

DOES INTERNATIONAL MIGRATION INFLUENCE MORTALITY PATTERN AND WHAT ROLE DOES MURDER AND ECONOMICS PLAY?

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Abstract

Introduction: A recent study empirically found a negative association between the migration and mortality discourse. The data that was used to establish the migration-mortality paradigm is taken from developed nations such as the United States and Europe. These nations have a positive net international migration which is contrary to that which is reported in many Caribbean nations such as Jamaica. **Objectives:** The aims of the current study are to: 1) examine the linear relationship between mortality and net international migration; 2) evaluate the best association between mortality and net international migration; 3) determine the role that murder plays in migration and net international migration and 4) evaluate whether there is economics to life occurring in Jamaica. **Method:** The data were derived from various Jamaican Government Publications including The Economic and Social Survey of Jamaica; the 2011 Census of Population & Housing report for Jamaica; the Demographic Statistics, and the Statistical Department of the Jamaica Constabulary Force. The period for this study is 1960 and 2013. **Results:** The association between migration and mortality in Jamaica is not a simple linear one; but a cubic polynomial function. **Conclusion:** Migration in Caribbean nations, such as Jamaica, negatively impact the population size of these countries and therefore, must be interpreted with its reality and offers insights into new thinking about how migration should be included in the mortality discourse.

Keywords:

Deaths, demography, net migration, mortality rate, murder rate, population, public health, Jamaica.

Introduction

Caribbean nations like Jamaica are well established on migrant populations. The building of some nations, by utilizing the services of migrant people, are not unique to the Caribbean as this is evident in countries such as Australia, New Zealand and the United States of America. The difference in the data obtained from the Caribbean and developed nations such as the United States of America, Australia and New Zealand is the negative net international migration. This difference is due in part to the rebuilding of nations in Europe following World War II and economic marginalization in the migrant's nation [1]. During World War II, many Caribbean nations that were

at the time, British colonies, sent men to fight in World War II. At the conclusion of the campaign the destructions of the physical infrastructure of many European nations meant that rebuilding required the aid of people from the colonies. This resulted in a significant number of those who emigrated from the Caribbean to the United Kingdom. While there was always immigration to these Caribbean nations, emigration has far surpassed immigration (i.e., negative net international migration) as a result of more lucrative economic opportunities in the United Kingdom, United States and Canada. Another reason for the increase in emigration, from the Caribbean, was to escape the crime, whose rate significantly increased since those countries earned their independence. [1-7].

According to Parkins “Jamaica has the twelfth highest emigration rate in the world—but is ranked among the twentieth least attractive countries in the world for immigrants” [2], and offers an insight into the pull-push factors of migration and how these affect population structure. Despite the long history of emigration to some developed nations, the discipline of public health in the Caribbean does have a body of knowledge on migration and its influence on mortality including murder. Although the number of murders in the Caribbean, particularly Jamaica, is greater than the number of deaths by diabetes mellitus and many other chronic non-communicable diseases such as ischaemic heart diseases, hypertension, and malignant neoplasm of the prostate and breast [8-11], there is a gap in Caribbean public health literature on international migration and its role in mortality.

Although Caribbean public health literature is lacking in empirical evidence on the matter of international migration and mortality along with murders, there is a wealth of previous research that is related to migration and mortality [12-17]. The literature has shown that migration and mortality are linearly associated, and that there was a negative relationship [17]. Such a finding, denotes that 1) the slope of the curve is constant throughout the entire function, and 2) direct remains the same over the function. On examining the OLS (i.e., Ordinary Least Square regression) on migration and mortality, using a population of Caucasian Americans ages 65+ years, Johnson and Taylor [17] found a negative statistical association between internal migration and mortality. Johnson and Taylor [17] discovered that migration at younger ages lowers the life expectancy of that population. In the same study, the researchers found that there is positive linear correlation between in-migration and mortality, which offers an insight into reason for lower life expectancy of those who migrate to different geo-political areas. Furthermore, it provides some explanation for the internal mortality in a nation as a result of internal and international migration.

The empirical finding that there is an association between mortality and migration (i.e., internal and external) and bears significance to public health leaders in the Caribbean. On examination of health literature in the Caribbean, particularly Jamaica, no study emerged in a literature search on the influence of net international migration on mortality and the inclusion of murder in the Caribbean region [2, 8, 18-21]. Mortality, inclusive of murder and chronic non-communicable diseases, have recently raised concerns for health demographers and/or epidemiologists like Bourne [8-10, 18,22], and none have sought to include net international migration in the discourse. The literature lacks empirical evidence from the Caribbean, especially Jamaica, on migration and mortality, in addition to validating the established research on the linearity of association. The aims of the current study are to: 1) examine the linear relationship between mortality and net international migration; 2) evaluate the best association between mortality and net international migration; 3) determine the role that murder plays in migration and net international migration and 4) evaluate whether there is economics to life occurring in Jamaica..

Materials and methods

The current work is a secondary data analysis. The data were derived from various Jamaica Government Publications including The Economic and Social Survey of Jamaica (ESSJ) [23]; 2011 Census of Population & Housing report for Jamaica [24]; the Demographic Statistics [11], and the Statistical Department of the Jamaica Constabulary Force (JCF) [25]. Demographic Statistics provided data on mortality, population, and deaths and the Statistical Department of the Jamaica Constabulary Force on murders. The Economic and Social Survey of Jamaica (ESSJ) is a publication that provides information on social and economic indicators of Jamaica. It is published by the Planning Institute of Jamaica (PIOJ). The period for this work is between 1959 and 2014. Data were recorded, stored and retrieved using the Statistical Packages for the Social Sciences (SPSS) for Windows, Version 21.0. The level of significance that is used to determine statistical significance is less than 5% (0.05). Ordinary least square (OLS) regression analyses and curve estimations were used to determine models and best fitted models.

Operational definition

Death is the absence of life or the permanent departure of life after birth [18, 26]. Murder is the number of people who are unlawfully killed (i.e., a crime causing death without a lawful excuse) within a particular geographical zone (i.e., excluding police killings or homicides) [26]. Mortality means the total number of deaths that occurred within the population for a particular period, which is usually per year. The quality of mortality statistics in Jamaica is relatively good as research conducted by McCaw-Binns and her colleagues [19, 20] established that in 1997, the completeness of registration of mortality was 84.8%; in 1998 it was 89.6%. The quality of completeness of mortality registration has been established by the World Health Organization (WHO), ICD classification [21]. A completeness of 70-90% is considered to be medium quality while more than 90% is considered high quality data. Within the context of the WHO's classification, death statistics in Jamaica is medium quality and is relatively close to being high quality. In keeping with the completeness of mortality data the Statistical Institute of Jamaica (STATIN) [11] has adjusted the information to reflect the 100 completeness of mortality figures [18].

Results

Table 1 presents the descriptive statistics on net international migration, mortality, murder, mortality rate and murder rate for over five decades. Over the last 54 years (1960-2013), the average number of net international migration was $-18\,610 \pm 6\,831$ (95% CI: $-20\,739 - -16\,482$), with mortality, murder, murder rate and mortality rate being $14\,877 \pm 1\,338$ (95% CI: $14\,460 - 15\,294$); 757 ± 457 (95% CI: $615 - 900$); 6.63 ± 0.97 (95% CI: $6.36 - 6.89$) and 30.34 ± 16.09 (95% CI: $25.23 - 35.35$) respectively. Clearly, Jamaica has been experiencing negative net international migration dating back to the 1960s and earlier, with the greatest annual percentage change occurring in 1984 over 1983 (142.73%; Annex 1), with the net international migration rate being $-8.58\% \pm 4.36\%$, 95% CI: -9.79% to -7.38% . In addition, murder as a percentage of mortality for the studied period (1970-2013) is: $0.4 \leq M \leq 11.1$ (Annex 1).

Table 1: Descriptive statistics of Net International Migration, Mortality and Murder: 1960-2013

Details	Mean±SD	95% Confidence Interval
Net International Migration	$-18\,610 \pm 6\,831$	$-20\,739 - -16\,482$
Mortality	$14\,877 \pm 1\,338$	$14\,460 - 15\,294$
Murder	757 ± 457	$615 - 900$
Net International Migration rate	-8.58 ± 4.36	$-9.79 - -7.38$
Murder rate	6.63 ± 0.97	$6.36 - 6.89$
Mortality rate	30.34 ± 16.09	$25.23 - 35.35$

H₀1: Net international migration has steadily increased in absolute terms over the last 53 years in Jamaica.

The curve shown in Figure 1 disproves the null hypothesis that net international migration has been steadily increasing in absolute terms over the last 54 years in Jamaica. In fact, between 1959 and 1990, net international migration in Jamaica has been fluctuating irregularly with post 1990 following a more seasonal pattern. As such, we reject the the null hypothesis.

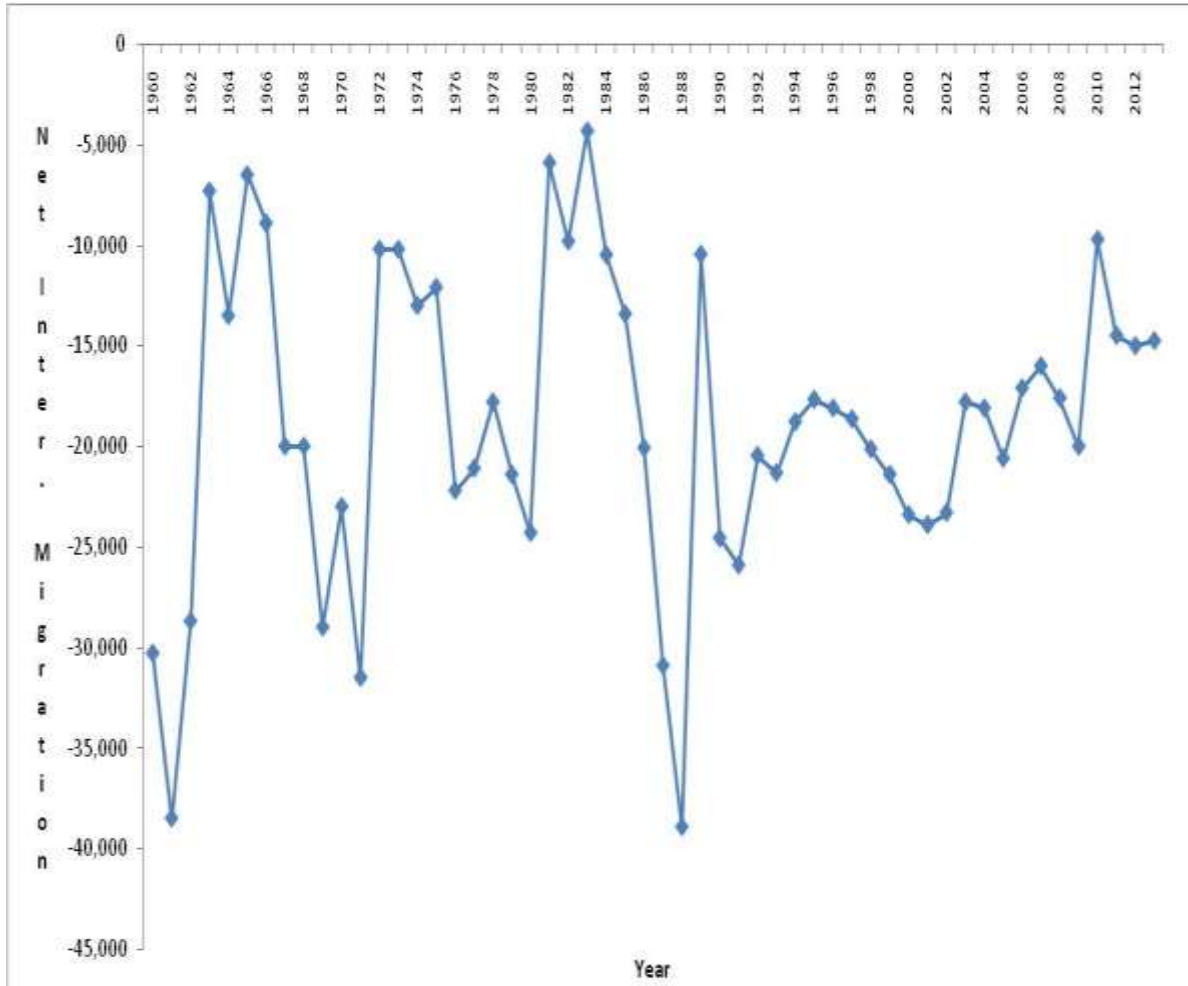


Figure 1: Net International Migration, 1960-2013

H₀2: Annual percentage change in net international migration has been declining (in absolute terms) over the last 54 years in Jamaica (1960-2013).

Figure 2 depicts the annual percentage change in net international migration in Jamaica for 1960-2013. Net international migration has been increasing more in absolute terms (33 times) compared to absolute declines. Simply put, absolute increases mean that net more people have emigrating Jamaica than the immigrants (i.e., those coming into the country), while the absolute decline denotes that there is a fall in the number of net emigrants which has occurred 19 times over the 54 years dating back to 1960. Hence, we reject the the null hypothesis.

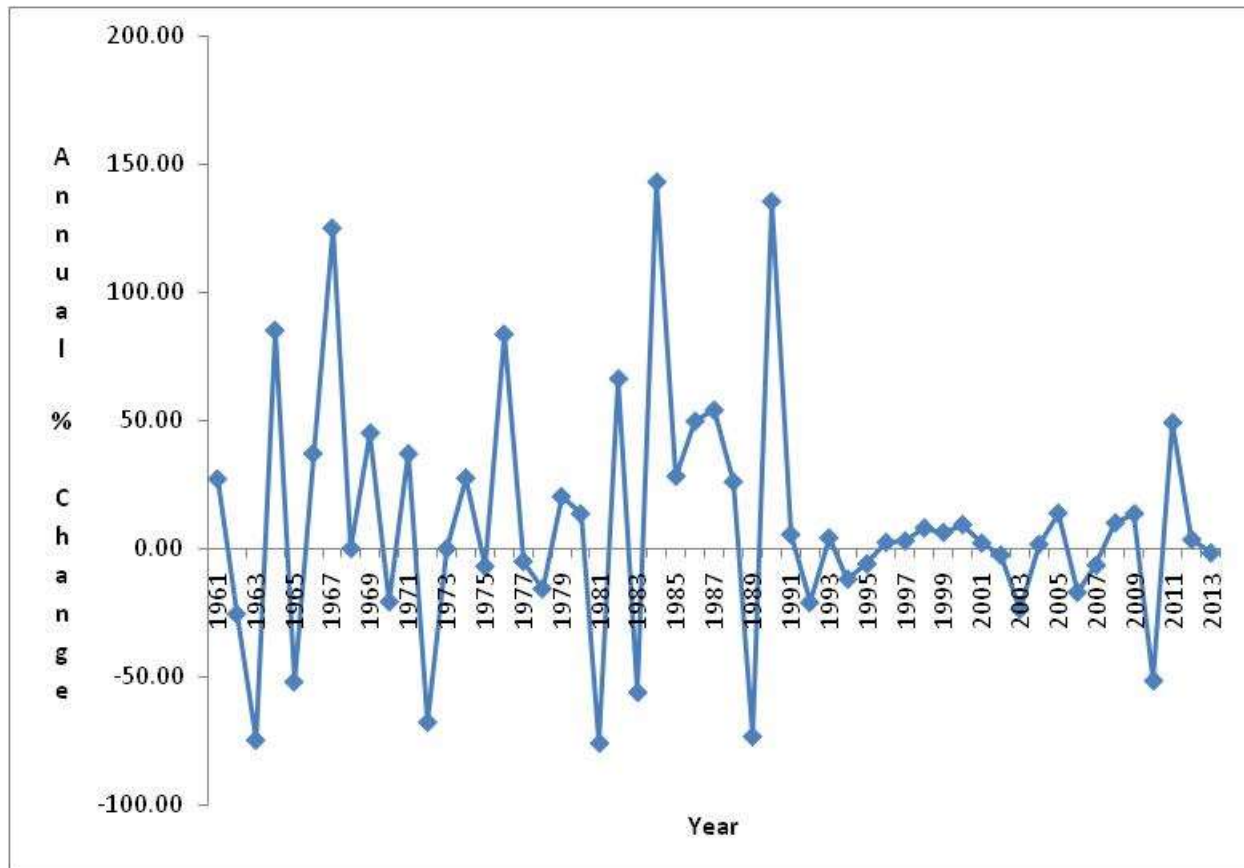


Figure 2: Annual percentage change in net international migration, 1960-2013

H₀3: Annual mortality in Jamaica has been increasing over the the last 54 years, 1960-2013

Annual percentage change in mortality is shown in Figure 3. For the 54 year period, annual mortality has declined more times than increased (27/52 or 51.9%). This means that 48.1% of the time mortality has increased on an annual basis in Jamaica, indicating that we have disproved the null hypothesis as mortality has both increased and declined in the last 53 years in Jamaica. Furthermore, over the studied period, in 1989 mortality increased by 33.96% over 1988, with the greatest percentage decline occurring in 1997 over 1996 (Annex 1). In addition to the aforementioned issue, the fluctuations have been irregular.

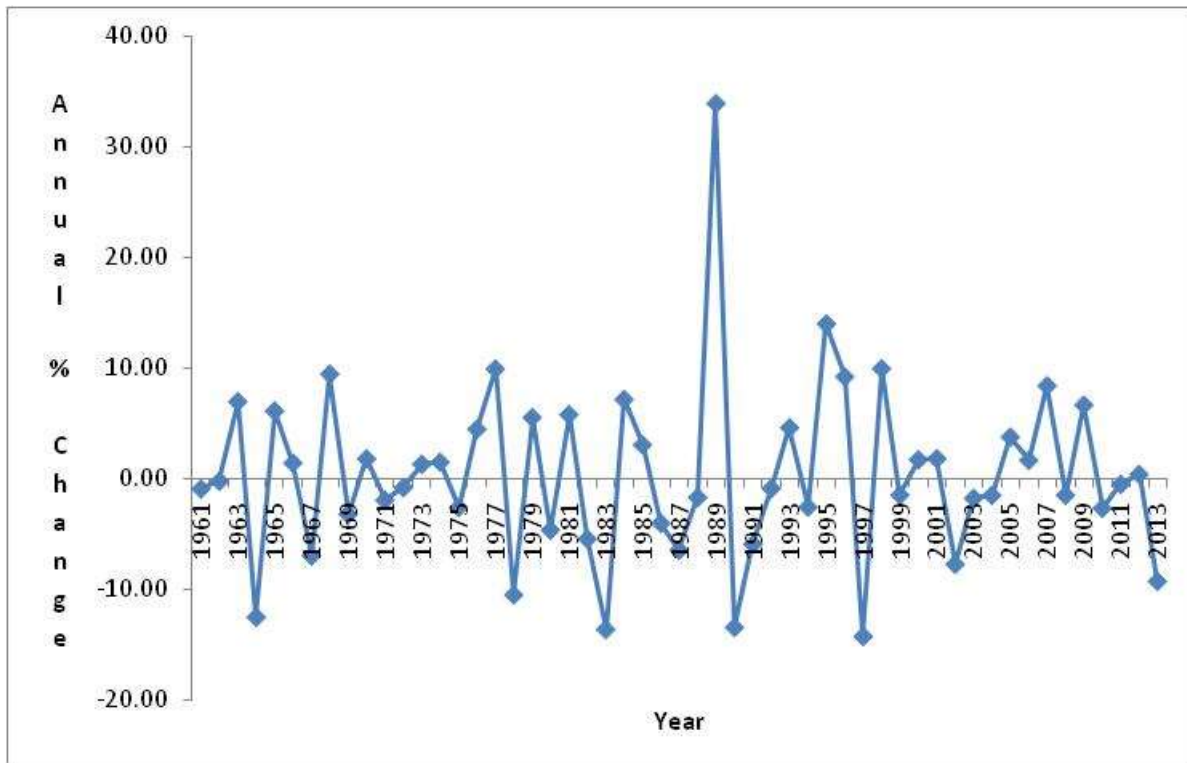


Figure 3: Annual percentage change in mortality, 1960-2013

H₀₄: Net International migration in time period t direct-linearly influences mortality in time period t.

Table 2 presents information on an OLS model of mortality rate and net international migration rate, 1960-2013. The OLS model shows that there is a negative-linear relationship between mortality rate and net international migration rate in Jamaica, using the sign of the unstandardized b value. The linear relationship between the two aforementioned variables is established by the probability of the F-statistic (P = 0.027) as well as the testing for the assumptions in regression (Annex 2-4). The indirect-linear relationship between mortality rate and net international migration rate means that mortality increase when net international migration falls and vice versa.

Table 2: OLS estimate of mortality rate by net international migration rate, 1960-2013.

Details	Unstandardized		t-statistic	P value	95% CI
	Coefficients				
	B	Std. Error			
Constant	6.047	0.285	21.214	0.000	5.474 - 6.619
Net International Migration Rate	-0.067	0.030	-2.275	0.027	-0.127 - -0.008

Dependent variable: Mortality Rate
 F-statistic [1, 51] = 5.174, P = 0.027
 R² = 0.092
 Adjusted R² = 0.074

H₀₅: Net International migration in time period t (N_t) and mortality in time period t (M_t) are best fitted by a linear function

Or

$$H_{05}: M_t = k + b_1N_t \dots\dots\dots[1]$$

Table 3 presents a model summary of parameter estimates of mortality and net international migration rate. Using the R² valuations, the relationship between mortality rate and net international migration rate is best fitted with a polynomial function and not a linear curve. Therefore, mortality rate and net international migration rate is best fitted by a cubic polynomial function:

$$M_t = k + b_1N_t + b_2N_t^2 + b_3N_t^3 \dots\dots\dots[2]$$

Based on Equation [2], we conclude by rejecting the null hypothesis

Table 3: Model summary and parameter estimates of net international migration rate

Equation	Model Summary					Parameter Estimates			
	R Square	F	df1	df2	P value	Constant	b ₁	b ₂	b ₃
Linear	0.092	5.174	1	51	0.027	6.047	-0.067		
Quadratic	0.228	7.369	2	50	0.002	7.417	0.231	0.013	
Cubic	0.243	5.234	3	49	0.003	8.672	0.686	0.058	0.001

Note: Dependent variable: Mortality rate

Examining the turning points of the polynomial function

$$M = 8.672 + 0.686N + 0.058N^2 + 0.001N^3 \dots\dots\dots[3]$$

$$\frac{dM}{dN} = 0.686 + 0.116N + 0.003N^2 \dots\dots\dots[4]$$

$$\frac{d^2M}{dN^2} = 0.116 + 0.006N \dots\dots\dots[5]$$

For maximum or minimum turning point $\frac{dM}{dN} = 0$

$$0 = 0.686 + 0.116N + 0.003N^2$$

Using quadratic formula to solve for N, gives:

$$N = \frac{-0.116 \pm \sqrt{(0.116)^2 - 4(0.003 * 0.686)}}{2 * 0.003}$$

$$N = \frac{-0.116 \pm \sqrt{0.013456 - 0.008232}}{0.006}$$

$$N = \frac{-0.116 \pm \sqrt{0.005224}}{0.006}$$

$$N = \frac{-0.116 \pm 0.0723}{0.006}$$

Either $N = -7.3$ or $N = -31.4$

Substitute $N = -7.3$ and $N = -31.4$ to ascertain M

Turning points (N, M): (-7.3, 6.4) and (-31.4, 13.4)

Substitute -7.3 in Equation 5, which gives $\frac{d^2M}{dN^2} > 0$; hence, -7.3 is a minimum turning point

Substitute -31.4 in Equation 5, which gives $\frac{d^2M}{dN^2} < 0$; hence, -31.4 is a maximum turning point

Interpreting the values: This denotes that when net international migrate rate lies between -31.5 and -7.4 mortality is decline and when it is more than -7.3, mortality rises (See Figure 4 for diagrametic evidence). Simply put, when the rate of Jamaica emigrating to other nation is more than 7.3 per 1,000, mortality decline and when the rate is less than 7.3 per 1,000 mortality increases indicating that the greater the rate of emigration in Jamaica beyond 7.3 per 1000 of the mid-year population, mortality is aided by this fact and vice versa.

H₀6: The slope of the best fitted function for Mortality and Net International Migration rate has the same direction throughout the curve

Figure 4 shows a best fitted function of mortality and net international migration rate. From the polynomial best fitted function, the slope and sign of the function changes over the curve. The slope and sign of the function between a rate of -25 and -7 for net international migration has a negative slope, which changes to a positive slope after net international migration rate of approximately 7.5. Hence, we reject the null hypothesis that the slope and direction of the function is same throughout the curve. This means that when net international migration rate is falling (i.e., there is more emigrants), mortality decline and when emigration falls, mortality rises in Jamaica. Furthermore, there is a there is a rate of net international migration which is associated with peak and trough for mortality rate.

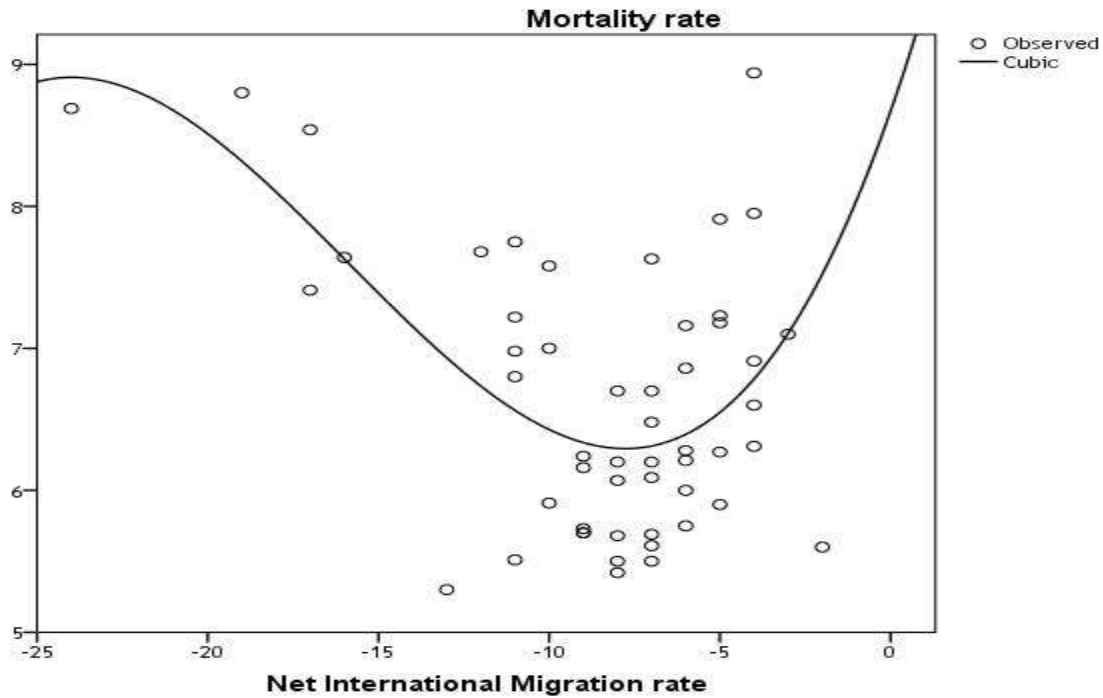


Figure 4: Slope of best fitted Migration and Net International Migration rate function

H₀7: There is a statistical correlation between Net International migration rate and murder rate

Using a P of value less than 5%, we can conclude from Table 4 that there is no statistical correlation between Net International Migration rate and Murder rate, when tested by linear, quadratic, cubic polynomial and exponential function, as P > 0.05 (or 5%). Therefore, we reject the null hypothesis.

Table 4: Model summary and parameter estimates of murder

Equation	Model Summary					Parameter Estimates			
	R Square	F	df1	df2	P value	Constant	b1	b2	b3
Linear	0.050	2.084	1	40	0.157	-9.221	0.044		
Quadratic	0.054	1.110	2	39	0.340	-10.009	0.103	-.001	
Cubic	0.057	0.766	3	38	0.520	-11.267	0.257	-.006	0.000049

Dependent variable: Net International Migration Rate

H₀8: The relationship between mortality rate and murder rate is best fitted by a linear function
or

H₀8: $M_t = k + b_1R_t$[3]

Table 5 presents a model summary and parameter estimates for murder rate. There existed a linear statistical relationship between mortality rate and murder rate ($P = 0.008 < 0.05$), with a squared R value of 0.165 (or 16.5%). However, using the squared R value (i.e., R^2), the statistical relationship between the two aforementioned variables is best fitted by a cubic polynomial ($R^2 = 0.412$, $P < 0.0001$). Hence, we reject the null hypothesis as best fitted function is a cubic polynomial:

$$M_t = k + b_1R_t + b_2R_t^2 + b_3R_t^3 \dots\dots\dots[4]$$

Table 5: Model summary and parameter estimates for murder rate

Equation	Model Summary					Parameter Estimates			
	R Square	F	df1	df2	P value	Constant	b1	b2	b3
Linear	0.165	7.876	1	40	0.008	6.802	-0.017		
Quadratic	0.317	9.033	2	39	0.001	7.783	-0.090	0.001	
Cubic	0.412	8.886	3	38	0.000	9.244	-0.269	0.007	-0.00005687
Exponential	0.145	6.808	1	40	0.013	6.749	-0.003		

Note: Dependent variable: Mortality rate

H_09 : The slope of the mortality function, with murder as the independent variable remains constant throughout the function

Figure 5 depicts a model fit of mortality and murder rates in Jamaica. We can conclude, there the slope of the curve is not constant, which disproves the null hypothesis.

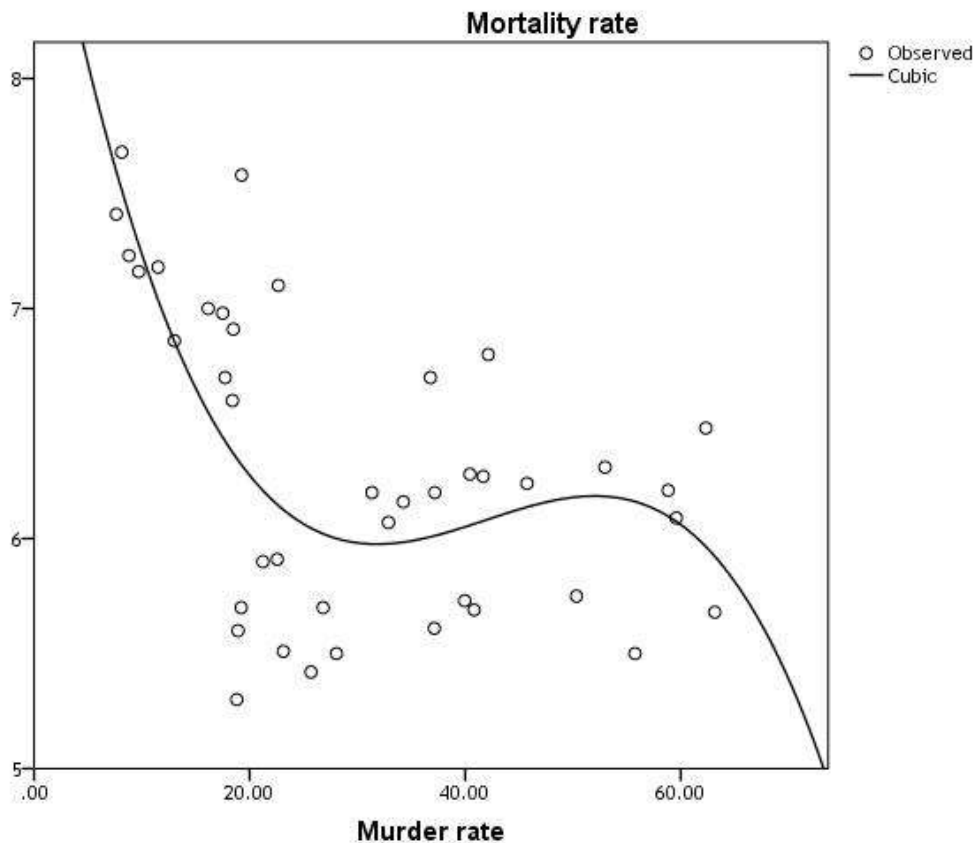


Figure 5: Murder and mortality rate

H₀10: There is a strong direct statistical correlation between selected macro-economic variables, mortality, murder and net international migration

Table 6 presents bivariate correlations of selected macro-economic variables, mortality, murder and net international migration. Only in two cases did we fail to reject the null hypothesis: 1) the direct relationship between 1) murder and the exchange rate ($r_{xy} = 0.924$, $P < 0.0001$), 2) inflation and poverty ($r_{xy} = 0.834$, $P < 0.0001$), 3) exchange rate and health-care seeking behavior (HSB), $r_{xy} = 0.854$, $P < 0.0001$. On the other hand, a moderate direct statistical correlation existed between the exchange rate and mortality ($r_{xy} = 0.663$, $P = 0.006$), HSB and mortality ($r_{xy} = 0.650$, $P = 0.001$) and mortality and HSB ($r_{xy} = 0.650$, $P = 0.00$). In addition, a relatively weak positive association emerged between murder and mortality ($r_{xy} = 0.528$, $P = 0.012$) as well as HSB and poverty ($r_{xy} = -0.737$, $P < 0.0001$). Other direct relationships are exhibited in Table 6 as well as inverse and no statistical association ($P > 0.05$).

Table 6: Bivariate correlations of selected macro-economic variables, mortality, murder, health-care seeking behavior (HSB) and migration

		Exchange Rate	Mortality	Net Inter Migration	Unemployment	Poverty	Inflation	GDP	murder	HSB
Exchange Rate	Pearson Correlation	1	.563**	.336	-.402	-.734**	-.514*	-.473*	.924**	.854**
	Sig. (2-tailed)		.006	.126	.063	.000	.014	.026	.000	.000
Mortality	Pearson Correlation	.563**	1	.451*	.005	-.514*	-.589**	-.390	.528*	.650**
	Sig. (2-tailed)	.006		.035	.981	.014	.004	.073	.012	.001
Net Inter Migration	Pearson Correlation	.336	.451*	1	.186	-.208	-.314	-.013	.229	.261
	Sig. (2-tailed)	.126	.035		.408	.352	.154	.956	.305	.254
Unemployment	Pearson Correlation	-.402	.005	.186	1	.520*	.375	.455*	-.328	-.429
	Sig. (2-tailed)	.063	.981	.408		.013	.086	.033	.136	.052
Poverty	Pearson Correlation	-.734**	-.514*	-.208	.520*	1	.834**	.253	-.766**	-.737**
	Sig. (2-tailed)	.000	.014	.352	.013		.000	.255	.000	.000
Inflation	Pearson Correlation	-.514*	-.589**	-.314	.375	.834**	1	.207	-.491*	-.611**
	Sig. (2-tailed)	.014	.004	.154	.086	.000		.356	.020	.003
GDP	Pearson Correlation	-.473*	-.390	-.013	.455*	.253	.207	1	-.388	-.532*
	Sig. (2-tailed)	.026	.073	.956	.033	.255	.356		.074	.013
murder	Pearson Correlation	.924**	.528*	.229	-.328	-.766**	-.491*	-.388	1	.774**
	Sig. (2-tailed)	.000	.012	.305	.136	.000	.020	.074		.000
HSB	Pearson Correlation	.854**	.650**	.261	-.429	-.737**	-.611**	-.532*	.774**	1
	Sig. (2-tailed)	.000	.001	.254	.052	.000	.003	.013	.000	

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Limitation of study

This study only reviewed data from Jamaica, however it would be more useful to compare the data to other Caribbean nations, in order to determine if the outcomes are similar. The results from this study provide invaluable data to support further examination of the causes of the decrease in migration to Jamaica and steps that could be taken to mitigate the disparity between immigration and emigration of the population.

Discussion

This paper was the first to examine the influence of net international migration on mortality and the role that murder plays in migration and mortality rates. Beginning with a thorough review of published research it was clear that the Caribbean public health literature lacked empirical evidence of the international migration and mortality and murders. Previous research by Johnson and Taylor [17] indicate that there was a negative statistical association between internal migration and mortality. The literature has a plethora of empirical investigations that showed a positive correlation between migrants and mortality [27-30]. Marshal [29] as well as the other researchers

opined that this is an expected outcome as migrants are healthier than non-migrants, which accounted for a 'healthy migrant' hypothesis. However, Johnson and Taylor [17] postulated what while they expected a positive statistical association between migrants and mortality, they found the opposite. Gibson et al. [31] empirically found that migrants have higher blood pressure and hypertension compared to non-migrants, which would concur with Johnson and Taylor's work [17] and disagrees with the healthy migrant hypothesis. None of the empirical work comprehensively examine the migration-mortality phenomenon to include macro-economic variables and murder in attempting to unravel the issues as well as simultaneously testing the direct hypothesis of international migration and mortality including the role of murder therein.

The rise in mortality rates, which includes murder along with other chronic non-communicable diseases have been the cause for public health concerns among demographers, epidemiologists and public health leaders in the Caribbean, especially in Jamaica. Bourne [8-10], [18, 22] raised these concerns in previously published literature in order to bring attention to these public health matters.

Unlike the literature which found either a negative [17] or positive statistical association between migration and mortality [27-30], this work found that the relationship is non-linear one, which is neither solely negative nor positive; but a combination of both directions. The present work having empirically established that there is no statistical correlation whatsoever between murder and emigration and one between emigration and mortality, we can deduce that the correlation is happening with non-murder mortality. The negative statistical correlation between net international migration and non-murder mortality occurs when rate of emigrants exceeds 7.3 per 1,000 of the mid-year population. In this situation, emigration is aiding in reducing the number of non-murder deaths and when the rate of emigrants is lower than 7.3 per 1000 of the mid-year population, non-murder deaths will rise. Does this issue explain those happenings?

The healthy migrants hypothesis theorizes that those who are likely to migrate from a healthy locale are healthier than non-migrants, which accounts for lower mortality when they are in a locality and higher mortality rate when they leave [29]. Such a findings is contradicted by this study as unhealthier people as well as those whom have a greater probability of deaths by external causes (i.e., accident) are likely to migrate from Jamaica as is evident from these findings as when they remain in Jamaica mortality rise. This rationale accounts for a reduction in mortality when there is a rise in emigration. It also supports the argument that a healthy non-migrant populace in Jamaica as well as the non-migrants have a lower probability of deaths owing to external causes. With studies showing that non-communicable diseases are the single largest cause of deaths in the Caribbean [32-37], we can deduce from the present findings that emigrants are more exposed to ill-causing pathogens as well as external causes of mortality than non-migrants. Hence, when they remain in Jamaica this account for the rise in mortality which occurs and a reduction on their leaving the country.

Unlike the literature, we are proposing that there is an economics of life that offers explanation for rise in mortality when the rate of emigrants is less than 7.3 per 1,000 of the mid-year population. On examination of the economic variables, this research found that the exchange rate accounts for a rise in murders as well as mortality in Jamaica and that the exchange rate inversely relates to the gross domestic product (GDP) and does not influence net international migration. There are some underlining issues embedded in the current findings, which must be vented therein as they offer insights into the rise in non-murder mortality when the net negative international migration rate is less than 7.3 per 1,000 of mid-year population.

Jamaica is a highly imported driven economy, which means that many goods are imported for consumption including medication, energy, transportation, clothing, and foods (i.e., rice, flour, wheat, salted fish, oxtail, etc). The pricing of the imported items are expressed in terms of foreign exchange (i.e., USD), which means that with a direct statistical correlation between the exchange rate and non-murder mortality as well as murder; depreciations in the exchange rate has an economics of life component that has never been explained before now. The reality is, a depreciation in the exchange rate increases the cost of medication, prices of imported good and therefore a substitution effect occurs as people forego medication and health care choices for basic necessity (food) in periods of a rise in the exchange rate. It means, therefore, that health care demand will be compulsory before it is sought, which often occurs in case of severe illness, that is life-threatening. When this becomes the reality among the ill who remain in Jamaica because of the inability to migrate, this accounts for the rise in mortality because they would seek health when it would be too late in periods of high exchange rate.

Another fact which is embedded in the economic of life is that, with the depreciation in the exchange rate domestic and imported goods become more expensive including medication. The marginalized in society as well as those whom are experiencing non-communicable conditions are forced to forego quality foods and the intake of healthy foods will also decline. There is an economics of life hypothesis that accounts for the rise in mortality when

the ill or those highly exposed to external injuries remains in the society are exposed to increases in the exchange rate. The present findings unearth that the exchange rate is strongly correlated with health-care seeking behavior, mortality is moderately correlated with mortality and net international migration is directly associated with mortality. Those issues speak to psychological stressors experienced when the Jamaican dollar depreciates. A depreciation in the Jamaica dollar translates into higher prices of foods and services including fuel, transportation, nutritional deficiencies, increase in psychological dysfunctions, which explains the rise in demand for health care services in periods of depreciation.

This study found a negative correlation between poverty and health-care seeking behavior, a positive association between the exchange rate and mortality and an inverse relationship between exchange rate and poverty, which denotes that a depreciation in the Jamaican dollars is eroding the quality of life of those in the non-poor income classes. We can go further to postulate that there is premature deaths among those in the non-poor income classes in Jamaica during periods of devaluation of the Jamaica dollars as well as a rise in demand for health care services. In addition to the aforementioned issues, the negative relationship between poverty and health-care seeking behavior indicates that there is a health care substitution effect occurring in Jamaica in economic hardship. The poor, in period of economic hardship, will substitute health care demand for food, which can compound and accumulate psychological stressors. This offers some explanation for what Bourne et al., called the economics of death occurring in Jamaica [22]. Although a negative relationship emerged between poverty and mortality in Jamaica, the psychological stressors experienced by the poor has not been identified because of the health care substitution effect that is occurring in periods of economic hardships. This also means that the poor are alive, while the non-poor are dying in economic hardship; however, their living condition is highly stressful, suffer from various ailments and experience a lower quality of living because of the economics of life. A strong direct correlation existed between health-care seeking behavior and the exchange rate, within the context that those who seek health care are more likely to die than those who fail to seek care.

There is an induced economic effect on mortality, which worsens deaths among the ill in Jamaica and that emigration alleviates this reality. The emigrants, from Jamaica, relocating to other nations in the world are not only those with the illness, higher health care demand, and more stressed in economic hardship; they are the non-poor people. Using national probability cross-sectional survey on Jamaica, Bourne et al., [33] found that there is no statistical difference between the health status of the poor and those who are in the wealthy-to-wealthiest income classes. Not only is there no difference between the health status of the poor and the wealthy Jamaicans, the latter sought more health care (83.7%) than the former (50.0%). Those findings offer more information in understanding economics induced mortality (i.e., economics of living) in Jamaica and with the current results that there is an inverse relationship between poverty and mortality, we can postulate that economics induced mortality (i.e., economics of living) in Jamaica are increasing illnesses including psychological stressors, which helps to boost emigration rates.

The nature of the psychological stressors, the higher probability of dying because of the stressors, increased non-psychological conditions because of the economics tunneled through psychological stressors, and the increased fear of the economics induced mortality, account for non-poor emigrating for a better quality of life. These non-poor have an induced psychological stressor and mortality when living in Jamaica during economic hardship, which explains the direct correlation between mortality and less non-poor Jamaicans migrating away from the economics induced mortality in Jamaica. Outside of non-poor Jamaica, it is already empirically established that direct correlation between poverty and illness [38], with the current findings showing an inverse relationship between poverty and health-care seeking behavior and no correlation between poverty and emigration, the poor have no avenue of release in periods of economic hardship.

The reality is, emigration improves the quality of living for those in the wealthy classes in Jamaica as is unearthed in this study and supported by research conducted by Bourne et al., [39], which found that 21.2% of the living life expectancy in Jamaica are below the poverty line compared to 16.5% of those in the wealthiest 20%. Hence, when the non-poor migrate from Jamaica this reduces the number of non-murder mortality and vice versa is equally true, which accounts for the cubic polynomial mortality function.

The rise in the non-murder mortality, when net emigrants is more than -7.3 per 1,000 of the mid-year population is cannot be explained by 1) poverty, 2) unemployment, and 3) inflation as these have negative or no effects on non-murder mortality. The finding of this work unearthed that net emigration is irresponsive to the economic milieu in Jamaica. However, mortality is highly responsive to the external environment that is translated into the exchange rate, and that emigration is lowering the death rate in Jamaica. It does so in two ways. One way is by the fewer number of people in the population and another is that the healthier individuals remain in Jamaica. The

present work revealed a moderately strong a direct correlation between health-care seeking behavior and mortality, indicating that ill-people are more likely to seek health care and die than those whom do not seek health. We can deduce from the findings that many ill-Jamaica migrate to other nations outside of Jamaica, which helps to lower the mortality rate with more of them emigrating and vice versa. So when Marshal [29] opined that the healthier people migrate, this is not the case in Jamaica. With such underlining characteristics of emigrants, a deterioration in the economy by way of the import-price effect makes it increasingly more likely for them to die which explains the economic of life among migrants in Jamaica.

With studies showing that majority of deaths in Jamaica are among elderly people, those 60 years and older [18, 40], and caused by non-communicable diseases [9, 10], it follows that the cost of dying at older ages are fueled by the economic environment. The economic environment acts as a conductor of death, reduces life expectancy, results in premature deaths and increases morbidity which are outside of non-communicable diseases. Economics induced mortality is embodied in the deaths statistics; but it is quantifiable in mortality statistics. Depreciation and devaluation of a country's currency acts as a stimulus for psychological stressors, these stressors increase depression and other illnesses that are not accounted for in the mortality statistics. What the economic environment does is to serve as the conduit for finally highlighting the issues such as non-communicables, suicides, murders, and accidents. It means, therefore, that a part of the mortality occurring in a society is accounting for the economic environment, which is never ascribed to it because they are operationalized and used in mortality literature.

The economics of induced mortality are accounting for premature deaths among elderly, non-poor and people who are internalizing the economic hardships. External international migration, therefore, alleviates the psychological stressors as well as economic stressors in a society and must be brought into the mortality discourse. A study in India established that illnesses such as hypertension, marital status, and type of family are associated with stressors among elderly [41]; but the researcher stop short of identifying economics induced stressors. Economic hardship is, therefore, a geriatric stress and because this induce other stressors and increase mortality, the economics of survivability and migration are crucial components in the public health issues.

Conclusion

The discipline of public health must begin to including migration in its discussions and examination of mortality as understanding this phenomenon goes a far way in providing some explanations in mortality discourse. Public health specialists and policy makers must not continue to neglect migration in the mortality discourse. A delay in action will come at the price of understanding human life and not being able to effectively implement policies and strategies to lower mortality. The reality is, there is an economics induced mortality that is occurring in Jamaica during periods of economic hardship and this is a non-poor phenomenon, which is lowered by emigration. Migration is more than a demographic issue as goes to the cure of mortality changes in Jamaica and therefore extends to public health. It is a psychological conductor that changes the population structure. As such, an effective reduction of non-murder mortality (i.e., causes of deaths by morbidity, external causes such as accidents) must include an understanding in the movements of the exchange rate and international migration, particularly among those who are in the non-poor income categories.

In summary, this study was an important one to address the gap in the literature with regards to international migration and morality and murders. Developing countries such as Jamaica and other Carribean nations must make immediate changes to reduce the emigration rates. The increase in crime rates and limited economic opportunities directly influence the population to migrate to other countries with lower crime and criminal activities and more lucrative economic options. The research outcome should be shared with key stakeholders in Jamaica in order to affect change that will help in improving the economic status of the country.

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