and foster social relationships around food (Florendo, 2019; Fernandez, 1994).

Distribution of Respondents according to their Socio-Demographic Characteristics and their Attitude towards Office Gastrodiplomacy

Table 3 presents the findings on the relationship analysis between respondent's socio-demographic characteristics according to age, sex, educational attainment, length of service, monthly income, nature of job position and their overall attitude towards office gastrodiplomacy.

Age and Attitude towards Office Gastrodiplomacy

A higher proportion of respondents (89.7%) who were 24-35 years old had a favorable overall attitude towards office gastrodiplomacy as compared to those who were 36-35 years old (83.7%) and 45-60 years old (73.8%). Inversely, a higher percentage (26.2%) among respondents aged 45-65 years had unfavorable attitude as compared to those who were 36-45 years old (16.3%) and those who were 24-35 years old (10.3%).

The result of the Cramer's V test for the relationship between two variables yielded a value of 0.172 with a p value of 0.008 which was significant, at 0.05 confidence level. This indicates that the age of the respondents had a significant influence on their attitude towards office gastrodiplomacy. Therefore, the hypothesis that there was no relationship between age and attitude towards office gastrodiplomacy is rejected.

This finding implies that younger employees tend to have favorable attitude towards office gastrodiplomacy than the older ones. This is in contrast with the findings of Browning et al. (2019), who said that older people tended to value food and eating rituals more primarily because of their food-related experiences in the past, where limited food resources affected their food choice and eating habits. The present results of this study can be associated with the higher appetite levels among the younger population. Moreover, another possible rationale is how younger employees may tend to think that eating is more of a social activity than merely a biological or nutritional process.

Sex and Attitude towards Office Gastrodiplomacy

A little higher proportion of male (82.4%) respondents had a favorable attitude towards office gastrodiplomacy than the female (81.2%) respondents. On the contrary, a little higher proportion (18.8%) of female respondents had a more negative attitude compared to their male counterparts (17.6%).

The result of the Cramer's V test for relationship between two variables yielded a value of -0.15 with p value of 0.783 which was not significant, at 0.05 confidence level. This indicated that age has no significant influence on attitude towards office gastrodiplomacy. The hypothesis, therefore, that there was no relationship between age and attitude towards office gastrodiplomacy cannot be rejected.

Table 3

Distribution of Respondents according to their Socio-Demographic Characteristics and Attitude towards Office Gastrodiplomacy

Socio-demographic Characteristics	Overall Attitude towards Office Gastrodiplomacy						
	Positive Attitude		Negative Attitude		Total		
	F	%	f	%			
Age							
	24 – 35	87	89.7	10	10.3	97	100.0
	36 – 45	87	83.7	17	16.3	104	100.0
	45 – 65	93	73.8	33	26.2	126	100.0
	Total	267	81.7	60	18.3	327	100.0
Cramer's V: 0.172 *Weak relationship Significant*							p=0.008
Sex							
	Male	103	82.4	22	17.6	125	100.0
	Female	164	81.2	38	18.8	202	100.0
	Total	267	81.7	60	18.3	327	100.0
Cramer's V: -0.15 *Weak relationship Not significant*							p= 0.783
Educational Attainment							

	Undergraduate	36	81.8	8	18.2	44	100.0
	College Grad	192	81.0	45	19.0	237	100.0
	Postgraduate	39	84.8	7	15.2	46	100.0
	Total	267	81.7	60	18.3	327	100.0

Cramer's V: 0.033
No relationship
Not significant   p= 0.833

Length of Service

	1 – 10 years	176	84.6	32	15.4	208	100.0
	11 – 25 years	75	82.4	16	17.6	91	100.0
	26 – 40 years	16	57.1	12	42.9	28	100.0
	Total	267	81.7	60	18.3	327	100.0

Cramer's V: 0.195
Weak relationship
Significant   p= 0.002

Monthly Income

	P8,000 – 16,000	135	82.3	29	17.7	164	100.0
	16,001 – 30,000	80	87.0	12	13.0	92	100.0
	above 30,0001	52	73.2	19	26.8	71	100.0
	Total	267	81.7	60	18.3	327	100.0

Cramer's V: 0.125
Weak relationship
Not significant   p= 0.077

Nature of Job Position

	Sub-professional	110	78.6	30	21.4	140	100.0
	Professional	157	84.0	30	16.0	187	100.0
	Total	267	81.7	60	18.3	327	100.0

Cramer's V: 0.069
No relationship
Not significant   p= 0.213

This finding implies that sex is not a significant factor that affect attitude towards office gastrodiplomacy. One rationalization that may be suggested in support of this finding can be attributed to the cultural distinctiveness of Filipinos and their attitude towards food in general. It can be said that Filipinos, regardless of sex, show nearly the same attitude towards the ceremonial function of food, as it is emphasized in every household that

the whole family should eat together. Filipino families view this practice as bonding time for them; thus, it appears normal for Filipinos to have a positive view towards food and eating.

This finding, however, contradicts the study of Mannippa et al. (2017), who said that sex was a determinant of attitude towards eating. They contended that women tended to have an evaluative attitude towards eating or not eating.

Educational Attainment and Attitude towards Office Gastrodiplomacy

A higher percentage (84.8%) of respondents who were on the postgraduate level had a favorable attitude towards office gastrodiplomacy as compared to those who were on the undergraduate (81.8%) and college graduates (81.0%) groups. Inversely, those were college graduates (19.0%) tended to have a more unfavorable attitude compared to those who belonged to the undergraduate (18.2%) and postgraduate (15.2%) groups.

The result of the Cramer's V test for relationship between two variables yielded a value of 0.033 with a p value of 0.833 which was not significant, at 0.05 confidence level. This indicates that educational attainment had no significant influence on the respondents' attitude towards office gastrodiplomacy. The hypothesis, therefore, that there is no relationship between age and attitude towards office gastrodiplomacy cannot be rejected. This finding implies that educational attainment is not a factor that affects attitude towards office gastrodiplomacy. This finding contradicts the study of Bartkiene et al. (2019) who said that there was a direct relationship between educational attainment and perceptions towards food and other food-related practices.

Length of Service and Attitude towards Office Gastrodiplomacy

A higher percentage (84.6%) of the respondents with 1-10 years of experience generally had a more favorable attitude towards office gastrodiplomacy compared to those with 11-25 years of experience (82.4%) and those with 26-40 years of experience (57.1%). Inversely, a greater proportion (42.9%)

of those with 26-40 year of experience had a more unfavorable attitude compared to those with 11-25 (17.6%) and 1-10 (15.4%) years of experience. The statistical analysis for a test of relationship generated a Cramer's V value of 0.195 with a p value of 0.002 which was significant, at 0.05 confidence level. This indicates that length of service had a significant bearing on the respondents' attitude towards office gastrodiplomacy. Therefore, the hypothesis that there is no relationship between age and attitude towards office gastrodiplomacy is rejected.

This finding implies that younger employees tend to have a more favorable attitude towards office gastrodiplomacy than the older employees. One outstanding reason that can be associated with this finding was the contention of McCuoat (2014) on the ability of food to lessen organizational boundaries and hierarchies when employees eat with their supervisors. As such, younger employees may generally have a more positive attitude as they may see such practice as a way to socialize with other employees at work, unlike older ones who had already established their social circles.

This is, further, consistent with the contention of Brandon (2018), who said that length of time was an indicator of influence on people's food habits. This idea can also be attributed to the study of Davey (2016), who said that sharing a meal with office colleagues helped create social networks.

Monthly Income and Attitude towards Office Gastrodiplomacy

A higher percentage of those earning between Php 16,001-30,000 (87.0%) generally showed a favorable attitude towards office gastrodiplomacy. This was closely followed by respondents earning between Php 8,000-16,000 (82.3%) and far behind by those earning above Php 30,001 (73.2%). Inversely, there was a greater percentage (26.8%) of those earning above Php 30,001 than those earning between Php 8,000–16,000 (17.7%) and those earning Php 16,001–30,000 (13.0%).

The statistical analysis for test of relationship generated a Cramer's V value of 0.125 with p value of 0.047, which was not significant, at 0.05 confidence level. This indicates that monthly income had no significant bearing on the respondents' attitude towards office gastrodiplomacy. The hypothesis, therefore, that there is no relationship between age and attitude towards office gastrodiplomacy cannot be rejected.

This finding implies that monthly income has no bearing whether one feels favorable or not towards office gastrodiplomacy. This finding is not consistent with the contentions of Fadulu (2019) who argued that income determines people's attitude towards food. It can be reasoned out that employees do not necessarily view office gastrodiplomacy as an opportunity for nutritional intake alone. Instead, food in the office or food shared in such space takes more meaning as cultural and ceremonial symbols within the organizations.

Nature of Job Position and Attitude towards Office Gastrodiplomacy

A higher percentage (84.0%) of the professional respondents indicated a favorable attitude in contrast with those in the sub-professional (78.6%) job positions. Inversely, a higher percentage (21.4%) of sub-professional respondents indicated an unfavorable attitude compared to those in the professional (16.0%) positions.

The result of the Cramer's V test for relationship between two variables yielded a value of 0.069 with a p value of 0.213 which was not significant, at 0.05 confidence level. This indicates that nature of job position had no significant influence on attitude towards office gastrodiplomacy. The hypothesis, therefore, that there was no relationship between nature of job position and attitude towards office gastrodiplomacy cannot be rejected.

This finding implies that attitude towards office gastrodiplomacy is not determined by one's job, whether it is sub-professional or clerical, or whether it is professional or scientific-specialist in nature. Again, it can be argued that this is perhaps related to the general attitude of Filipinos who view the ceremonial function of food as innately positive.

Moreover, this finding is not consistent with the report of the USDA – Economic Research Service (2019), which said that situational factors such as the nature of people's job positions directly affect access to food, thereby affecting people's attitude towards eating and actual eating practices.

CONCLUSIONS AND RECOMMENDATIONS

Office gastrodiplomacy is a common practice in the Philippines. In public offices, however, it has been treated as a norm and a standard operating

procedure even in simple gatherings like casual office meetings or more organized events like official gatherings. Food is served to encourage higher engagement among employees and to ease out organizational hierarchies/ boundaries and establish harmonious relationships among co-workers. This is particularly true in the Filipino culture, where people tend to be more personal with work, thereby building social networks among colleagues and being attached to the office not only professionally but also socially. One cannot take away the notion that Filipinos are natural food-lovers, as a result of how they are nurtured during childhood and in their respective homes.

Office gastrodiplomacy is proven to influence work-related processes of which office managers may take advantage for the organization's benefit. In this study, it was found that age and length of service had a bearing on the respondents' attitude towards gastrodiplomacy. This means that those from the lower age groups and the younger employees positively perceived this practice. Relating this to previous studies, it can be said that these groups may feel more motivated, satisfied, and engaged in work (Ariely, 2016; Taylor, 2014; Baldoni, 2013). One major implication of the findings of this study is for office managers and the academic community to realize the ceremonial and cultural value of food within the organization and not merely to understand it within biological and nutritional domains. Gastrodiplomacy evidently develops healthy relationships within organizations and may also be instrumental in keeping, maintaining, and improving such relationships. Though not within the scope of this paper, it is suggested based on the present findings that gastrodiplomacy may increase efficiency, reduce organizational conflicts, and improve governance. There is high potential in food's ability to draw a grey line on the relationship between employees and supervisors, and such relationship reflects how they connect with their companies in general. In this sense, gastrodiplomacy may change the individual from being detached from the organization to being attached to it, thus softening the rigid boundaries within the different levels of organizational structure. Literature has long before suggested that increasing participation of individuals in organizations can lead to greater employee productivity, as they are not considered pawns but rather as partners for development. Albeit a widely studied topic in management sciences abroad, more dimensions of this topic remain unexplored, but this study may serve as a guide for future researchers to explore this growing field of knowledge in terms of the local literature.

As a groundwork in this emerging area, this study envisions that in further grappling with the intrinsic and extrinsic capacity of office gastrodiplomacy, office managers may consider the findings, and perhaps a few concrete recommendations that are stated hereunder:

1. Office gastrodiplomacy can provide opportunities to minimize the rigid organizational hierarchies. Hence, public administrators should make sure that they allow regular employees to eat together with their officials to provide the latter opportunities get to know more about their subordinates on a personal level. This may be achieved, say for example, by prescribing seat plans during official occasions.

2. Younger employees may be given an opportunity to be acquainted with the organization and with older employees through office gastrodiplomacy. In this manner, generic stereotypes may be eliminated for the greater benefit of the organization.

3. The academe should encourage the proliferation of literature on office gastrodiplomacy as one of the emerging areas in the management sciences. The comprehensive literature from foreign academic institutions may serve as a guide to re-test whether the same effects may be generated from the Filipino work setting.

4. This is a study in applied anthropology for modern organizations. This study encourages researchers to seek to apply anthropological themes in organizational and management research, precisely on how organizational culture influences organizational practices and processes, such as organizational conflict, employee engagement, efficiency, and governance.

5. For future researchers who would like to undertake the same study, it is recommended that they study the same sector in different regions of the Philippines to generalize the findings of the study. Further, it is also suggested that the study be extended to different industries such as banking, education, multi-national companies, etc.

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Administrative Regulation of Philippine Health Care Professionals

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This study evaluated complaints against health personnel filed with the Professional Regulation Commission (PRC), in order to describe the complaint patterns; identify providers' lapses in professionalism; compare the administrative outcomes between patient care-related and other cases; and infer the critical areas in health personnel regulation.

Data was collected from a retrospective records review of complaints involving health professionals filed with the PRC from January 2013 to December 2016. Case summaries were written based on the submitted complaints and other documents. The anonymous summaries of all the cases were reviewed by the authors, and attribution of errors and causes were made. Specialists were consulted to review selected cases.

Only 358 case files were retrieved, nearly equally divided between those concerning patient care and those which did not. Among the former, deaths occurred in 30% of cases. Physicians, dentists, nurses and midwives had the most complaints. Clinical management lapses were the most commonly identified errors for professionals. For some, the adverse events were perceived as due to system deficiencies and even the patients' severity of illness. Most of the reviewed cases which had corresponding PRC Board decisions were either dismissed or settled. There were more and harsher penalties among the non-patient care cases.

Keywords: *professionalism, health personnel, patient safety, quality of health care, government regulation*

INTRODUCTION

Professionalism, as it applies to health personnel, has been variably defined as consistency with aspired attributes or codes of conduct as well as the attainment of specified competencies.[1-4] Due to increasing complexities in the health field, the conferment of professional status has shifted beyond peer recognition to official certification by publicly designated organizations.[5-7] Lapses in professionalism among health personnel can diminish the health care experience and even harm patients. Complaints, aside from other means for redress, may then be brought against health professionals by the offended parties. Being a crystallization of patients' appreciation of apparent service provision oversights, such complaints have been shown to provide important insights on the interrelated concerns of professionalism, patient safety, and quality of care.[8-10] Among other concerns, a comprehensive review of these complaints can define the extent by which professional standards of health practitioners are met and how these affect the provision of health services. The nature and handling of these complaints vary across settings. This is apparent even among Asian countries, given the differences in the prevailing legal or ethical norms, socioeconomic milieu, and even cultural preferences.[11-15]

In Southeast Asia, the Philippines is noteworthy for its health workforce. It has the largest number of physicians, nurses and midwives, sizable even on a per capita basis, among the countries in the region.[16] From a global standpoint, the Philippines is a dominant supplier of health professionals, particularly nurses, for many receiving countries.[17] The Philippines has also been described as having a health regulatory system that has a middle-of-the-road maturity, when compared to other Asia-Pacific countries.[18] The statutory regulation of health workers is centered on the Professional Regulation Commission (PRC). It is an autonomous government agency that is authorized to set training standards and grant licenses to qualified professionals, including health care providers.[19] The licenses are prerequisites for local clinical practice and even for foreign work placements. Private professional organizations, notably those established by medical specialties, have independent self-regulation arrangements for their members. The Department of Health (DOH) sets manpower standards for hospitals and clinics and administers personnel

under its direct employ but does not have any general health professional regulatory responsibility.

The PRC has several constituent Boards which oversee respective professions, including the following health-related occupations: Dentistry, Medical Technology, Medicine, Midwifery, Nursing, Nutrition and Dietetics, Optometry, Pharmacy, Physical and Occupational Therapy, Psychology, Radiologic and X-Ray Technology, and Respiratory Therapy. As the agency also has quasi-judicial functions, its Boards receive, process, and adjudge complaints from the public against health personnel who are either in the process of seeking licenses or are already registered professionals, as well as non-qualified persons who illegally render health services. Complaints lodged with PRC against professionals may relate to adverse patient events or incidents involving supposed inappropriate or immoral behavior in non-health care situations. In the Philippines, complaints concerning the former may be legally considered as negligence cases. These may be pursued with the PRC as administrative cases, or, separately, for civil damages or criminal penalties in regular courts.[20] The PRC only metes out administrative penalties, with license revocation being the harshest. Still, with proceedings in regular courts deemed to be more expensive and protracted, the PRC would be the most convenient route for filing charges against health professionals. Nonetheless, the PRC has procedures similar to those of regular courts.[21] If no conciliation is achieved, hearings proceed and are conducted by a Board member of the same profession as the implicated providers. Complainants and respondents need not be represented by legal counsel although they have a choice to be represented by one.

There is no national registry for ongoing legal cases in regular courts, including those concerning medical negligence or malpractice. There is likewise no central database for complaints against health workers filed in individual health facilities or other venues. The PRC is therefore the default national repository of complaints against licensed professionals and thus provides a unique yet untapped source for obtaining data and insights on what patients or other parties consider to be lapses in professionalism among health workers and determine the implications of these on overall health service quality and safety.

A study was therefore undertaken to assess the status of professionalism and the related concerns of patient safety and quality of care in the country

from the inverse context—from patients' complaints with the PRC that are supposed to document lack or absence of professionalism. This report has the following specific objectives: 1) describe the patterns of PRC complaints against health personnel, with emphasis on those directly related to patient care; 2) identify the correspondingly common or important lapses in professionalism among the involved health care providers or professionals; 3) compare the administrative outcomes between cases which were directly related to patient care and those which were not, and; 4) infer the critical areas in the regulation of health professionals in the Philippines.

METHODS

The study involved a retrospective records review, specifically of the files of complaints against health professionals kept at the PRC. The research protocol was developed in coordination with the PRC, primarily to work out confidentiality and security arrangements, and was reviewed and subsequently approved by the research ethics board of the authors' university. Only those cases implicating health professionals that were accepted by the legal unit at the main PRC office from 1 January 2013 to 31 December 2016, and which could be made available by the same office during the 2 May to 29 September 2017 review period, were included. A supposedly small number of cases which were with the regional PRC offices were excluded from the study.

Using the PRC electronic master list of received complaints as reference, the corresponding case files were requested from the legal staff. Based on the written complaints as well as any supporting documents (including those submitted by the respondents), the research assistants wrote case summaries. For patient care-related cases, additional details were obtained and entered in registry forms, with items loosely based on a JCAHO (Joint Commission on Accreditation of Healthcare Organizations) framework.[22] There were several encoding rules which were adopted, such as case registration being based on individual events (rather than, for example, multiple case entries for different providers but involving the same incident); limiting the listed facility to that which was primarily related to the event (and not the subsequent referral sites); and denoting a single count for providers under the same profession or physician specialization (thus, if several physicians and nurses were implicated in a particular event, only one count would be tallied for each provider type).

The case files were reviewed and the registry forms were accomplished only at a designated secure room within the PRC premises.

The registry data, expunged of all personal and institutional identifying information, were encoded in a secure online spreadsheet. Microsoft Excel and Epi Info 7 software were used to generate frequency distributions and summary figures. The case entries were individually reviewed, details were verified, and the corresponding causes for the patient-related events were deliberated on by the investigators. Cases requiring more nuanced assessments were referred to clinical specialists. Investigators and specialists were inhibited from reviewing any cases which they had been directly or implicitly involved in. Though the cases were evaluated objectively, there was partiality for the patient's perspective in contradictory instances.

RESULTS

Based on the PRC master list, there were 597 filed complaints that implicated health professionals from 2013 to 2016. Of these, only 60%, or 358 cases, could be made available for review. The highest yield was in 2015, at 100%, and the lowest was in 2016, with only 35% of the complaints retrieved. There was nearly an equal number of the compiled cases which were directly concerned with patient care events and those which were not (see Figure 1).
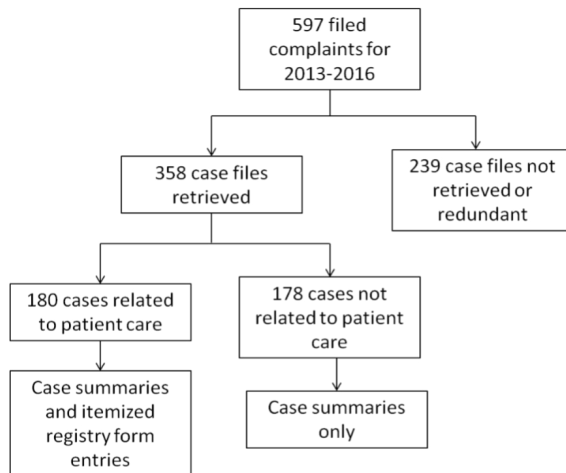

Figure 1. Collection of cases from complaints filed with the PRC against health care providers

Patient Care Events

Most of the complaints which concerned patient care involved adults, with a slight preponderance of females. A large majority of the patients required therapeutic interventions, which also included those for cosmetic and rejuvenation purposes (see Table 1). Deaths as well as resultant moderate or severe physical incapacitation were reported in the majority of the patient care-related complaints. Psychological harm was less often alluded to (see Table 2). A few of the unfortunate outcomes occurred under seemingly disconcerting circumstances. These included the following illustrative cases: maternal deaths from uterine rupture or massive post-partum haemorrhage; unattended recovery room mortalities; post-procedural blindness; severe reactions to non-conventional therapies; and offensive sexual behavior. Most of the incidents occurred in hospitals, particularly in tertiary centers.

Table 1
Distribution of allegedly harmed patients, by selected characteristics, PRC Health Board complaints, 2013-2016

Category	Group	Frequency	%
Age Group (n=180)	Minor (0-17 years old)	33	18%
	Adult (18-59 years old)	108	60%
	Elderly (≥ 60 years old)	35	19%
	Not Specified	4	2%
Gender (n=180)	Female	93	52%
	Male	84	47%
	Not Specified	3	2%
Care Requirement (n=197)*	Therapeutic	163	91%
	Diagnostic	16	9%
	Cosmetic	14	8%
	Rehabilitative	2	1%
	Not specified	2	1%

* category assignments are non-exclusive, with some cases having more than one care requirement

Table 2
Distribution of patient care-related events, by alleged harm, PRC Health Board complaints, 2013-2016

Alleged Harm	Frequency		%
Physical Harm (n=180)	Death of a complainant's family member	58	32.22
	Moderate to Severe, Permanent	35	19.44
	Moderate to Severe, Temporary	26	14.44
	Moderate to Severe, Unknown Duration	18	10.00
	Minimal, Temporary	12	6.67
	Not Specified	6	3.33
	Minimal, Permanent	3	1.67
	Minimal, Unknown Duration	2	1.11
	None	20	11.11
Psychological Harm (n=180)	Present, Unknown Duration	41	22.78
	Present, Temporary	5	2.78
	Present, Permanent	4	2.22
	Not Applicable or Not Specified	130	72.22

Dental and lying-in clinics were also relatively common sites for adverse events. There were, in cumulative terms, an ample number of cases involving smaller facilities, such as stem cell clinics. Patients' homes, with health workers in attendance, were the sites of untoward events in some cases (see Table 3).

Table 3
Distribution of patient care-related events, by reported location, PRC Health Board complaints, 2013-2016

Health Care institution	Frequency		%
Hospital (n=128)	Level III	54	30.00
	Level II	35	19.44
	Level I	37	20.56
	Unspecified hospital	2	1.11
Other Health Service Facility (n=42)	Dental clinic	17	9.44
	Lying-in clinic	10	5.56
	Cosmetic surgery/ Dermatology clinic	3	1.67

	Mall clinic	3	1.67
	Private clinic	3	1.67
	Eye clinic	2	1.11
	Stem cell clinic	2	1.11
	Pharmacy	1	0.56
	Work place clinic	1	0.56
Other Venues (n=7)	Home	5	2.78
	Hospice	1	0.56
	Medical Mission	1	0.56
Not specified		3	1.67

Physicians were the object of complaints for most patient care cases. Dentists, nurses, and midwives accounted for smaller but still substantial number of incidents. There were only very few complaints against other health professionals (see Table 4). The respondents were specifically identified as students or trainees in eleven cases. A handful of complaints also referred to physicians in their capacity as facility administrators. There was, in accordance with the JCAHO framework, an extensive listing of apparent errors by health professionals. A summary of the leading types of errors committed by selected professionals is provided in Table 5. While intervention-related problems were more common among physicians and dentists, communication errors were foremost for nurses and midwives.

Table 4
Distribution of patient care-related events, by type of allegedly involved health professional, PRC Health Board complaints, 2013-2016*

Health Professional	Frequency	%	
Physician		143	72.59
	Surgery	31	
	Obstetrics Gynecology	26	
	Internal Medicine	21	
	Pediatrics	15	
	Anesthesiology	11	
	Ophthalmology	7	
	Orthopedics	6	
	Radiology	5	

Emergency Medicine	4	
Primary Care	3	
Otorhinolaryngology	3	
Dermatology	2	
Pathology	2	
Psychiatry	2	
Family Medicine	1	
Neurology	1	
Rehabilitation Medicine	1	
Not Specified	2	
Dentist	19	9.64
Nurse	17	8.63
Midwife	10	5.08
Radiation Technologist	2	1.02
Pharmacist	2	1.02
Medical Technologist	2	1.02
Physical Therapist	2	1.02
Optometrist	0	0.00
Total	197	100.00

* more than one type of professional in some cases

Table 5

Percentage frequency distribution of patient care-related events, by leading inferred error types and selected professions, PRC Health Boards, 2013-2016

Physician		Dentist		Nurse		Mid-wife			
Error Type	% Freq	Error Type	% Freq	Error Type	% Freq	Error Type	% Freq	Error Type	% Freq
Correct Intervention, with Complication	12%	Correct Intervention, Incorrectly Performed	15%	Inappropriate or Disrespectful Comments	15%	Questionable Advise or Interpretation	15%		
Questionable Advise or Interpretation	9%	Questionable Advise or Interpretation	10%	Questionable Advise or Interpretation	10%	Correct Intervention, with Complication	12%		

Questionable Tracking or Follow-Up; Omission of Essential Procedure	6%*	Questionable Disclosure; Correct Intervention, with Complication	10%*	Questionable Tracking or Follow-Up	10%	Inappropriate or Disrespectful Comments; Insufficient or Questionable Use of Resources; Inaccurate Diagnosis	9%*
* percentage value applies equally to the error types listed for the third tier of the category							

Even as the actual complaints were against professionals, the investigators figured that many of the adverse events were attributable, concurrently or independently, to systems deficiencies (see Table 6). Foremost among these were the apparent absence or inadequacy of clinical or administrative protocols in the health facilities. Instances occured wherein health staff were deemed to be indifferent to patients' needs, epitomizing attitudinal deficiencies from defective organizational cultures. Physical inadequacies, such as the lack of equipment in smaller facilities, were also found to be contributory to adverse patient events. There were a few cases wherein external factors, such as facility incapacitation due to typhoons, were also at play.

Table 6

Distribution of patient care-related events, by attributed causes, PRC Health Boards, 2013-2016*

Attributed Cause	Frequency		% for Group	
Systems	**Organizational**			
		Service Protocols/ Processes	71	39.01
		Administrative Procedures	41	22.53
		Organizational Culture	40	21.98
	Technical			
		Facility	27	14.84
		External	3	1.65

Human	Health Professional		171	74.35
		Rule-based	109	
		Knowledge-based	71	
		Skill-based	59	
	Patient		48	20.87
	Other Person		11	4.78

* more than one cause attributed in some cases

Nevertheless, specific persons were identified by the investigators as either being primarily responsible for or contributory to the supposed incidents. The actions of the practitioners accounted for the vast majority of these cases. Their apparent errors were further attributed to non-observance or lapses related to the applicable rules, knowledge, or skills. Patients themselves accounted for the next tier. In the respective cases, the investigators surmised that the severity of the patients' medical conditions was a primary factor that had caused the reported adverse outcome. A few of the supposedly untoward cases were deemed to be contentious mostly due to the divergent perceptions or expectations of the patient's relatives and other parties who considered the actions of the health professionals as inappropriate or detrimental, but these claims could not be substantiated by the investigators.

Non-Patient Care Events

For the 178 cases which were not directly related to patient care, only the alleged offenses of the professionals were tallied. As classified in general terms, and ranked in decreasing frequency of cases, the leading infractions were as follows: marital infidelity (29%), swindling (19%), misrepresentation/falsification (15%), inter-professional conflict (7%), and sexual harassment/violence (4%). Among the complaints were those lodged by the Philippine Health Insurance Corporation (PhilHealth), the country's social health insurance agency, and pertained mostly to supposedly bogus procedures.

Regulatory Outcomes

Most of the cases which were included in this study were ostensibly still undergoing hearings, or had not yet otherwise been decided upon by the

respective PRC Boards (see Table 7). A majority of the resolved cases did not beget any regulatory sanction, having been dismissed by the Boards or because the contending parties had apparently reached amicable settlements. In only a few cases were penalties meted out against health workers. There were fewer providers penalized, and the disciplinary actions were also much less severe among the adjudged patient-related cases.

Table 7
Distribution of patient care-related events, by outcomes and main event types, PRC Health Boards, 2013-2016

Case Status		Patient care events		Non-patient care events	
		n	%	n	%
Ongoing		91	51%	83	47%
Dismissed/ Settled		86	48%	74	42%
Penalty for Professional	Reprimand	3	2%	1	1%
	Suspension			6	3%
	Revocation of license			6	3%
	Other/ Unspecified			8	4%

DISCUSSION

A premise of the study is that the PRC provides a comprehensive patient complaints resource, providing a bellwether of health care professionalism, safety, and quality. But while the PRC may be the least expensive route, the process can still be financially burdensome particularly for poor families. This would have deterred them from filing complaints, especially for less serious incidents. Some events may, for various reasons, including non-recognition, have not been pursued at all. Studies in other Asian countries have shown how cultural preferences and social gradients deterred complaints from filing, a phenomenon which could just as well apply to the Philippine context.[23-25] Many untoward events could have also been

addressed in other venues, such as within the concerned hospitals. Civil and criminal suits could have also been filed in regular courts, even among those who had already filed complaints with the PRC. There may have been divergent case details and outcomes for these venues, but these were beyond the study's scope. These issues could have contributed to the total number of PRC-tendered complaints, being low relative to the figures reported for other countries, considering the overall count of the country's health professionals.[11,15, 26]

The study had additional intrinsic limitations. A good number of complaints could not be provided by the PRC, affecting the quantity and quality of the available data. For the complaints which were included, the findings and inferences were gleaned from abstracted files. Relevant but undocumented details would have therefore been missed. The practitioners cited in the complaints were aggregated and not individually counted, leading to lower tallies of implicated professionals. In compliance with privacy and confidentiality restrictions, not only were the identities of specific persons or institutions withheld, but relationships between surmised lapses and Board decisions could also not be delved into. These logistical and methodological factors would have affected the study's findings, leading to, among others, differences in attributions of accountability and due sanctions with those decided upon by PRC Boards.

The large number of mortalities, and severe morbidities, that were collated among the care-related events are consistent with a "tip of the iceberg" complaints-filing bias. It would have been expected that the more serious cases were to have been complained about. It was in anticipation of this occurring that the JCAHO framework, with its added focus on the safety and quality dimensions of health services, was utilized in data collection and processing.[22] The identified errors and their inferred causes were thus not only attributed to individual professionals, but also to systems lapses that undermined the quality and safety of patient care.[8,9,26] Some adjustments in the framework were adopted, such as additional error categories (e.g., inappropriate statements), to also reflect local quality of care concerns. The non-patient care cases were not segregated to the same extent as, while providers' professionalism may have been questioned, the events would not have as direct a bearing on patient safety and quality of care. These would,

therefore, not have provided added insights on professionalism or patient care concerns at the systems level.

The demographics of the patients in the safety events are consistent with documented health care demand patterns.[27] The higher proportion of female patients is due to a good number of reported mishaps involving obstetric care. That therapeutic interventions were predominant is also to be expected, as patients are more likely to seek such services from health professionals – and do so in the hospital setting. Higher level hospitals would have dealt with more serious cases, which, due to the complexity of required care, would have been anticipated to have more complaints. The researchers did identify such cases primarily in tertiary hospitals, wherein the unfavourable outcomes of some patients were mostly attributable to the gravity of their conditions. There were cases wherein the patient's status was apparently compromised by care given at lower echelon facilities, but the staff at the receiving hospital got to be blamed for the patient's deterioration. The contrary expectation would also be that lower level facilities – which presumably dealt principally with less morbid cases – would have had fewer safety events. The investigators were nonetheless struck by an array of morbidities and mortalities which were specific for smaller scale facilities. These ranged from problems attendant to cosmetic procedures, to those related to obstetric cases. Adverse events that occurred in lower level settings were often due to lack of adequate equipment. Among the very few cases involving malicious actions on the part of practitioners, the small staffing pattern in smaller facilities would seem to have contributed to opportunities for such incidents. There are also inherent ambiguities in assigning accountability in these specific contexts, such as the incidents that involved close patient contact as well as unproven treatments, as have been previously raised.[28,29]

Physicians were by far the providers who had the most complaints. They had either directly provided health services, or overseen such. In a minority of cases, the physicians were implicated in their capacity as administrators of health facilities. The complaints had to do mostly with perceived failures in these roles. Procedure-based specialists comprised the majority of those cited, in line with what has been reported in foreign literature.[30,31] The study pointedly reveals though that physicians, for the most part, performed the appropriate interventions but complications ensue. Such suggests that the

informed consent process was wanting in many instances, with physicians not having relayed realistic risks to patients and family members. While few, and therefore not highlighted with the leading errors, there were cases wherein unproven therapies were administered by physicians, with severe consequences on patients. Diagnosticians had also been found wanting, in that wrong information was relayed. Patients also found the apparent dismissive attitude of physicians objectionable. While not having really caused physical harm, these oversights nevertheless created a hostile environment which further compounded the felt gravity of the actual or perceived safety event.

Cosmetic interventions were sought from most of the concerned dentists, and a skill-based cause was inferred for most of the dental cases. On the other hand, nurses had more communication-related errors, including the most complaints concerning inappropriate comments. Nurses for the most part have a supportive role in health care. In the hospital setting, they would have the most patient contact among the health professionals. Communications skills are therefore important. While uncalled-for remarks may not be directly injurious to patients (but can, as discussed earlier, aggravate already detrimental circumstances), the importance of proper and adequate exchange of information in specific situations, such as in reported patient handover incidents, cannot be underestimated. Midwives perform both procedural and assistive roles in caring particularly for obstetric patients. The cited errors involving midwives were therefore a mix of those alluded to for the preceding procedure-based as well as support-centred professionals.

Trainees constituted only a small fraction of the health providers implicated to in the safety events. However, the study presents an underestimate of the involvement of trainees. The designation and tally of trainees were based on what were stated in the complaints. In accordance with the recording rules of the study, only one count in a respective medical specialty could be given even if, for example, several residents training in the same field were mentioned. What is more problematic, however, is that patients or family members may not have known, or at least not indicated, that the health providers they complained of were actually trainees. The position of trainees makes them vulnerable to being involved in safety events. Even as they may not possess all the essential knowledge and skills, they may

have to provide front-line services to patients, often under urgent care or resource-constrained situations. That adverse events involving trainees can and do happen and calls attention to the need for more adequate supervision, whether by direct or vicarious means (e.g., ready and responsive protocols).

Lapses in protocols and processes were the leading system-related causes for most institutions. These concerned clinical management protocols, which, for the greater part, were either breached or non-existent. Management operations as well as organizational culture were also wanting in some cases. Management flaws refer to inefficiencies or ineffectiveness of administrative or organizational systems and processes. These occurred more in higher level facilities, possibly due to their more complex services. Cultures which were inimical to patient safety were more rife in lower level facilities. It is apparent that different health care environments, with the corresponding health staff complement, bear upon health care safety and quality.

The categorization of cases in this study provides a convenient dichotomy of the key dimensions of professionalism that apply to health personnel. On the one hand are those for which the related lapses have a more immediate affinity with patient care, such as those concerning technical competency as well as ethical and compassionate practice. These aspects have been the onus of prior studies and pronouncements regarding professionalism in health services.[1-4,32] The other group of complaints were lodged against providers for supposed immoral conduct, even as the acts in question were not directly related to the actual provision of health services. These kinds of complaints have not received as much attention in the related regulatory literature.[33] The PRC's mandates have consistently referred to professional and ethical (which, among physicians, refers mainly to professional ethics, as expounded in the Code of Ethics of the Board of Medicine) lapses as grounds for administrative complaints.[19,21] Immoral behavior, and other non-patient care-related basis, were only specified in the PRC rules on investigations, which has since been revised.[34] It would seem then that an expanded social contract is tacitly upheld by the PRC, wherein providers are expected to not only be technically competent but also to abide by social conventions and laws conscientiously, in line with their stature as professionals.

Given the frequency and severity of the reported adverse events, the relatively benign administrative outcomes for patient care cases seemed to be incongruous. Nonetheless, as earlier discussed, circumstances other than those

attributed to health professionals may have also been borne upon many of these cases. Likewise, it must be noted that not every adverse event that occurs in the course of treatment is necessarily a result of provider error, and even the occurrence of the latter does not always equate with the administrative or legal requirements of professional negligence.[20]

Still, some patient care cases were deemed by the investigators to be attributable to grave professional shortcomings, such as those involving erroneous interventions. There were also cases with apparent serious ethical lapses and even deliberate malice committed by health care providers. It would have been therefore expected that, even with due consideration of the study's limitations as well as the occurrence of extenuating circumstances, there would be more cases deserving of sanctions, and possibly harsher ones at that, against the professionals with patient care-related complaints. The mostly non-punitive outcomes for the latter that may have involved amicable settlements may have been mutually agreeable, and, any compensations provided to the aggrieved parties would have also effectively penalize culpable practitioners. Such, however, can work against giving due recognition to the gravity and frequency of providers' errant behaviors, particularly for cases amounting to professional negligence. There is therefore some cause for concern in having less and lighter penalties meted out for patient care cases, as compared to the other set of complaints.

The evident discrepancy may be attributed to several factors. There may have been a greater inclination for patients or their affected family members to settle, or alternatively, for Health Boards to dismiss or give lighter penalties for patient care cases. On the other hand, parties involved in non-patient care incidents may have been more recalcitrant with their positions (e.g., cases involving fraudulent financial transactions), with complainants more determined to seek punitive actions. These are but conjectural, however, and will therefore need to be better elucidated in subsequent studies. Previous reports, conducted over a variety of settings as well as administrative and legal venues, also demonstrated that only a minority of implicated health professionals, particularly physicians, ended up being penalized.[26,35-37] Problems related to conflicts of interest involving health professionals, as well as unjust structural arrangements, may work against complainants.[35,36] The current PRC system, with hearings and deliberations undertaken only by Board members of the same profession as

the plaintiffs and the often circuitous complaints and hearing process, may engender these dilemmas.   In the context of perceived deficiencies of the legal or administrative regulation of health professionals in other settings, the Health Court concept, wherein health professionals adjudicate, has been raised.[35,36] To some extent, with health professionals themselves conducting the trials, the said approach is already in place in PRC. While such an arrangement more readily ensures an appreciation of technical details, this also begets questions of partiality. A more inclusive composition may be considered, with non-health persons participating in Board deliberations to better achieve balanced inquiries and decisions.[37,38]

Though the collected complaints may not provide a sufficient representation of adverse patient events in the country, these are still compelling, and should therefore not be taken for granted. Efforts are needed to ensure the technical proficiency of health personnel as well as to instill other equally important yet apparently overlooked aspects of professionalism. Thus, for instance, the value of proper communication, as exemplified by the informed consent process, should be given more attention. This would be in line with universal ethical standards as well as local legal precedents.[20] As averred to in this study, the types of professional lapses vary across different groups of practitioners. Corrective measures thus have to also be adjusted accordingly. Further studies are needed to clarify the determinants and validity of the PRC decisions. These are needed to better guide the subsequent introduction of appropriate corrective measures. A reexamination of the mandates of the Health Boards may need to be undertaken, if only to thresh out their judicial scope. Limiting their administrative adjudication to breaches of professionalism that are clearly related to patient safety or quality of care, an option which is still in line with the Board's existing mandates may be a recourse.[19,21] The regulatory function of the PRC also goes beyond the determination of unprofessional behavior and imposition of corresponding disciplinary action. Its Health Boards have the agency to influence training standards, thereby prospectively advancing professionalism among health personnel. Thus, for example, more emphasis can be given to the teaching of ethics in the undergraduate curriculum. Similarly, professional ethical principles can be highlighted in licensing examinations, license renewal as well as re-acquisition requirements.[26,39] To the extent that standards and processes can be improved, the PRC can

also participate in international initiatives concerning health workforce regulation.[13,18,40]

While concerns regarding the effectiveness of PRC need to be addressed, it must also be recognized that regulation is but one of several levers that needs to be utilized if significant improvements in professionalism, patient safety, and quality of care are to be achieved. The DOH can take the lead in putting systems-level mechanisms in place for this purpose.[41-43] A network can be forged, incorporating the DOH, PRC, educational institutions, professional organizations and even judicial courts. Such will allow, for example, the occurrence of exceptionally disconcerting events to be expeditiously communicated, regardless of the administrative or even legal venue or status, and to have corresponding remedial measures undertaken in a timely and comprehensive manner. As a case in point, the adverse obstetric events brought before the PRC could have been raised with other bodies. Integrative approaches may then be worked out to prevent untoward obstetric events and thereby also contribute to addressing the still high maternal mortality rates in the country.[44]

CONCLUSION

The regulation of health professionals can be difficult in many countries, and the Philippines is no exception to this. The Health Boards of the country's Professional Regulations Commission are important channels for administrative complaints against health providers. Though the number of complaints seem to still be relatively small compared to the overall health service and human resource capacities, many of the attendant events were inimical and tragic for the affected patients and their families. Many of these events could have also been made preventable by adopting systems and cultures that promote professionalism and consequent greater emphasis on patient safety and quality of care. The study shows that while few complaints resulted in professionals being penalized, those unrelated to patient care had relatively more frequent and severe sanctions meted out on them. This implies a double standard that may translate to ineffective health professional regulation. The system therefore needs to be reformed, not just to more effectively sanction apparent provider errors, but more so to contribute to improvements in the overall delivery of patient care.

The ascendance of a more responsive regulatory system, anchored on an enhanced PRC, is vital in promoting professionalism among the country's health workers. Considering their extensive presence, these developments can be expected to greatly contribute to the provision of effective, safe, and quality care across the full spectrum of health service settings.

DISCLOSURES

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Automated Teachers No More: A Closer Look into Teachers' Role in Postmethod Era

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This paper discusses the perceived roles of teachers explicated from the principles of postmethod pedagogy proposed by Kumaravadivelu (2001). This review of an article published in TESOL Quarterly Vol. 35, No. 4 by Kumaravadivelu (2001) entitled *Toward a Postmethod Pedagogy* highlights some salient points and directions set by postmethod as a response to increasing dependence on method-based language teaching. Here, we situated the facets of postmethod in the Philippine setting as well as experiences from other foreign language classrooms. The focus of the review was on the perceived roles of English Language Teachers (ELT) in the postmethod era. There are three derived key characteristics of teachers: postmethod teachers are autonomous, they have a sense of plausibility, and they are educators who legitimize voices and visions of prospective teachers. In brief, teachers in the postmethod have to be theorizers of their practices. Reflective teaching must be emphasized to address issues in the classrooms. Since no method is considered best, teachers should reconsider developing their own contextualized strategies to maximize learning opportunities.

Keywords: *Postmethod, Autonomy, Plausibility, Language Teaching*

BACKGROUND

Finding the best method is thought to be an integral part of language education. In the last two decades, a dramatic shift in language teaching is observed particularly on which 'Methods' are deemed effective. However, Prabhu (1990) contrastingly emphasized that no single method is best for all

because the 'best method' is relatively dependent on the classroom contexts. In this sense, we could say that no particular method should fit a general classroom situation. Similarly, every classroom is unique and within which are varied groups of language learners coming from diverse linguistic and cultural backgrounds.

The concept of method is criticized by Kumaravadivelu (2001) who stated that methods have 'limiting and limited effects' both on the teachers and learners of the language. Methods may provide guiding principles; however, they may fail to offer context-specific situations among teacher-practitioners. Methods should not be synthetically transplanted into the classroom thus swaying away from the prescriptive and 'mechanical' nature of methods to a 'real' language learning and teaching experience. Therefore, teachers should develop language teaching approaches that could permit them to be themselves and do what is appropriate and necessary (Brown, 2002).

Hence, this critical commentary will explore the perceived roles of teachers in the postmethod era and does not include relevant criticisms towards postmethod pedagogy.

SUMMARY OF ARTICLE

The shift of perspectives from method to postmethod has assigned different roles to language teachers. It is extremely difficult for teachers to contest which 'Method' is most appropriate in every teaching situation. Kumaravadivelu (2001) published an article in TESOL Quarterly where he conceptualized the parameters of postmethod pedagogy and discussed the roles of learners, teachers, and teacher educators as postmethod practitioners. The focus, however, of this paper is on the perceived roles of teachers and teacher-educators in the move towards postmethod era.

Since postmethod looks into the localization of experiences in the classroom and the involvement of social and political ideologies, there is a need to redefine what exactly the roles of teachers are. Therefore, postmethod teachers are deemed to be autonomous (Kumaravadivelu, 2001), to have a sense of plausibility (Prabhu, 1990), and to be persons whose voices and visions are recognized and whose knowledge and experiences are legitimized.

COMMENTARY AND DISCUSSION

The following discusses the perceived roles of teachers in the postmethod era as presented in Kumaravadivelu's (2001) article.

Postmethod Teacher is Autonomous

Autonomy is central in postmethod that Kumaravadivelu (2006a) referred to it as 'the heart of postmethod pedagogy.' In this context, teacher autonomy connotes competence and confidence on the part of the teachers in building and implementing their theory of practice (Kumaravadivelu, 2001). The prior and current knowledge of teachers are recognized, as well as their potential to act and teach independently (Chen, 2014). Consequently, this promotes teachers' ability to develop reflective teaching which is critical in the process of creating changes in the classroom and in analyzing and evaluating their effects.

Reflective teaching, as a sign of the autonomous role of postmethod teacher, is integral especially in the field of language teaching. Owing to the principles and standards of TESOL, teachers are expected to demonstrate and apply knowledge of various factors and contexts (dynamic academic, personal, familial, cultural, social, and socio-political) on English language learners and language learning (TESOL International Association, 2017). Language teachers should reflect on the personal and academic characteristics of students to develop effective instructional and assessment practices in recognizing how their identity, role, culture, and biases impact the interpretation of English language learners' strengths and needs. Adjusting their teaching to the social and cultural context of students leads to the 'localized' language pedagogy (Lusianov, 2020). Kumaravadivelu (2006b, p. 173) emphasized that postmethod teachers should "theorize from their practice and practice what they theorize."

Teachers' autonomy in postmethod era would be effective as it sounds. However, there are constraints especially to preservice teachers and teachers whose view on critical language pedagogy is narrow. In a study conducted by Amiri (2018), he endeavored to unveil the perspective of Iranian EFL teachers concerning the applicability of the postmethod pedagogy. Findings indicated the absence of required autonomy among teachers. They claimed

to have no available time to participate in decision-making activity with regards to the overall process of teaching. The problem with this is a result of the lack of opportunities for teachers to design and decide on the content of the syllabus.

Similar to the Philippines, the Department of Education provides all guidelines on language policy. By reviewing all these, there are three identified dominant English Language Teaching (ELT) practices in the Philippines according to Martin (2014): Communicative Language Teaching (CLT), English for Specific Purposes (ESP), and Task-Based Language Teaching (TBLT). There are criticisms provided on the use of these approaches, however. Generally, the assumptions set by these ELT approaches are not neutral and universal and may or may not be applied to the unique contexts of teaching and learning English in the Philippines. Persistently using those approaches will have negative effects on the students because the practices accompanied by these language teaching approaches promote 'native speaker' norms (Martin, 2014). So, if teaching autonomy is practiced in the Philippines, language practitioners should receive ample opportunity to effect modifications on the curriculum and the way language skills are assessed for example. Cases of standardized exams measuring only content knowledge of language must be deemphasized, and focus should be lifted towards the acquisition of communicative skills.

In the study of Bacus (2021) conducted among Grade 10 students in the Philippines, teachers were identified to be leaning towards the parameter of postmethod. According to her, there were practices of developing contextualized activities for students and not using a particular method in the class, thus showing teachers' control in class. In foreign classrooms, however, research studies show contrasting results. A study conducted by Motallebzadeh et al. (2017) indicated that Iranian EFL teachers do not show a significantly high level of willingness and conformity to the principles of postmethod pedagogy which includes the principle of autonomy. This is consistent with the results gained by Khany and Darabi (2014), Razmjoo, et al. (2013), and Mardani and Moradian (2016), who confirmed that postmethod pedagogy is not highly applied in EFL Iranian classes. Furthermore, Pishghadam et al. (2009) and Pourali (2011) asserted that Iran's educational system is still under the influence of Behaviorist view of learning. The same finding presented by Safari and Rashidi (2015) indicated

that most teachers in Iran lack skills, knowledge, and autonomy. This lack of autonomy is brought about by the prevalence of 'banking education' (Safari & Rashidi, 2015).

The autonomous role of teachers in the postmethod era offers hopes of getting away from traditional perspectives of language teaching. However, teachers' willingness to adopt the changes shows significant inconformity. Lack of training and opportunities for language teachers to practice autonomy especially on the evaluation of classroom curriculum can be attributed to that. In addition, the nature of the curriculum itself does not recognize the professional autonomy of teachers to exercise their ability to evaluate the programs. A striking comment comes from a teacher-practitioner (Amiri, 2018), who said that the concept of teacher autonomy is neglected in Iran's EFL context as teachers are supposed to follow predefined syllabus prepared for them.

Postmethod Teacher has Sense of Plausibility

One important facet of postmethod is the conceptualization of localized strategies and techniques which fit classroom-specific situations. When teachers are confined only to top-down syllabuses, teaching becomes more synthetic and mechanical rather than real. Teachers even do not have the chance to involve themselves in the reformulation of syllabuses and become passive recipients of knowledge which is automatically transferred to students which in turn solidify their learning experience into a predesigned sequence of thoughts and ideologies. With this, Prabhu (1990) asserted that teachers need to possess a 'sense of plausibility' to enhance the process of teaching.

Sense of plausibility is the product of teachers' gained experiences and varies from one teacher to another. Prabhu (1990) maintained the idea that teachers build their theories of teaching and learning through a continuing process of reflection on life experiences. The experiences teachers have in the past (e.g., their preservice years) greatly affect their sense of plausibility. However, almost all higher education institutions treat prospective teachers to be clean slates, therefore are ought to receive inputs from their teacher educators. Preservice teachers are taught and trained to do things by the book, following suggested pedagogical principles from experts resulting in

shaped behavior. This is the reason why Kumaravadivelu (2001) asserted that this kind of preservice education is hopeless and that student teachers should not be seen as clean slates. To quote verbatim, Prabhu (1987, p.1) explained that "the development of competence in a second language requires not systematization of language inputs or maximization of planned practice, but rather the creation of conditions in which learners engage to cope with communication."

In the Philippines, preservice education faces different challenges. One of which is the lack of teaching resources and teaching strategies (Ulla, 2016). In an interview conducted with some student-teachers of BSEd and AB English courses about their reasons for using particular techniques and strategies in their actual classroom teaching, they revealed to just be imitating what they observed from their teacher educators. There is a lack of resources for them to make their lessons effective and enjoyable other than what they had already known and learned. And this eventually leads to the recycling of learned strategies and methods during their practice teaching years (Ulla, 2016).

Furthermore, Prabhu (1990) believed that classroom rapport is achieved when teachers engage their sense plausibility. Teachers can look into the depth of situations and involve students in crafting possible theories and apply such to achieve effective learning. Also, the considerations of students' needs are put on a pedestal, unlike adhering only to curricula that are written by experts. In fact, Rogers (2010 as cited in Ahmadian, 2014) argued that simply the imposition of any type of top-down syllabus exerts an external agenda on learners and does not regard their interests; in other words, it is external to learners rather internal; as such, this kind of syllabus by itself does not serve the postmethod purpose(s). In a study conducted by Seidi (2019), it was found out that teachers' sense of plausibility is not given importance. Public schools in Iran are somehow independent of the policies of the Ministry of Education in terms of their textbooks and methodology. Textbooks are designed and administered by the Ministry of Education, so the teachers are expected to manage the classroom to fulfill the textbooks needs. Unfortunately, as well, language institutions consider their activities more as a business than teaching as a very precious job.

However, in the Philippines, public school teachers practice the sense of plausibility in crafting their instructional materials. DepEd schools

outside Manila developed what they call 'big books.' These 'big books' contain indigenized stories reflective of the sociolinguistic realities of the students, and teachers who are doing it ensure the success of ELT in their classrooms (Martin, 2014). As teachers of English as Second Language (ESL), the adjustment of instruction based on the quality of students' responses should be given emphasis. Effective teaching occurs when teachers evaluate what students know and what they do not know real-time. Most importantly, teachers must know their learners well by making sure that the curriculum caters to and capitalizes on linguistically and culturally diverse learners. For Filipino language teachers, the materials to be used should take into account the non-native status of Filipinos (Wa-Mbaleka, 2014). So, there must be some accommodations based on SLA theories and models to meet their language needs.

Considering all these, language teachers' sense of plausibility can be beneficial in the language classroom only if it constitutes experiences of teachers that adhere to postmethod pedagogy. Furthermore, this sense of plausibility will become frozen if teachers are to follow some methods turning their teaching 'mechanical' than 'real' (Prabhu, 1990).

Prospective Teachers' voices and visions should be recognized and their knowledge and experience should be legitimized

Since postmethod pedagogy looks into teachers' language training and experiences, their predefined sets of knowledge must be given importance. Their voices and visions become the primary tool to develop meaningful language instruction. The idiosyncratic ideologies should be manifested as a unifying agent towards transformational instruction rather than meaningless proofs of individuality.

As an implication, language education and training in the preservice years should coincide with the postmethod condition. Programs must focus not on the transmission model of training but realistic pedagogy. In TESOL language courses, language training must be viewed as a pedagogy to develop lifelong learning. It is where greater emphasis is on becoming thinking teachers who can theorize practice (Richards, 2010) and on learning through experience in a reflective framework (Wright, 2010 as cited in Eaton et al. 2018). The importance of theorizing practice in a language classroom sheds

light on the significant role of reflective teaching as one of the signature pedagogies of TESOL as it emphasizes the total engagement of teachers that includes collaboration and self-direction. As described by Kumaravadivelu (2001), student teachers need to shift their perspectives from the previously hailed notion of teacher educators as producers of knowledge and student teachers as consumers of it.

In a study conducted by Dela Rosa (2017), he explored the dichotomy of reflective practice between experienced and novice language teachers. Result reveals that experienced language teachers (ELT) display a higher level of reflective practice specifically on showing diligence in completing reflective entries in daily lesson log. This can be noted with consideration to their long years of experience. This is supported by Kumaravadivelu's (2006a) claim that what postmethod pedagogy assumes is that this kind of personal knowledge that teachers develop over time will eventually lead them to construct their theory of practice. The aim of transforming Filipino teachers into reflective practitioners would enable them to produce well-prepared and well-planned lessons that are fundamental to ensuring the realization of quality teaching and learning in schools (Department of Education, 2016).

SUMMARY

This critical commentary explores the tenets of postmethod pedagogy and application in the language classroom. Specifically, this looks into the perceived roles of teachers in the postmethod era: having a sense of autonomy and plausibility and being persons whose voices and experiences are given importance.

Teachers in postmethod era have to be theorizers of their practices. Reflective teaching must be emphasized to address issues in the classrooms. Since no method is best, teachers should reconsider developing their own contextualized strategies to maximize learning opportunities. Specifically, teachers of English as a second language should continue challenging their approaches by learning and developing a personal understanding of what transpires in their classrooms and apply self-inquiry as a tool to effect positive changes in the teaching-learning process.

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Rational Choice and Philippine Politics

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Is there a limit in so far as applicability of Western traditions of theorizing the Philippine and Filipino experience, especially in the aspect of establishing, maintaining, and transforming political order? I would like to argue that there are planes of intersection and applicability in so far as "some" Western traditions of theorizing and the Philippine experience especially in the aspect of establishing, maintaining, and transforming political order. To elaborate, I would like to pay particular attention to the rational choice tradition. Developed by a handful of economists in the University of Chicago, its main assumption is that individuals are self-interested utility maximizers. As a theoretical tool for analyzing political behavior, rational choice employs a linear and simplistic way of analyzing political conduct (Petracca, 1991; Hindmoor, 2010). Rationale choice assumes that the participation of individuals in collective decisions is aimed at increasing his own advantage (Buchanan & Tullock, as cited in Petracca, 1991). To illustrate, when a rational thinker is asked why countries behave in the way that they do, a he or she would simply respond by saying that it is always a question of incentives. Or when the question is asked as to why government cuts taxes

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prior to an election year, a rational thinker would simply say that it was in order to win the election.

Essentially, I argue that the Western idea which points to the political actions of man, which have implications on political order and institutions, and are largely driven by self-interest, fits well with Philippine political relations especially in the local level politics. Reflecting on political participation in the Philippines, I contend that the rational choice perspective is able to account for the prevailing character of local Philippine politics. However, towards this end, I will also attempt to propound that while this perspective can be used as a lens to interpret dominant patterns in local politics, there are limits as to its explanatory power. It cannot claim watertight applicability as it is constrained by its own features and by the unique Filipino core value of "kapwa" captured in the work of Virgilio Enriquez (Enriquez, 1994; Cabral, Santos, Silva, & Torres, 2016).

My attempt to develop a specialization in local Philippine politics has led me to the works of Carle Lande (1964) and other known scholars of Philippine politics. In his detailed account of the structure and nature of Philippine politics, Lande pointed to the misconception people have over the little people in Philippine politics--the masses. They are known to be "mere pawns" in the game of politics in the Philippines which is played by big people--the landlords, the political elites, and the owners of the vast estates in various localities. As puppets and characters are subject to manipulation, they neither know what they want or what their interests are. They simply submit and willingly follow and obey the big people as docile followers. Lande remarked that this is a very erroneous and oversimplified understanding of the ordinary Filipinos. He argued that the little people are conscious of their interests, and they use the power of their vote to advance their interest. This being the case, the little people are not docile manipulated actors. Rather, they are conscious and calculating players of local politics. Taking this queue, I would like to venture into trying to establish this plane of intersection between the rational choice theory and the actions of the actors in local Philippine politics.

The first demonstration of the politics of self-interest in Philippine politics is the pattern of dyadic ties that characterize political relations. Lande (1977) noted that the supportive dyadic relationship became the basis of the patron-client linkages in the country. These dyadic patterns of exchange

have become the vehicles for aid and protection. To James Scott (1972), the dyadic tie between a client and a patron is an effective way of uniting people who are not in any way connected by kinship and is an important element in building "vertical integration." The reciprocity existing in the dyad is such that each actor is able to provide something that is highly valued by the other. A patron is able to secure clients mainly on his ability to provide valuable assistance to the latter. What this demonstrates is a relationship cemented in mutual self-interest. The patron has his own share of interests to achieve, while the client is not a passive participant in the relationship as previously thought. Rather, he is a rational individual out to maximize his own utility out of the relationship. Quimpo (2012) later explained that this vertical dyadic pattern formed the basis of organizing the base of support of the two contending political parties--the Liberal and the Nacionalista, with each party constructing an elaborate vertical network of patrons and clients from the provincial level all the way down to the towns and villages.

The second demonstration of rational interest calculation in Philippine politics can be seen in how local politics is organized for elections. At the time when there were still two political parties in the country (i.e., Nacionalista and Liberal), the political parties were each composed of a network of personal followings and alliances, local factions in the village and municipal levels, and factions in the provincial level. Thus, it can be understood that the provincial political faction maintained a constellation of factions and personal following in the towns and villages. Hence, in order for the political party to retain the faction, it must continue to provide rewards and benefits to the faction (Lande, 1964; Grossholtz, 1964). While Hicken's (2018) observation that, at the moment, there was no functional and institutionalized political party system in the Philippines was undeniably true, the party system then revealed one important fact--that the parties were platforms for interest aggregation. But the interests being aggregated were not of the little people. Rather, the interests aggregated by the parties were those of the elites. Similar to the little people, the big people were not only active actors in the politics of the locality but were also active rational utility maximizers. David Wurfel (1962; 1963) argued that the parties were basically cadre parties and that both were a loose confederation of leadership groups held together by less than permanent personal loyalties. The parties were dominated by elites and lacked clear or manifest differentiation in

ideologies. The party competition, according to Wurfel, was concentrated on the "material aspects of a power struggle."

These basic descriptions of the political parties in the Philippines then, and the amorphous party system of the country today only indicates one thing: the party system is plagued by exceptionally elevated levels of unpredictability in competitive politics and has delicate links in society. Voters and politicians do not share in lasting relations, and their political parties lack any form of ideological footing or solid and programmatic party platform.

How local political parties before and their representations in the contemporary Philippine politics operate has not changed significantly. And their actions are consistent with rational self-interest politics of Downs and Schumpeter (as cited in Hindmoor, 2010) who argued that rational self-interested politicians are guided by individualism which focuses on the "me" and the "I" over the "we" in their effort to win elections. Because self-interest was the principal consideration, programmatic politics is negated. They veer away from what Lande (1967) referred to as "categorical commitments" on very provocative and socially alienating policy questions and issues as these defeat self-interest articulations.

Now, is this plane of intersection watertight? As I have contended, it is not. The applicability of the tradition of the "Chicago Boys" who crafted the rational choice framework is subject to constraints. Foremost of these constraints is the character of rational choice. Hindmoor (2010) argued that it is politically destructive in that it leads to individualism and self-interest. It assumes that all people are out to maximize their advantage. Riker (as cited in Hindmoor, 2010) pointed out that this premise is not entirely true considering that people, in reality, are not all the time rational. People may not have access to all information needed to drive them to make rational choices. Hence, they may be rationally unknowledgeable at a certain point. It is perhaps for this reason that Riker reasoned that rational self-interest is a faulty enterprise. It basically leaves no room to accommodate altruistic behavior and decision-making, and fails to account for the human convolutions or complexities and the impediments of political organization (Petracca, 1991). Like the analogy of a fishing net, the rational choice framework cannot entirely capture political phenomena as it leaves no room for agency and structure which are two equally powerful endogenous and exogenous forces that explain political behavior (Hindmoor, 2010).

Virgilio Enriquez' conception of the "kapwa" is also very instructive counterintuitive to rational choice' explanations of the dyadic ties that form the basis of the clientelistic linkages perforating local Philippine politics. Regarded as the core in the complex of Filipino values and a crucial aspect of relationships, the conception of "kapwa," as Enriquez (1994; Cabral et al., 2016) noted, explains all forms of relationships among Filipinos, may such relationships be with the "ibang tao" or with the "hindi ibang tao." In a very intellectually stimulating work, Contreras (2014) pointed out that the indigenous concept of "kapwa" is what binds the relationship between "iba sa kanila" and "di iba sa kanila." As argued by Enriquez, there is a connection between the "iba sa kanila" and the "di iba sa kanila" in that while relations among "di-ibang tao" are stronger and more profound, the relations between and among the "ibang tao" bear the signs of "pakikipagkapwa tao." The concept of "pakikipagkapwa tao," as pointed out by Cabral et al. (2016) combines the rules of reciprocity and warrant commitment between members of a society. What this tells me is that in the light of the concept of "kapwa," rational choice thinkers may have oversimplified the dyadic linkages in Philippine politics. Instead of looking at these ties and factional relations that stretch from the provincial down to the village level as expressions of rational interest calculations, it might be more meaningful and liberating to view these mechanisms of political consolidation as manifestations of "pakikipagkapwa tao."

This is basically what Contreras (2002) was harping about in an article meant to promote a post-modern way of reading Philippine politics. Analysis and appreciation of Philippine politics with profound theoretical grounding has long been the enterprise of Western scholars who have imposed their western frames of theorization on an oriental setting. It is largely state-centric. While there is nothing bad about this seemingly Western imposition, it is perhaps in the best interest of advancing the scholarship and cognizance of Philippine politics that we peruse it from a non-traditional and unconventional lens that is divorced from the traditional state-centric Western thinking.

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