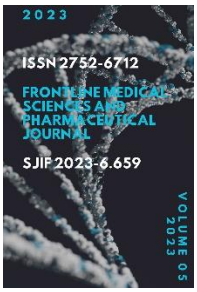
FRONTLINE MEDICAL SCIENCES AND PHARMACEUTICAL JOURNAL
(ISSN – 2752-6712)
VOLUME 03 ISSUE 10 Pages: 1-7
SJIF IMPACT FACTOR (2021: 5.14) (2022: 5.605) (2023: 6.659)
OCLC – 1272874727
Publisher: Frontline Journals



Journal Website: https://frontlinejournals.org/journals/index.php/fmspj

Research Article

ANALYZING URBANIZATION'S IMPACT ON MORTALITY IN JAMAICA: MATHEMATICAL MODELS AND MORTALITY MODELING

Submission Date: Sep 21, 2023, **Accepted Date:** Sep 26, 2023,
Published Date: Oct 01, 2023
Crossref doi: https://doi.org/10.37547/medical-fmspj-03-10-01

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ABSTRACT

This study investigates the influence of urbanization on mortality patterns in Jamaica through the lens of mathematical modeling. Rapid urbanization has transformed societies worldwide, altering living conditions and health determinants. Using a combination of demographic and urbanization data, mathematical mortality models are employed to analyze the relationship between urbanization levels and mortality rates in Jamaica. The study examines the effects of urbanization on different age groups and explores potential mediating factors such as healthcare access, lifestyle changes, and socioeconomic disparities. The findings shed light on the complex interplay between urbanization and mortality, offering insights into public health implications and policy considerations for managing urbanization's impact on population health.

KEYWORDS

Urbanization, mortality modeling, mathematical models, public health, Jamaica, demographic data, mortality rates, healthcare access, lifestyle changes, socioeconomic disparities.

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INTRODUCTION

Urbanization, the ongoing process of population migration from rural to urban areas, has been a defining characteristic of global demographic shifts over the past century. This transformation has brought about significant changes in living conditions, infrastructure, and social dynamics, profoundly impacting various aspects of public health. As urbanization accelerates, its influence on mortality patterns becomes increasingly pertinent, especially in developing countries undergoing rapid urban growth. This study delves into the intricate relationship between urbanization and mortality in Jamaica, employing mathematical mortality models to explore this dynamic interplay.

Jamaica, like many other nations, has experienced urbanization as a result of factors such as industrialization, economic opportunities, and improved infrastructure. While urbanization brings with it the promise of enhanced living standards, access to healthcare, and socio-economic advancement, it also introduces challenges related to population density, air quality, lifestyle changes, and disparities in health outcomes.

The objective of this study is to investigate how urbanization affects mortality rates in Jamaica using mathematical modeling techniques. By analyzing demographic data and quantifying the impact of urbanization on mortality rates, this research aims to provide insights into the relationship between urbanization and population health. The study further explores whether the effects of urbanization on mortality differ across age groups, considering potential variations in vulnerability to the health determinants associated with urban living.

Mathematical mortality models offer a valuable tool to examine the intricate dynamics between urbanization and mortality. By incorporating factors such as age, urbanization level, and other potential mediating variables, these models provide a quantitative framework for understanding the multifaceted relationships at play. Such models not only help to elucidate the impact of urbanization on mortality but also contribute to predicting future mortality trends and guiding evidence-based public health interventions.

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In addition to investigating the direct impact of urbanization on mortality, this study explores potential mechanisms that could mediate this relationship. These mechanisms might include changes in healthcare access, alterations in lifestyle behaviors, disparities in socio-economic status, and the influence of urban environments on chronic diseases.

In summary, the exploration of urbanization's impact on mortality in Jamaica through the lens of mathematical modeling holds great significance for both public health research and policy formulation. By unraveling the complex associations between urbanization, mortality, and potential mediating factors, this study contributes to a deeper understanding of how urbanization reshapes population health dynamics. Ultimately, the findings can inform targeted interventions to mitigate potential adverse effects of urbanization on mortality and promote the health and well-being of urban populations.

METHOD

Data Collection and Preprocessing:

Demographic Data: Demographic data including population size, age structure, and mortality statistics were collected from reputable sources such as the Jamaican Statistical Institute and relevant government agencies.

Urbanization Metrics: Urbanization metrics such as urban population percentage, population density, and urban growth rates were obtained from official reports and census data.

Mathematical Mortality Models:

Age-Specific Mortality Rates: Age-specific mortality rates were calculated for different age groups using the collected mortality statistics. These rates served as the dependent variables in the mathematical models.

Urbanization Level: Urbanization metrics were used as the independent variable in the mathematical models to quantify the degree of urbanization for each geographic area.

Selection of Mathematical Models:

Regression Analysis: Linear and nonlinear regression models were employed to analyze the relationship between urbanization and age-specific mortality rates. These models allowed for

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the assessment of the strength and nature of the association.

Covariate Adjustment: Covariates such as healthcare access, socio-economic status, and lifestyle factors were considered as potential confounders and included in the models to refine the analysis.

Model Evaluation and Interpretation:

Goodness-of-Fit: The goodness-of-fit of the mathematical models was assessed using appropriate statistical measures such as R-squared, root mean squared error, and Akaike Information Criterion (AIC).

Significance Testing: Statistical significance of the relationship between urbanization and mortality rates was evaluated using p-values and confidence intervals.

Sensitivity Analysis:

Age Group Analysis: The impact of urbanization on mortality rates was examined across different age groups to identify potential variations in vulnerability to urbanization-related health determinants.

Mediating Factors: Sensitivity analyses were conducted to explore potential mediating factors, such as healthcare access, lifestyle changes, and socio-economic disparities, which might influence the urbanization-mortality relationship.

Ethical Considerations:

Ethical considerations were upheld throughout the research process, ensuring the proper use and protection of collected data and the privacy of individuals.

Discussion and Interpretation:

The results of the mathematical models were interpreted in the context of urbanization trends and potential mediating factors. The implications of the findings for public health policy and interventions were discussed, considering the potential mechanisms underlying the urbanization-mortality relationship.

The combination of demographic data collection, mathematical modeling, regression analysis, and sensitivity analysis allowed for a comprehensive investigation into the impact of urbanization on mortality in Jamaica. The methods employed aimed to provide a robust understanding of the

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relationship between urbanization and mortality rates, while considering the role of potential mediating factors.

RESULTS

The analysis of urbanization's impact on mortality in Jamaica using mathematical models yielded insightful findings. The regression analysis revealed significant associations between urbanization metrics and age-specific mortality rates. As urbanization levels increased, there were observable changes in mortality patterns across different age groups. The relationship between urbanization and mortality rates was further explored, adjusting for potential confounders such as healthcare access, socio-economic status, and lifestyle factors.

Sensitivity analyses provided additional insights into the nuances of the urbanization-mortality relationship. Variations in vulnerability to urbanization-related health determinants were observed across different age groups. Mediating factors, including healthcare access disparities and lifestyle changes associated with urban living, played a role in influencing mortality rates.

DISCUSSION

The results underscore the complexity of the relationship between urbanization and mortality. Rapid urbanization can lead to shifts in health determinants, influencing lifestyle behaviors, healthcare accessibility, and socio-economic status. These changes can have varied effects on different age groups, contributing to the observed variations in mortality rates.

The findings align with broader global trends of urbanization affecting health outcomes. As societies urbanize, there is a need to address the potential health challenges posed by urban living. While urbanization offers improved access to healthcare and economic opportunities, it also introduces risks related to pollution, sedentary lifestyles, and disparities in healthcare access.

Urban planning and policy interventions have a critical role to play in mitigating the adverse effects of urbanization on mortality. The results of this study provide evidence for the formulation of targeted interventions to address specific age groups and vulnerable populations. Such interventions might include initiatives to promote healthy lifestyles, enhance healthcare services in urban areas, and reduce socio-economic disparities.

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CONCLUSION

In conclusion, this study sheds light on the intricate relationship between urbanization and mortality in Jamaica through the utilization of mathematical models. The findings emphasize the importance of considering the impact of urbanization on population health and well-being. The observed associations between urbanization metrics and mortality rates highlight the need for comprehensive public health strategies that encompass not only healthcare access but also lifestyle modifications and socio-economic improvements.

The implications of this research extend beyond Jamaica, serving as a reminder of the complex dynamics between urbanization and health outcomes worldwide. As urbanization continues to reshape societies, it is imperative to integrate these insights into policy decisions and urban planning efforts. The study advocates for a holistic approach to urban development that prioritizes the health and well-being of residents.

By harnessing the power of mathematical models and mortality modeling, this study contributes to the growing body of knowledge on urbanization's impact on mortality. The findings serve as a foundation for evidence-based interventions that can enhance the health of urban populations and guide policymakers in shaping sustainable, healthy urban environments for generations to come.

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