REDUCING CHRONIC DISEASE THROUGH TRANSPORTATION AND BUILT ENVIRONMENT IN HIGH CRIME COUNTRIES: A REVIEW OF THE LITERATURE

Katherine Agong[1*], Debra Bartholomew[2] and Dawn Goddard-Eckrich[3]
[1]Faculty of Engineering, The University of the West Indies, Trinidad
[2]Ophthalmologist Resident, Trinidad
[3]Associate Research Scientist, School of Social Work, Columbia University, United States of America
[1]Email: katherine.agong@sta.uwi.edu *(Corresponding author)
[2]Email: deb25bie@gmail.com
[3]Email: dg2121@columbia.edu

Abstract*:* Trinidad and Tobago has the third highest diabetes deaths, the highest rates of kidney failure in the world and is listed as one of the top countries where citizens have a fear of crime. There is a large body of research that has proven that there is an association between physical activity, fear of crime, health outcomes and built environment. However, most scientific research around urban design, physical activity, planning and transportation have been conducted in developed countries. There have been few studies in developing countries, particularly Trinidad and Tobago and the Caribbean, which are facing both high crime and chronic disease. To evaluate the literature on physical activity, chronic disease and the built environment, we conducted a review of the literature through a systematic search and also analysed research gaps and implications. Future studies should develop a multidisciplinary research on physical activity, fear of crime, transportation and the interactive effects of the built environment that can help improve chronic disease health outcomes. Future studies should also better understand the social and environmental influences of barriers to physical activity in Trinidad and Tobago.

Keywords: B*uilt environment, Chronic disease, Crime, Health, Physical activity transportation, Trinidad & Tobago.*

https://doi.org/10.47412/YAPS7603

1. Introduction

Chronic conditions remain the top causes of death among Caribbean populations, with non-communicable diseases (diabetes, cancer and heart disease) accounting for 81% of all deaths in 2016 in Trinidad and Tobago (World Health Organization, 2018). Diet and lack of exercise are among some of the prevention methods that can be used, however in many Caribbean countries, particularly Trinidad and Tobago, high crime may be a barrier to daily exercise or walking as a mode of transport. A study of the association between crime and transport walking was undertaken by Everson et al (2012). They found that perceiving a safer neighbourhood was positively associated with transport walking. Everson et al (2012) study concluded that "since walking may be an important source of physical activity, greater attention to reductions of violence and crime and increased perceptions of neighbourhood safety may contribute to higher population levels of

physical activity". According to Seepersad (2016) crime levels in Trinidad and Tobago are relatively high compared to the rest of the Caribbean. He also states that public perception remains fixated on crime as the country's most pressing concern. Thus this perception may affect the transportation mode choice of some people in Trinidad and Tobago. Reducing chronic diseases require populations to have access to exercise and healthy diets in order to manage their prevention and treatment effectively. Access to safe places to exercise on a regular basis is a challenge, therefore, is a necessity to address this issue.

Chronic diseases also known as non-communicable diseases (NCDs) tend to be of long duration and are the result of a combination of genetic, physiological, environmental and behaviours factors (Who.int. 2018). NCDs are diseases such as diabetes, heart disease, stroke, cancer, and lung disease. The rise of NCDs has been driven by primarily four major risk factors: tobacco use, physical inactivity, the harmful use of alcohol and unhealthy diets. Among the forces that drive these diseases are rapid unplanned urbanization. A lack of physical activity may manifest in people as raised blood pressure, increased blood glucose, elevated blood lipids and obesity. These are called metabolic risk factors that can lead to cardiovascular disease, the leading NCD in terms of premature deaths. Modifiable behaviour such as physical inactivity can help reduce the occurrence and control of NCDs and the built environment which includes transportation can assist in this. The built environment is the community surroundings designed, laid out and created by humans for humans to live, work and have leisure (Ottawa publichealth.ca, 2020; Visual Arts and the Built Environment, 2020). Examples of the built environment are cities, buildings, urban spaces, footpath, sidewalks/ walkways, bike paths/ cycle paths, cycle lanes, roads, parks, etc. The use of different modes of transportation for example walking and cycling is affected by the nature of the built environment. Within the sectors of public health and engineering there is increasing knowledge of the ways that the nature of the built environment can impact physical and mental health (Frank, Giles-Corti, Ewing, 2016, 423-425).

Non-communicable diseases (NCDs) cause 71% of all deaths globally and Trinidad and Tobago has one of the highest prevalence, morbidity and mortality rates for chronic non-communicable diseases (heart disease, stroke, diabetes, cancer) in the Caribbean, and these rates have been steadily increasing over time. Non-communicable Diseases (NCD) are estimated to account for 81% for all deaths in Trinidad and Tobago as of 2016 with most (33%) NCD deaths being due to cardiovascular disease followed by diabetes (15%) (World Health Organisation, 2016). The risk of death due to NCDs because of physical inactivity is 49% for females and 27% for males aged over 18 years. The risk of death due to NCDs because of raised blood pressure is 27% for females and 29% for males aged over 18 years. Whilst the data for the risk of death by NCD due to obesity is 28% for females and 11% for males (World Health Organization – Non-communicable Diseases (NCD) Country Profiles, 2018). It is predicted that the proportion of the population who will be obese will be around 35% for females and around 15% for males by 2025 and the proportion of the population who will have raised blood pressure is predicted to increase to 33% for males and 30% of females by 2025 (World Health Organization – Non-communicable Diseases (NCD) Country Profiles, 2018.

This paper will evaluate the main literature relating to how the role transportation and the built environment can contribute to increased physical activity, through walking in particular, in order to tackle chronic diseases.

2. Aims and Objectives

A systematic review of the literature on built environmental effects on chronic disease to promote the development of innovative interventions to change and promote crime safe built environments in Trinidad and Tobago was undertaken. Our specific objectives were:

1. To catalogue the chronic disease in Trinidad and Tobago (obesity, hypertension, type 2 diabetes and cardiac problems) in the international and regional context identified in the literature;

2. To report circumstances that observed associations between built environment and chronic disease allowing the identification of populations at a particular risk;

3. To identify studies investigating built environmental and crime, which is useful to develop more efficient interventions targeting this barrier;

4. To identify areas of research that are understudied, and evaluate previous literature and propose a research agenda.

3. Methods

A systematic review of the literature was performed on built environments and chronic disease in high crime countries. Literature searches were conducted in PubMed. The search terms were identified from previous related reviews and the following terms were used to search for relevant articles: 'Built environment AND ('built environment' or 'urban environment' or 'neighbourhood environment' or 'physical environment') AND ('chronic disease or 'Non-communicable diseases or ''diabetes' or 'cardiovascular disease or 'heart disease or 'poor health) AND ('health' or 'physical health' or 'mental health' or 'social health' or 'health-related behaviour' or 'health promotion'). ('crime' or 'unsafe neighbourhood' or 'unsafe neighbourhood or 'violent crime' or 'public crime'). Non-English studies were excluded from the results.

3.1 Search Strategy

The search only included articles dealing with built environment, chronic disease, crime, health, physical activity and transportation. As mentioned above the strategy made use of the PubMed search methodology as well as online search engines which gave access to online journals. PubMed is a free resource that provides access to MEDLINE, the National Library of Medicine database of citations and abstracts in the fields of medicine, nursing, dentistry, veterinary medicine, health care systems, and preclinical sciences.

3.2 Study Selection

Inclusion criteria were: (i) built environment; (ii) physical activity; and (iii) NCDs. Exclusion criteria were specified to restrict those that focused on motorised transportation and diet related behaviours. We excluded studies: (i) traffic; (ii) diet; and (iii) congestion

3.3 Data extraction and Assessment of Studies

The data extraction and assessment of studies was partly undertaken manually and partly undertaken using Microsoft Excel to organise the data and information collected.

3.4 Results

3.4.1 Overview of the Review Process

The PubMed search retrieved few abstracts. None were included during the screening of the abstracts, and none were selected for a full text examination. Articles and abstracts from search engine search were included in the review. We then performed a hand-screening search in the references and undertook citations of these articles. A total of fifteen (15) were included.

3.4.2 Main Characteristics of the Samples

All of the references except two (2) were published over the past 10 years (2009–2019), indicating that 80% of the selected studies were conducted in the past 10 years.

3.4.3 Outcome

Associations between built environmental factors and chronic disease were discovered.

4. Physical Activity

Men spend more time on physical activity (PA) overall. For the age group 15-64 years, men spend more than 100 minutes per day whereas women spent only 14.3 minutes. Twice as many males than females engage in high-level activity (>3000 MET-minutes per week), but more females engage in low or moderate physical activity. Physical activity tends to be seasonal between both genders. This pattern of PA might explain the gender difference observed in relation to body mass index (BMI) levels - a higher percentage of men are overweight when compared to women, and a higher percentage of women than men are obese. (Ministry of Health, Government of Trinidad and Tobago, 2017)

Table 1: Distribution of NCD Risk Factor of Low Physical Activity among persons ages 15-64 years

by Sex from the 2011 STEPS Risk Factor Survey

Risk Factor	Prevalence by sex %		Overall Prevalence %
	Male	Female	
Low levels of physical activity(defined as <600 MET – minutes per week)	33	57	45.4

Physical activity related to travel to and from places in Trinidad and Tobago was an average of 23.4 minutes per day (30 for men and 17.3 for women). Of all respondents the percentage of respondents classified as doing no transport-related physical activity was 55.8% (53.4% for men and 57.9% for women) (Ministry of Health Trinidad and Tobago, 2012).

Day (2016) was reviewed although it is a study in China. This review showed that there is a need for studies to establish stronger causal relationships between features of the built environment and physical activity outcomes. A focus is needed on specific physical activity of walking as it relates

to transportation (not leisure) to understand its link to NCD in high crime communities. In addition a decision on the categories of community to be included i.e. urban vs suburban vs rural will have to be made.

5. Crime

Foster and Giles-Corti (2008) say that crime or perceived crime does affect physical activity but their study does not specify the type of physical activity. Everson et al (2012) found that perceiving a safer neighbourhood was positively associated with transport walking, thus participants felt that if their neighbourhood was safer they would choose to walk as a means of transport more frequently. There is a gap in understanding the association between crime and the frequency of use of walking as a form of transport and how changes to the built environment has modified this association.

6. Policy Options for the Built Environment

National policy is important for forcing engineers to create health promoting environments. Policies relating to urban planning and transport are required to improve the accessibility, acceptability and safety of, and supportive infrastructure for, walking and cycling. In addition, Trinidad and Tobago must develop policy measures in cooperation with relevant sectors to promote physical activity through activities of daily living, including through "active transport".

None of the policies within the National Strategic Plan for the Prevention and Control of Non-Communicable Diseases Trinidad and Tobago 2017 -2021 related to increasing physical activity through changes to the built environment to facilitate active travel. However, it can be noted that a role of the Ministry of Works and Transport was identified in the prevention and control of NCDs by the following actions which relate to physical activity:

- Improve facilities for walking, through the provision of sidewalks where possible.
- Provide cycling lanes in appropriate areas.

According to the Trinidad and Tobago PANAM STEPS Chronic Non-Communicable Disease Risk Factor Survey - Final Report 2012 "there is a need to build community-based activities at the primary care level, or maybe community recreational facilities". There is no mention of increasing physical activity through active transport or transport-related activities.

By contrast Europe's response to WHO Global action plan for the prevention and control of non-communicable diseases 2013–2020 as it relates to health, physical activity and the built environment is very clear and set out in the document "Physical activity strategy for the WHO European Region 2016–2025". Priority Area 3 of the Strategy relates to promoting physical activity for all adults as part of daily life, including during transport, leisure time, at the workplace and through the health-care system. It mandates Member States to take action to promote human-powered transport in order to increase physical activity in daily life (World Health Organization, 2016). Objective 3.1 is to reduce car traffic and increase walking and cycling suitability. It goes on to say that "national governments and local decision-makers should promote human-powered transport and establish a mix of accessible walking and cycling infrastructures appropriate to national geographic and cultural contexts." In addition, it states that "member States may consider

passing legislation to make pavements and cycling infrastructure mandatory, with priority given to pedestrians and cyclists" (World Health Organization, 2016).

7. Engineering Interventions for NCDs

The risk factors for non-communicable diseases can be reduced by many interventions. In this paper the focus has been put on the following interventions as recommended by the WHO which involve use of the built environment:

- Ensure that macro-level urban design incorporates the core elements of residential density, connected street networks that include sidewalks, easy access to a diversity of destinations and access to public transport. This requires involvement and capacity of other sectors apart from health.
- Provide convenient and safe access to quality public open space and adequate infrastructure to support walking and cycling.
- Lifestyle interventions such as exercise for preventing type 2 diabetes.

However, the WHO has not included crime as a variable in the consideration of interventions using the built environment. There is a role for engineers where the above interventions are concerned. Engineers therefore have opportunities to create health-promoting environments especially where walking is concerned. In addition, perceived environmental factors such as safety from crime need to be considered in the design of interventions the use of walking as a mode of transport.

8. Discussion

The present research sought to shed light on the types of studies and research that have focused on built environment, chronic disease in high crime countries. This paper identified gaps in the scientific production of knowledge, thus we provide recommendations for future progress.

Our literature review revealed that only 17 articles were published in peer-reviewed journals between 2009 and 2019. Despite this limited amount of studies, there is a growing body of literature addressing issues related to chronic disease, safety, transportation and built environment. There are few academics in the Caribbean working in this research track. Chronic or non-communicable diseases have also been the main lifestyle investigated in the Caribbean.

Little is known about the roles that transportation, built environment and crime play in influencing diabetes and obesity in Trinidad and Tobago and the Caribbean. Based on this review and on an assessment of the strengths and weaknesses of the literature, we propose a research agenda for future research. Further studies are needed to provide a better understanding of the relationships between chronic disease, physical environment and crime in the Caribbean that includes theoretical models that frame and guide the planning and analysis of current and built environments. More research needs to be conducted that are evidence based to inform policy and practice which is critically needed to make structural and behavioural changes to help promote and ensure that Caribbean populations have an opportunity to engage in physical activity and that promote lifestyles. Comprehensive research that includes both qualitative and quantitative research methods to better understand these important understudied public and environmental health issues, and the relationships may provide guidance to develop country health-promotion action plan and

a high priority, focused on the development of urban planning and built environments that that support physical activity in Trinidad and Tobago and the Caribbean.

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