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ABSTRACT

In this study, seven socio-economic indicators were associated with Covid-2019 cases across 17 regions in the Philippines. The number of Covid-2019 cases as of April 7, 2020, was considered for the analysis. Descriptive statistics, Kendall rank correlation, and stepwise regression were used to determine if the seven socio-economic indicators were associated with Covid-2019 cases. No significant associations were noted in both magnitudes of poor families and subsistence poor population, and savings to Covid-2019 cases. However, high income and low subsistence incidence were associated with significant reductions in Covid-2019 cases across the 17 regions of the Philippines. The result of the study provides additional knowledge to policy makers and health officials in formulating targeted strategies to regions that could potentially record high number of Covid-2019 cases in the future. Given the seasonal and recurring nature of Covid-2019 with respect to previous outbreaks, it is essential for the Philippine government to create directed policies and innovate programs that would decrease subsistence and increase income. Concerted multi-region efforts should be made to prepare for possible infection outbreaks in the future.

KEYWORDS: Covid-2019; income; poverty; socio-economic; subsistence

1. Introduction

A wide spectrum of indicators has been postulated to associate with Covid-2019 cases. Among which were epidemiological profile, healthcare resource, humidity, and temperature [1-3]. Age and sex were risk factors of the disease [4]. The disease prevalence was high in areas with high latitude and humidity, extreme temperature, and sufficient ozone concentration [5]. In the Philippines, the median age of laboratory-confirmed Covid-2019 cases was 46 years, with majority being female and living in the National Capital Region [6]. Despite the mentioned indicators of Covid-2019 cases, there is still a dearth of research exploring socio-economic determinants of Covid-2019 cases, specifically in the Philippines.

The Philippine government is currently challenged to address issues pertaining to poverty and subsistence. Based on a recent report, poverty incidence or the proportion of poor Filipinos was approximately 16.6 percent in 2018 [7]. Also, subsistence incidence or the proportion of Filipinos whose income is not enough to meet even the basic food needs was 5.2 percent in the same year [7]. Studies show that poverty and income were the strongest indicators of disease risk and infection prevalence [8-9]. Empirical evidence of these studies suggests how identification of potential indicators could aid in the formulation of targeted strategies to mitigate future health problems. In this study, seven socio-economic indicators were associated with Covid-2019 cases across 17 regions in the Philippines.

2. Methodology

This is a retrospective study utilizing prior data in the analysis. Socio-economic indicators used were poverty incidence, magnitude of poor families, subsistence incidence, and magnitude of subsistence poor population. In addition, the income, expenditure, and savings recorded per Philippine region were taken for the analysis. A single Philippine region was the sampling unit; hence, a total of 17 regions were assessed. Data pertaining to the socio-economic indicators were taken from the open-

access database of the Philippine Statistics Authority. The measurements were estimates collected in 2018 and posted in the online website (https://psa.gov.ph/) in December 2019. Poverty and subsistence incidences were expressed in percentage, while magnitudes of poor families and subsistence poor population were expressed in thousands. Income, expenditure, and savings were expressed in Thousand Philippine Peso (PhP).

Data of Covid-2019 cases in the Philippines were extracted from the University of the Philippines Tracker (https://endcov.ph/cases/). Cases as of April 7, 2020, were considered for the analysis. Ethics approval was considered exempt because all records used were taken from publicly available archives.

For the data analysis, R statistical package was used. Descriptive statistics (mean and SD) was used for continuous variables. Due to small sample size, Kendall rank correlation was used to determine if socio-economic indicators were associated with Covid-2019 cases across 17 regions in the Philippines. Stepwise regression was used to determine significant predictors of Covid-2019 cases across regions. Fitting of regression model was done by adding or removing predictor variables via a series of F-tests. Added or removed variables were chosen based on test statistics of estimated coefficients. A p-value of less than 0.05 was considered significant.

3. Results

Mean and SD of socio-economic indicators and Covid-2019 cases are shown in Table 1. Kendall rank correlation revealed that poverty incidence, subsistence incidence, and expenditure are positively related with Covid-2019 cases ($p<0.05$); however, income was negatively related with Covid-2019 cases among Philippine regions ($p<0.01$) (Table 1). No significant associations were noted in both magnitudes of poor families and subsistence poor population, and savings ($p>0.05$).

A stepwise regression removed previously significant variables, poverty incidence and expenditure, after yielding nonsignificant p-value (Table 2). Subsistence incidence and income were retained for the regression model, which explained 87.2 percent of the variance in the Covid-2019 cases ($R^2 = 0.872$).

The results indicated that for every 1,000 PhP increase in income, there was a decrease of 3.99 Covid-2019 cases in each Philippine region. Meanwhile, for every 1.0 percent increase in subsistence incidence, there was an increase of 3.34 Covid-2019 cases in each Philippine region.

4. Discussion

The main objective of this study was to determine if the seven socio-economic indicators were associated with Covid-2019 cases across 17 regions in the Philippines. Among the seven socio-economic indicators, only four were significantly related to Covid-2019 cases. Poverty incidence, subsistence incidence, and expenditure were positively related to the disease cases per Philippine region. This implies that Philippine regions with high poverty incidence, subsistence incidence, and expenditure had most likely high Covid-2019 cases. In other words, Philippine regions with high proportions of poor Filipinos whose income is not enough to meet even the basic food needs, would most likely have high cases of Covid-2019. Alternatively, Philippine regions with low proportions of poor Filipinos whose income is not enough to meet even the basic food needs, would most likely have low cases of Covid-2019. Regions which spend more funds had most likely high number of Covid-2019 cases and vice versa.

On the other hand, income was negatively correlated with Covid-2019 cases suggesting that Philippine regions with low annual accumulated income, had high cases of Covid-2019. Conversely, Philippine regions with high annual accumulated income, had most likely low cases of Covid-2019.

Further analysis was employed to determine which variables could significantly influence Covid-2019 cases. The analysis has shown that high income and low subsistence incidence are associated with significant reductions in Covid-2019 cases across the 17 regions of the Philippines. An increase in 1,000 PhP income per region would result to a reduction of 3.99 Covid-2019 cases while a decrease in 1.0% subsistence incidence would result to a reduction of 3.34 Covid-2019 cases in each Philippine region. These data offer essential insights into the significance of several socio-economic indicators to manage surges of Covid-2019 cases in the Philippines.

As of April 11, 2020, the Philippines is one of the top 50 countries with the greatest number of Covid-2019 cases. Cases burgeoned to 4,195 while case fatality rate was 5.27 percent, which is greater than neighboring Southeast Asian countries such as Malaysia, Singapore, Brunei, and Thailand.2, With these high infectivity and fatality rates, the Philippines need to respond quickly by practicing infection control guidelines and recognizing infection spread indicators. Studies have shown several possible treatments for the disease; however, at the present time, no vaccines have been formulated to fight against the causative virus. Indicators of Covid-2019 incidence such as humidity, ozone concentration, and temperature have merited exploration. In the study, income and subsistence incidence are potential indicators of Covid-2019 case surges in the Philippines. This provides additional knowledge to policy makers and health officials in formulating targeted strategies to regions that could potentially record high number of Covid-2019 cases in the future. Early identification of these high-risk regions would warrant prompt preventive measures.

Existing evidence indicated a seasonal and recurring nature of Covid-2019 with respect to previous outbreaks, MERS, and SARS [10-11]. Hence, it is essential for the Philippine government to formulate directed policies and innovate programs that would decrease the proportion of Filipinos who cannot meet the basic food needs while increasing the income of each Philippine region. Sustainable provision of source of income to the most marginalized Filipinos should be considered to mitigate problems pertaining to food subsistence. Concerted multi-region efforts should be made to prepare for possible infection outbreaks in the future.

This study should note several limitations. Data extracted were analyzed at only one point of time; hence, longitudinal studies could be explored in the future to capture significant changes in the socio-economic indicators. The reporting of cases across 17 regions in the Philippines may be biased due to confounding factors that might affect the high or low number of Covid-2019 cases such as not but limited to the presence of testing kits and clinical laboratory of the region which could increase testing

capability of the region. Finally, other socio-economic indicators were unaccounted for in the study and could be included in the analysis in the future research.

5. Conclusions

In conclusion, high income and low subsistence incidence are associated with significant reductions in Covid-2019 cases across the 17 regions of the Philippines. Data extracted were analyzed at only one point of time; hence, additional studies could be explored in the future to capture significant changes in the socio-economic indicators. Nevertheless, the study reported income and subsistence incidence as potential indicators of Covid-2019 case surges in the Philippines. This provides additional knowledge to policy makers and health officials in formulating targeted strategies to regions that could potentially record high number of Covid-2019 cases in the future. Early identification of these high-risk regions would warrant prompt preventive measures. Given the seasonal and recurring nature of Covid-2019 with respect to previous outbreaks, it is essential for the Philippine government to formulate directed policies and innovate programs that would decrease subsistence and increase income. Concerted multi-region efforts should be made to prepare for possible infection outbreaks in the future.

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Conflict of Interest Statement

The authors declare no conflict of interest.

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Table 1. Descriptive statistics and Kendall rank correlation.

Variables	Mean	SD	1	2	3	4	5	6	7	8
1. Poverty incidence	20.92	13.88	-	0.54**	0.93**	0.68**	-0.75**	-0.65**	-0.50**	0.46*
2. Magnitude of poor families	1034.98	554.89		-	0.50**	0.84**	-0.50**	-0.28	-0.63**	0.15
3. Substinence incidence	6.95	6.87			-	0.66**	-0.77**	-0.63**	-0.46*	0.56**
4. Magnitude of substinence poor population	324.93	267.64				-	-0.60**	-0.41*	-0.59**	0.30
5. Income	280.54	70.32					-	0.69**	0.60**	-0.60**
6. Expenditure	207.48	58.20						-	0.29	0.43*
7. Savings	73.05	22.69							-	-0.31
8. Total confirmed cases	99.76	293.74								-

* p < 0.05 ** p < 0.01.

Table 2. Stepwise regression analysis summary predicting Covid-2019 cases.

Variables	B	β	t	p-value
(Constant)	728.64		4.25	.001
Income	-3.99	-.79	-5.01	<0.001
Substinence incidence	3.34	.65	4.87	<0.001

* p < 0.05 ** p < 0.01.