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Echocardiographic Categorization of Cardiac Disease in Guyana

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Impact Statement

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There is very little known about the causes of heart disease in Guyana due to lack of centralized record keeping. The purpose of this study was to describe the findings of a newly established echocardiography laboratory in Georgetown, Guyana over a three-year time period. This study is the first to describe the significant burden of structural heart disease in both adults and children who are referred for echocardiograms in Guyana.

Abstract

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BACKGROUND

Guyana is a Caribbean country in which prevalence and etiology of cardiac disease is unknown. An echocardiography lab was established at the Georgetown Public Hospital in 2012. The objective of this study is to utilize data from this lab to determine the prevalence and etiology of heart disease (HD) among adults and children referred for echocardiography in Guyana.

METHODS

Initial echocardiograms performed at the Georgetown Public Hospital from July 2012 to January 2015 were reviewed and categorized based on primary diagnosis.

RESULTS

Among the 1493 initial echocardiograms, 34% were performed on pediatric patients. The majority of echocardiograms (65%) were performed on hospital outpatients. Among both adult and pediatric echocardiograms, 64% were abnormal. Predominant diagnoses in adults were left ventricular systolic dysfunction (43%) and valvular HD (21%), attributed to ischemic cardiomyopathy and rheumatic HD respectively. Of the adult echocardiograms, 7% demonstrated unrepaired congenital HD. Among pediatric echocardiograms, 56% demonstrated a congenital cardiac lesion, 88% of which were unrepaired. The majority of congenital lesions were simple shunts, though 12.1% of pediatric echocardiograms demonstrated unrepaired complex congenital lesions.

CONCLUSIONS

There is a large burden of HD in patients referred for echocardiography in Guyana, demonstrating the need for chronic heart failure and vascular risk factor management, rheumatic HD prevention, and specialized surgical expertise and screening for congenital HD. Our hope is that the insight into the demographics of cardiac disease presented in this study will contribute to development of national public health strategies for prevention and management of cardiac disease in Guyana.

Background

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Cardiovascular disease is the leading cause of death in most Caribbean countries (PAHO & CARICOM 2006 [D](#)) but reliable information on etiology and prevalence of heart disease is currently not well documented. This data is essential not only for national prevention and management policies but for international agencies such as the World Health Organization, and can contribute to setting priorities for sustainable development. Guyana is a small, ethnically Caribbean country with a population of approximately 771,000 (United Nations 2016 [D](#)) on the northeastern coast of South America. The majority of the population is located in the capital city of Georgetown, while smaller mining settlements and indigenous peoples are found scattered in the surrounding hinterlands. In Guyana, the standardized rates of cardiovascular mortality are higher than the global average (World Health Organization 2014 [D](#)) but accurate data on the prevalence and etiology of pediatric and adult cardiac disease is lacking due to the absence of centralized medical record keeping. In 2012, an Echocardiography Lab was established at the Georgetown Public Hospital Corporation (GPHC) in Guyana in partnership with the Libin Cardiovascular Institute of Alberta, Calgary, Canada. This was done concurrently with other cardiovascular care programs to improve public access to care, particularly for those who could not afford to pay for care at private hospitals. This study aims to determine burden of heart disease among adults and children referred for echocardiography at GPHC and to categorize etiology of heart disease using echocardiography.

#2.0.1



- 1 *Report of the Caribbean Commission on Health and Development*
- 2 *World Statistics Pocketbook*
- 3 *Global status report on non-communicable diseases*

Methods

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This was a retrospective single-center cross-sectional study using the Echocardiography Report Database established at the GPHC in Georgetown, Guyana. Using this electronic database, the results of all echocardiograms performed over a 30-month period between July 2012 and January 2015 were reviewed. Physicians in and around the capital city of Georgetown made referrals for echocardiography based on physician judgment and standard of care in the region, and were not influenced by the study. Categorization of cardiac diagnoses was predetermined to code echocardiograms. Characteristic congenital abnormalities were categorized by diagnosis when possible while non-congenital abnormalities were categorized descriptively as clinical data was not available to ascertain a particular diagnosis. Only initial echocardiograms were used, though some patients received multiple studies, particularly if an intervention such as surgical repair or pericardiocentesis was performed. Valve disease was categorized as acquired or congenital according to presumed cause of the lesion. Atrial septal defects, ventricular septal defects, and patent ductus arteriosus were categorized as simple shunts. While multiple defects may have been present, each study was categorized based on the echocardiographer's interpretation of the primary diagnosis or most responsible defect. No patient history or ex-

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amination information was available to aid in categorization of heart disease. Complete, age-appropriate echocardiograms were performed at GPHC using Phillips HP5500 echo machines according to a standard North American protocol by a Guyanese echocardiography technician and local physicians trained by the Libin Institute as well as by visiting Libin Institute technicians and physicians. Interpretation was performed using Accesspoint software (Freeland Systems Inc.). Libin Institute cardiologists interpreted all echocardiogram reports. Data was expressed using descriptive statistics with categorical variables expressed as percentages and continuous variables expressed using mean and standard deviation using Microsoft Excel (Microsoft Corp).

Results

A total of 1802 echocardiograms were performed in 1493 patients from July 2012 to January 2015. Among these, 309 were excluded from analysis because they were non-initial studies. The majority of echocardiograms (65%) were performed on hospital outpatients. The mean age of adult patients was 49 ± 16 years and 56% of the adult patients were female. The majority of adults were working-age, with 177 (17%) categorized as 65 years or older. Among the 1493 studies analyzed, 508 (34%) of echocardiograms done were performed on pediatric patients. The mean age of pediatric patients was 6 ± 6 years. Fifty percent of the pediatric patients were female, 171 (39%) were infants 0-1 years old, 64 (15%) were in toddlers 2-4 years old, 120 (27%) were in school-aged children 5-12 years old, and 82 (19%) were adolescents.

Adult primary diagnoses consisted mainly of left ventricular systolic dysfunction (27%) and acquired valvular heart disease (15%), though 77 adult echocardiograms (7%) demonstrated unrepaired congenital heart disease (Table 1). The most common causes of acquired valve disease in adulthood are rheumatic heart disease and endocarditis as well as degenerative changes with older age. The mean age of adults with simple and complex congenital lesions was 32 ± 13 years. In the subgroup of patients 65 years and older, there were 25 normal echocardiograms and 152 abnormal studies. Within this subgroup, the majority of patients with abnormal studies had a primary diagnosis of segmental and global left ventricular dysfunction (43%) or valvular pathology (21%). The oldest adult patient with complex congenital lesions was a 44-year-old man with unrepaired Tetralogy of Fallot.

Among pediatric echocardiograms, 243 (56%) were found to have congenital lesions composed mainly of simple shunts, 214 (88%) of which were unrepaired (Table 1). Many pediatric patients with unrepaired congenital lesions were well beyond infancy and the recommended age of repair with 42% of toddlers, 31% of school-aged children, and 24% of adolescents with complex congenital heart disease living with unrepaired defects (Figure 1).

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#2.2.2



#2.2.3



TABLE 1

#2.2.4



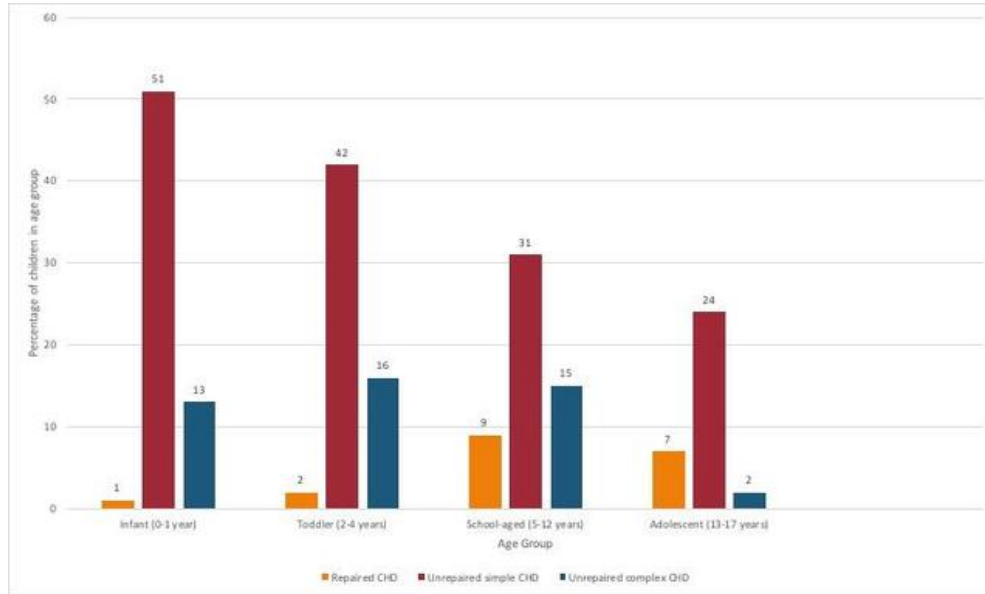
Diagnosis	Adult n=1056 (%)	Pediatric n=437 (%)
Normal	375 (35.5)	159 (36.4)
Valve disease		
Acquired aortic valve disease		
<i>Unrepaired</i>	41 (3.9)	-
<i>Repaired</i>	2 (0.2)	-
Acquired mitral valve disease		
<i>Unrepaired</i>	87 (8.2)	17 (3.9)
<i>Repaired</i>	2 (0.2)	-
Acquired pulmonic valve disease		
<i>Unrepaired</i>	3 (0.3)	-
<i>Repaired</i>	-	-

Adult and pediatric echocardiograms by primary diagnosis

FIGURE 1

#2.2.5





Repaired and unrepaired pediatric congenital heart disease by age group
CHD=congenital heart disease

Discussion

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This study describes structural cardiac disease using echocardiography in a low-income setting, and demonstrates that there is a high burden of heart disease in both adults and children who are referred by their physicians for an echocardiogram at a public hospital in the capital city of Georgetown, where most of Guyana's population is located. We demonstrate the need for population-based studies to determine the true burden of congenital and acquired heart disease in this population, so that national policies and public health strategies can be developed for prevention and management of cardiovascular disease.

#2.3.1





Prevalence and etiology of heart disease in adults

One third of adult echocardiograms showed global and segmental left ventricular systolic dysfunction and left ventricular hypertrophy. These findings are uncommon in the pediatric echocardiograms and very common in echocardiograms of elderly patients. This is likely reflective of acquired heart disease, namely the high burden of unmanaged hypertensive heart disease and ischemic heart disease present in this population and is an expected finding given the lack of cardiovascular risk factor screening and public health education undertaken in the population. The Bureau of Statistics of Guyana reported in 2008 that ischemic heart disease was found to be the primary cause of death in the country and hypertensive disease was ranked fourth (Bureau of Statistics: A Government of Guyana Agency 2016 [D](#)). As a point of comparison, 11% of American adults were diagnosed with any type of heart disease in 2015 and ischemic heart disease is also the primary cause of death in the United States (U.S. Department of Health and Human Services 2016 [D](#)). There were a surprisingly high number of adults in Guyana living with unrepaired congenital heart defects, a phenomenon rarely seen in Western countries. This is due to a lack of availability of surgical correction. In adults with unrepaired congenital defects, repair is often no longer possible and life expectancy is shortened. Hypertrophic cardiomyopathy is observed to be present in the Guyanese population, which has not been previously described in the literature. Standard of care for hypertrophic cardiomyopathy patients includes family screening of this autosomal dominant disease due to the risk of sudden cardiac death and development of heart failure and arrhythmia. The high relative incidence of acquired mitral valve disease in adults (and low incidence in children) could reflect the incidence of rheumatic heart disease in the population, as chronic rheumatic valve changes often manifest many years after the initial incidence of streptococcal infection causing rheumatic fever (Bonow et al. 2012 [D](#)). Rheumatic heart disease is endemic to low-income settings and its prevalence in Guyana should be characterized by further study. The majority of abnormalities in adult echocardiograms were in those of working age, which may have important social and economic implications in the country.

#2.4.1



- 1 *Statistical Bulletin*
- 2 *Health, United States, 2016: With Chartbook on Long-term Trends in Health*
- 3 *Braunwald's Heart Disease: A textbook of cardiovascular medicine*

Prevalence and etiology of heart disease in children



There are high rates of unrepaired congenital heart disease in children over one year old, which is notable and uncommonly seen in Western countries. The high rate of unrepaired congenital heart disease is seen to decline with age (Figure 1), which likely reflects the high rate of mortality associated with unrepaired congenital defects, although some do survive to adulthood. Because pediatric cardiac surgery had not been available in Guyana, and only accessible to a few children through non-triaged charitable programs, many children did not have access to adequate assessment and repair of their heart defects. The few children in this study that had congenital defects repaired, had these surgeries performed in other countries such as India. The identification of the large burden of unrepaired congenital heart disease and the lack of follow-up for those children with prior surgery for congenital heart disease resulting from our study has led to the development of a clinical program in Pediatric cardiology and partnership with the International Children's Heart Foundation to address this gap in access to care (Issac et al. 2017 [D](#)).

#2.5.1



- 1 *Impact of a Pediatric Cardiology Clinical Program on Congenital Heart Disease Outcomes in Guyana* (Global Pediatric Health)

Heart disease in surrounding countries

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There is very little literature describing etiology of heart disease in Caribbean countries, particularly related to congenital heart disease. There is similarly inconsistent medical record keeping leading to a paucity of data regarding adult cardiac disease in this region of the world. A retrospective cohort study of heart failure management in Puerto Rico noted that in their adult cohort of patients, 61% of cases of cardiomyopathy were noted to be non-ischemic while 28% were due to an ischemic cause (Banchs-Pieretti et al. 2008 [D](#)). In the Caribbean, the death rate from coronary heart disease was estimated to be 96.6 per 1000 individuals per year in 1996. In neighboring countries with more data, namely Brazil and Antigua, it has been found through small population and cohort studies that ischemic cardiomyopathy and hypertensive heart disease are the most common etiologies of heart failure in adults (Cubillos-Garzón et al. 2004 [D](#))(Khatibzadeh et al. 2013 [B](#)).

#2.6.1



- 1 *Analysis of Heart Failure Management at the Heart Failure and Transplantation Clinics of the Cardiovascular Center of Puerto Rico and the Caribbean* (Puerto Rico Health Sciences Journal)
- 2 *Congestive heart failure in Latin America: the next epidemic* (American Heart Journal)
- 3 *Worldwide risk factors for heart failure: A systematic review and pooled analysis* (International Journal of Cardiology)

Limitations

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Since this sample includes only those referred to the echocardiography laboratory at Georgetown Public Hospital, it is not a random sample and therefore does not reflect the true prevalence of heart disease in Guyana. This population was composed mainly of patients who could travel to the public hospital for an echocardiogram, thus heart disease in the rural Guyanese population was not captured though this a mi-

#2.7.1



nority of the Guyanese population. Local factors such as dehydration, the requirement for sedation in some children, and the patient's blood pressure at the time of the study may have influenced the adjudication of valve pathology and primary diagnoses in some echocardiograms. Echocardiography machines used were of an older generation and echocardiograms were predominantly performed by trained but non-expert technologists and physicians, thus the quality of some studies was suboptimal. Primary diagnosis was adjudicated based on best available information.

Conclusion

There is large burden of heart disease in Guyanese patients referred for echocardiograms. There are a large number of congenital heart defects in children, the vast majority untreated well past the recommended age for intervention. This study demonstrates the need for chronic disease care for adults (predominantly addressing cardiovascular risk factors and heart failure), investigation into incidence and prevention of rheumatic heart disease, and a need for specialized surgical expertise and early screening for congenital heart disease in children. This study provides valuable insight into the demographics and etiology of cardiac disease in Guyana; however further study is required to determine true population prevalence of heart disease.

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