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Likelihood of Covid-19 Contagion Cases Using Barangay Classification and Population Density Predictors: A Binary Logistic Regression Analysis

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Abstract: *Environment hostility jeopardizes social distancing thus weakens the mitigation of COVID-19. This study investigates the role of environment in the probability of COVID-19 cases. It determines the rate and classification of most and least dense environments with COVID-19 cases, and the likelihood of COVID-19 cases using environment classification and population density predictors. Analyzing the 182 universally selected samples via binary logistic regression, it is found that all most congested [Barangay] environments are rural with nearly half has at least one COVID-19 case. The top most congested environment has approximately 11 sq. m. space to one-person ratio. The entire least congested are rural wherein 12.5% haveCOVID-19 cases. COVID-19 cases are less expected in rural environment but more probable in congested areas such that it is one times higher in heavily than less congested environment. Rapid-mass testing and strict monitoring of critical environment followed by isolation of COVID-19 positives, and relocation of individuals or households to least congested environments for decongestion purposes are urged. Researches on critical health care facilities preparedness assessment via survey, on ratio and proportion that determine rapidity and phasing, on success stories of survivors, and on contract tracing using scientific and Barangay participatory method are urgently recommended.*

Keywords: Binary Logistic Regression, COVID-19 Contagion Cases, Environment Classification, Population Density

Introduction

In many previous epidemic incidents in various countries, social distancing has proven to be beneficial. Especially in times of uncertainties due to scarcity of medical treatment related concerns such as absence of vaccine and shortage of health care facilities, social distancing provided a more functional advantage. It is a trusted strategy to reduced contacts among possible virus carriers and susceptible individuals (Lewnard and Lo, 2020), thus could delay or lessen if not, to impede the spread of COVID-19 (Painter and Qiu, 2020).

Even if social distancing is undertaken at a moderate level, millions of lives and trillions of economic benefits can be saved within 3 to 4 months (Greenstone and Nigam, 2020).In fact, no less than the members of the Inter-Agency Task Force COVID-19 in Region XI agreed that premature or untimely lifting of social distancing could cause a wave of transmission that nullifies previous efforts exerted to prevent the spread of the virus (NEDA XI, 2020).

Despite its highly recognized importance, social distancing remains a critical concern within the entire population density and community classification issue. It may have been an effective measure in countries where population density is not a problem, yet it probably remains a challenge to overly populated areas such as in highly urbanized communities and cities. In order to address such apprehension, it is foremost vital to examine the role of community classification and population density, where social distancing is attuned with, in determining the likelihood of occurrence of COVID-19.

This study aims to determine the rate and classification the leading most and least dense Barangays with COVID-19 cases, and the likelihood of COVID-19 contagion cases using Barangay classification and population density predictors.

Method

This study is inferential type. It determines a conclusion that goes beyond the instantaneous and proximate data. It derives a judgment of the probability and chance of occurrence that an observed difference between groups is reliable (Kumar, 2014).It is cross sectional type. It utilized secondary data available online such as the Barangay density, classification, and number of COVID-19 cases collected at a single point of time. It is

a retrospective design. It investigates a phenomenon that happened in the immediate past (Kumar, 2014). It utilizes data from purposively selected 182 rural and urban Barangays in Davao City with COVID-19 cases as of 24 May 2020. It is a non-experimental in nature. It follows the path tracing of the cause starting from the effects involving the variables under study. The assumed causes have already occurred and the causes with hindsight are linked to the outcome. It is a systematic empirical investigation where the researcher does not have direct control of the predictor variables, because inherently they cannot be manipulated (Kumar, 2014).

This study was conducted in Davao City, Philippines which has a total land area of 244,000 hectares (NEDA XI, 2020). It is heavily hit by COVID-19 pandemic crisis. Based on 2015 census it had a population of 1,632,991 (PSA, 2020).With an estimated +2.42% annual population growth rate, by 2020 the city is a home to 1,839,969 (Population City, 2020). There are 182 numbers of Barangays in Davao City. Fifty-three (51%) are urbanized areas, 49% are classified as predominantly rural Barangays. Forty-four Barangays (24%) have COVID-19 cases based on the 26 May 2020 official report of the Department of Health.

Finally, this study utilized bivariate correlation specifically the Pearson Product Moment Correlation Coefficient in order to determine the significance and the strength of the correlation between Barangay classification and population density as predictors, and the COVID-19 cases as criterion variable. It also utilized the binary logistic regression to directly model the relationship using nonlinear methodology and to provide an equation for circumstances in which the dependent variable is categorical and usually dichotomous. In this study, the dichotomous data are categorized as presence and absence of COVID-19 at the Barangay level.

Results and Discussions

1. Rate of most and least congested Barangays with COVID-19 cases

Population density matters a lot in terms of the movement of the people. In other words, mobility is intense and more concentrated in highly dense than decongested areas. The issue on vehicular traffic is a matter of concern within this assertion. In a traffic condition, vehicles are so condensed. Similarly, in an area with high population density, people are too congested. Moving matters like vehicles and people tend to be so closed to each other that they move slow in a highly dense place. Indeed, one study revealed that low-mobility of public transport is correlated with urban population density and land-use characteristics – that the higher the population density, the slower is the mobility of the people (Schafer and Victor, 2000).

According to a study, the actual population flow significantly causes higher risk in the spread of the contagion during pandemic. It further asserts that other factors namely, geographic proximity and economic status do not determine the increase of the number of infected cases. Based on such findings, it was strongly recommended that the number of community inhabitants, mobility of the people, and population density have to be considered in the mitigation or in a larger scale, the prevention of the spread of COVID-19 (Qiu,Chen, and Shi,2020).

Table 1.1 shows the leading 12 most dense Barangays with Barangay 23-C as top of the list (82,897 per square kilometer). One hundred percent (100%) are urbanized Barangays. Forty two percent (42%) have at least one COVID-19 case. The biggest number of COVID-19cases in the entire city is in a Barangay found in the list. In the most congested [critical] Barangay, one person occupies about 12 sq. meter space but based on the 2015 population census. If the rate of increase [2010-2015] that is 8.6% (PSA, 2020) is used to estimate the recent population, then by the current year (2020) the ratio in the most critical Barangay is reduced to approximately 11 sq. meter per person. In such congested condition, people are too closed to each other, much more when they are locked down and no way but to just move around the area. In a situation like this, the practice of social distancing that is supposed to be called for in times of pandemic is jeopardized if not worthless given the fact that persons are mobile individuals.

Table 1.1 Leading Most Congested Barangays

Barangays	COVID-19 Case	Classification	Population Density/ Sq. Km.
21-C	4	Urban	81,727
22-C	4	Urban	67,999
23-C	33	Urban	82,897

24-C	0	Urban	32,627
25-C	0	Urban	37,776
26-C	0	Urban	31,200
31-D	0	Urban	75,276
37-D	0	Urban	55,364
39-D	0	Urban	37,187
5-A	6	Urban	32,359
Centro San Juan	0	Urban	30,111
Leon Garcia	32	Urban	70,349
	5/12		

The leading 16 least congested Barangays are all (100%) located in the rural areas (Table 1.2). Their densities range from 31.5 to 97.17 per square kilometer. Among them, only 12.5% have one COVID-19 case a piece. Obviously, rural Barangays offers wider areas that can accommodate more numbers of people and thus may be utilized as a temporary relocation site in order to decongest the COVID-19 vulnerable Barangays. This contention draws the involuntary resettlement experience of China as a model. The compulsory resettlements of millions of Chinese families and households to the rural sites were a program that turned out to be beneficial to national development. Its success gained a huge attention of the international community (Croll, 1999).

Table 1.2 Leading Least Congested Capacious Barangays

Barangays	COVID-19 Case	Classification	Population Density
Baganiha	0	Rural	67.76
Buda	0	Rural	96.88
Colosas	0	Rural	44.43
Dalag	0	Rural	56.48
Gumalang	0	Rural	31.5
Lampianao	0	Rural	90.31
Lumiad	0	Rural	58.28
Mabuhay	1	Rural	84.99
Magsaysay	0	Rural	58.48
Malamba	0	Rural	47.3
Mapula	0	Rural	39.15
Marilog	0	Rural	93.62
Paquibato	0	Rural	66.87
Salapawan	0	Rural	77.26
Salaysay	0	Rural	97.17
Saloy	1	Rural	96.31
	2/16		

2. Likelihood of COVID-19 Contagion Cases

Both the Barangay classification and population density (Table 2.0) obtain respective odds ratios that are statistically significant (*p*-value=0.000). It indicates that both variables are significant predictors of the probability of COVID-19 cases.

Table 2.0 Binary Logistic Regression

Independent Variables	COVID-19 Cases at Barangay level			
	Odds Ratio	***p*-value**	**Interpretation**	
Barangay Classification	0.105	0.000	Significant	
Population Density	1.00	0.000	Significant	

Since Barangay classification (Table 2.0) obtains odds ratio of less than 1, it denotes that having COVID-19 in rural Barangays is less likely to occur than in urbanized Barangays. The odds ratio obtained in population

density explains that the probability of having COVID-19 cases in congested Barangays is more likely to occur than in decongested areas. Indeed, the likelihood of having covid-19 cases in congested Barangays is 1.00 times higher than the less congested Barangays.

This finding contradicts the assertion of a previous study conducted in Italy on COVID-19 stating that reduction of deceases may occur in more polluted areas. Pollution is most likely to take place in a very congested environment; although, such study looked into the effectiveness of lockdown as an intervention action. It was further asserted that heterogeneity of diffusion of various control variables such as population density among others does not affect the spread of the contagion. Rather, adverse COVID-19 outcomes depend on the share of small compact of skilled workers (Becchetti, Conzo, Conzo, andSalustri, 2020).

Summary Findings

Based on the statistical results, it is found that the leading most congested Barangays are all urban areas. Forty-two percent have COVID-19 case/s. In the top most congested Barangay, one person approximately occupies 11 square meter space. On contrary, the leading least congested Barangays are classified as rural. Only 2 out of 16 have one COVID-19 case each. All the rest are free of COVID-19 contagion. Moreover, the Barangay classification and population density predictors obtain respective odds ratios of 0.105and 1.00 which are both statistically significant.

Conclusion

COVID-19 cases in rural Barangays are less likely to occur than in urbanized Barangays. COVID-19 cases in congested Barangays are more likely to occur than in decongested areas. Indeed, the likelihood of having COVID-19 cases in congested Barangays is 1.00 times higher than the less congested Barangays. Therefore, environment poses a critical role in predicting the likelihood of COVID-19 contagion.

Recommendations

Based on the findings and conclusion, the following recommendations may be considered:

1. Before the critical Barangays are locked-down, rapid-mass testing and strict monitoring may be undertaken. Consequently, those who are tested positive are immediately isolated in designated treatment centers. Those tested negative may be relocated by the government to less dense rural Barangays for the purpose of decongestion and practice of social distancing.

2. A study using epicenter-Barangay estimated distance as interest variable may be instigated urgently in order to determine its effect on the change of degree of influence and predictive strength specifically of Barangay classification and population density as variables to define the likelihood of COVID-19 contagion occurrence at the Barangay level.

3. A study on the level of preparedness of the critical health care facilities to address the possibility of another wave of COVID-19 in critical Barangays. The study may be undertaken through the following strategies: survey on critical health care preparedness based on the perception of front liners assigned to COVID-19patients care; inferential research employing the ratios of the following data admission, days before ICU admission, time in ICU, recovery, and death; and qualitative research utilizing the feedback of recovered patients.

4. Conduct contract tracing of COVID-19 contagion in every Barangay through community-based research. Such research utilizes available equipment and local initiatives by tapping volunteerism of local people, innovating technologies especially in the gathering of data, and developing practical skills in detecting COVID-19 symptoms.

References

Becchetti, L., Conzo, G., Conzo, P., &Salustri, F. (2020). Understanding the heterogeneity of adverse COVID-19 outcomes: the role of poor quality of air and lockdown decisions. *Available at SSRN 3572548*.

Croll, E. J. (1999). Involuntary resettlement in rural China: The local view. *The China Quarterly*, *158*, 468-483.

Greenstone, M., & Nigam, V. (2020). Does social distancing matter?. *University of Chicago, Becker Friedman Institute for Economics Working Paper*, (2020-26).

King, Jason E. (2008). Best Practice in Quantitative Methods. Chapter 24/Binary Logistic Regression. Retrieved on 23 May 2020 from https://methods.sagepub.com/book/best-practices-in-quantitative-methods/d29.xml

Lewnard, J. A., & Lo, N. C. (2020). Scientific and ethical basis for social-distancing interventions against COVID-19. *The Lancet. Infectious diseases*.

National Economic Development Authority, Region XI. Retrieved on May 24, 2020 from http://nro11.neda.gov.ph/davao-region/davao-city/

National Economic Development Authority, Region XI. Retrieved on 25 May 2020 from http://nro11.neda.gov.ph/davao-region-task-force-on-covid19-convene-to-discuss-situation-agree-on-next-actions-for-the-region/

Painter, M., & Qiu, T. (2020). Political beliefs affect compliance with covid-19 social distancing orders. *Available at SSRN 3569098*.

Philippine Statistics Authority, Republic of the Philippines, POPCEN (2015). Retrieved on 24 May 2020 from https://psa.gov.ph/tags/popcen-2015

Philippine Statistics Authority. Retrieved on 25 May 2020 from http://rsso11.psa.gov.ph/search/node/Davao%20City%20population

Population City. Retrieved on May 25, 2020 from http://population.city/philippines/davao-city/

Qiu, Y., Chen, X., & Shi, W. (2020). Impacts of social and economic factors on the transmission of coronavirus disease (COVID-19) in China. *medRxiv*.

Schafer, A., & Victor, D. G. (2000). The future mobility of the world population. *Transportation Research Part A: Policy and Practice*, *34*(3), 171-205.

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