HEALTH SERVICES USE FOR AMBULATORY CARE SENSITIVE CONDITIONS IN THE DEVELOPING COUNTRY OF BARBADOS

by

Jennifer H. Bushelle-Edghill

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Approved by:

_____
Dr. James N. Laditka

_____
Dr. Sarah B. Laditka

_____
Dr. Larissa R. Brunner Huber

_____
Dr. Jennifer L. Troyer

_____
Dr. Susan Johnson

ABSTRACT

JENNIFER BUSHELLE-EDGHILL. Health services use for ambulatory care sensitive conditions in the developing country of Barbados (Under the direction of Dr. JAMES N. LADITKA, and Dr. SARAH B. LADITKA)

Objective: This research examined hospitalization for ambulatory care sensitive conditions (ACSH) for the population of Barbados during 2003-2008. I examined differences in ACSH rates for females and males at the parish and population levels over the six year period. This study compared hospitalization rates across years and geographic locations for the six most prevalent ambulatory care sensitive conditions in the adult population, ages 20 and over, and for five individual ambulatory care sensitive conditions in the population ages 19 years and younger. I also compared ACSH rates in Barbados to published rates for other developed and developing countries.

Methods: ACSHs were identified using data from the Queen Elizabeth Hospital in Barbados for 2003-2008. For the adult population, ages 20 and over, *International Classification of Diseases, Tenth Revision Australian Modification* (ICD-10-AM) codes and categories were used to identify ACSH rates based on the codes used to define potentially avoidable hospitalizations by the Victorian Government Department of Human Services (VGDHS, 2004), codes that are used by the government of Australia that have been validated through extensive research and publication. The United States Agency for Healthcare Research and Quality (AHRQ) area level pediatric quality indicators (PDIs) were used to identify ACSHs for the population ages 19 years and younger, using an ICD-10 cross-walk developed for this research. Cross-sectional and time series analyses of ACSH rates were performed for the period 2003-2008. Poisson

analysis estimated relative rates and provided 95% confidence intervals and p-values, enabling comparisons of differences in hospitalization rates between women and men, among years of the study, and across parishes. *Results*: For the adult population, the gender analysis showed that women age 50+ had the highest percent of hospitalizations that were ACSH, nearly half of all hospitalizations (47.4%). Across years studied, the highest ACSH population-based rates were observed for men age 50+ (31.36 per 1000). Considerable variation in ACSH rates was observed among parishes for both men and women for all age groups. The analysis by gender found that, compared with men, women ages 20-49 had higher rates of hospitalization across the study period 2003-2008 and for each year. For women and men ages 50+, ACSH rates were higher for men than for women. For men and women ages 20-49 years, those who lived in St. Michael had the highest rates of ACSH of the eleven parishes. Among adults ages 20-49 and 50+, the top six ambulatory care sensitive conditions were influenza and pneumonia, congestive heart failure, diabetes, angina, dehydration, and hypertension. Among all ACSHs, the rate of hospitalization for influenza and pneumonia was highest for both women and men ages 20-49 and 50+. In the age 19 and younger population, ACSH rates differed considerably for girls and boys, and were generally higher for boys than girls across parishes and across the years 2003-2008. The most prevalent ACSH in the 19 and younger group was asthma. Trends for ACSH rates in Barbados were consistent with countries such as Taiwan and Australia, with considerable variability across the study years; however, there was notable evidence that ACSH rates may have increased considerably in the latter study years. *Discussion*: There were significant differences in ACSH rates across the parishes in Barbados for females and males. The substantial

variation in ACSH rates among parishes suggests evidence of potential problems in access to primary care, particularly for residents of St. Michael, and the adult populations in St. Thomas, St. Andrew, and St. James. This study provides relevant base line information about ACSH rates and suggests the need for future research in this area. It is possible that the higher ACSH rates in these parishes are attributable to area factors other than primary care, factors such as disease prevalence or differences in education; further research should investigate this possibility.

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CHAPTER 1: INTRODUCTION

Statement of the Problem

Barbados is an island nestled within the Caribbean Sea that has been identified as a developing state due to its lack of industrialization. Barbados has an aging population, which is somewhat different from its regional counterparts, with an epidemiological profile somewhat similar to a developed country. Improvements in the quality of life and greater longevity due to the reduction of infectious and parasitic diseases among Barbadians have resulted in many challenges for the Ministry of Health. An effect of longer life, coupled with changes in lifestyles due to increased socio-economic growth, is increased prevalence of chronic diseases (Project Design and Implementation Unit, 2003).

Ambulatory care sensitive conditions are conditions for which a lack of primary health care increases in the likelihood of hospitalization. Hospitalization for ambulatory care sensitive conditions (ACSH) consist of some chronic diseases that benefit from continuity of care at the primary care level, as well some acute conditions that often can be readily treated when the affected individual has timely access to ambulatory care. Thus, ACSH is an indicator of access to primary care of reasonable quality (Institute of Medicine, 1993). The ACSH indicator has been widely used by many countries to assess the state of the health care system (Ansari, Barbetti, Carson, Auckland, & Cicuttini, 2003; Cloutier-Fisher, Penning, Zheng, & Druyts, 2006; Niti & Ng, 2003).

My dissertation research will use the ACSH indicator to gain insight into access to primary care for residents of Barbados. Using this indicator to evaluate the health care system in Barbados will provide evidence based information to assist with policy decisions and planning in the public health environment.

Diabetes exemplifies ambulatory care sensitive conditions. Reports from Barbados for 2001 suggest mortality due to diabetes was 48.8 per 100,000 (PAHO. Health Analysis and Statistics Unit, 2007). The mortality rate due to diabetes-related amputations in Barbados ranks among the highest in the world (Hambleton, et al., 2009). These amputation rates have been attributed to underuse of preventative health care, possibly due to stigma associated with use of the public health care system that provides most health care in Barbados, a stigma that dates to the early 20th century (Walrond, 2001). The high mortality rate for diabetes has also been attributed to lack of access to primary health care, and to inadequate protocols for foot care (Hambleton, et al., 2009; Rodney, 1995; Walrond, 2001). The stigma attached to use of public facilities has increased use of private institutions; many health officials suggest that private facilities have less expertise than the public facilities (Walrond, 2001). The private sector is believed to have the capability to provide better services in some aspects of care. However, most of the high technological equipment is located at the Queen Elizabeth Hospital (QEH), with radiology, cardiac, renal dialysis and other diagnostics privately owned and operated (Project Design and Implementation Unit, 2003). In addition, many believe that the perceived ineffectiveness and inefficiency observed in the public system, results in access to care issues, primarily due to overcrowding at public health care facilities, including long wait times for services especially for complex procedures at the

QEH (Pan American Health Organization, 2008; Rodney, 1995).

In Barbados, a comprehensive decentralized health care system delivers care to residents at the primary, secondary, and tertiary levels. Research suggests that the availability of this comprehensive decentralized national health care system should limit problems related to access and low socioeconomic status (Casanova, Colomer, & Starfield, 1996), which are often observed in health care systems where health care delivery is not universal. However, observed health outcomes in Barbados point to problems in the country's health care system, including inadequate supply and distribution of health professionals. Physician supply has been linked to access barriers in many studies, which ultimately result in poor health outcomes (Basu, Friedman, & Burstin, 2002b; Gulliford, 2002; Laditka, Laditka, & Probst, 2005).

No research has used the ACSH indicator to examine access to primary care in Barbados. My dissertation research will provide new information about how to improve the primary health care system in Barbados. Findings from this research will also contribute knowledge about access to primary health care of reasonable quality in Barbados. The results will provide valuable epidemiological information about variations in ACSH by age and gender across the eleven parishes in Barbados. By examining variation in ACSH defined by location (i.e., parish), this research will help to identify specific areas that may benefit the most from efforts to improve the delivery of primary health care in Barbados. The findings of this research can inform policy and assist with the monitoring and planning of health care in Barbados. In addition, findings can contribute to better understanding the use of the ACSH indicator as a measure of access to quality primary health care in a developing country with a universal health care

system.

Background

Barbados is the most easterly of the Caribbean Islands, latitude 13.3o North, longitude 50o west. The island is approximately 166 sq miles of coral stone. The island is divided into eleven parishes. National health care is provided through primary, secondary, and tertiary care facilities to all residents of the island. A network of polyclinics and three satellite clinics provides primary care services, which are free at point of service. These services include clinical and public health services such as maternal care, pediatric and mental health care, dental services, community mental health, nutrition, health education, in-home care and environmental health services (PAHO, 2005). In addition, private clinics and stand alone physician offices provide primary care and specialist services. Tertiary care is provided by the Queen Elizabeth Hospital (QEH) and the Bayview Hospital. The QEH is the largest acute care facility in Barbados. It also provides outpatient services to approximately 110,194 patients for major chronic illnesses including diabetes, hypertension, and cardiovascular diseases, as well as services in ophthalmology and nephrology (PAHO, 2005). The only privately owned hospital, Bayview Hospital, has 30 acute-care beds and is geared towards less acute illnesses, outpatient surgery, and obstetric and gynecological care (PAHO, 2005)

Estimates of combined private and public health expenditures suggest an increase from 6% to 7% of GDP in 1999-2001, to 15% during 2002-2004 (Pan American Health Organization, 2008). It has been suggested that this growth could have been due to increases in health insurance and private health care (Pan American Health Organization, 2008).

In 2007 a policy was approved by the Barbados cabinet to promote preventative care programs leading to the development of a commission of National Chronic Non-communicable Disease. Recently the Ministry of Health has expressed an interest to increase focus and research at the primary care level to emphasize preventative care, maintenance and treatment of illness aimed at reducing the burden of care at the tertiary care level (Bayley, 2011). Current knowledge about rates of ACSH will provide useful baseline information for monitoring the success of this effort.

Hospitalizations for Ambulatory Care Sensitive Conditions

Hospitalization for ambulatory care sensitive conditions may suggest the need for improvements in primary care settings. ACSHs are conditions for which appropriate quality primary care can potentially prevent hospitalization or complications that can lead to more serious or severe diseases (AHRQ, 2001; Ansari, Carson, Serraglio, Barbetti, & Cicuttini, 2002; Billings, et al., 1993; Bindman, Chattopadhyay, Osmond, Huen, & Bacchetti, 2005; DeLia, 2003; Institute of Medicine, 1993; Laditka & Laditka, 2006; Laditka, Laditka, & Mastanduno, 2003; Pappas, Hadden, Kozak, & Fisher, 1997; Weissman, Gatsonis, & Epstein, 1992). The ACSH indicator has been used internationally to provide evidence-based guidelines for health related policy decisions (Ansari, Laditka, & Laditka, 2006; Ricketts, Randolph, Howard, Pathman, & Carey, 2001; Rizza, Bianco, Pavia, & Angelillo, 2007; Schreiber & Zielinski, 1997a; Silver, Babitz, & Magill, 1997). The use of the ACSH indicator is based on the premise that hospitalizations for these conditions can be reduced if ambulatory care services of reasonable quality are available in a timely manner and used effectively (Billings, et al., 1993; Pappas, et al., 1997; Rizza, et al., 2007; Weissman, et al., 1992). Appropriate

monitoring at the ambulatory care level should typically limit the risk of hospitalizations for these illnesses. Lack of access to quality primary care has been noted to affect hospital bed use and emergency departments, resulting in increased governmental cost of health services. Thus, policy makers and health planners view ACSH as a useful indicator, as these hospitalizations suggest opportunities for cost control.

ACSH have been used in many studies as an indicator to determine the accessibility and overall quality of primary health care (Ansari, et al., 2006; Billings, et al., 1993; Laditka, et al., 2003; Pappas, et al., 1997; Weissman, et al., 1992). Some studies have also shown that ACSH rates are associated with various factors related to individual behaviors and area characteristics such as socioeconomic status, wealth of the community, race/ethnicity, region, gender and the incidence of disease (Laditka & Laditka, 2004; Laditka & Laditka, 1999). Similarly, health behaviors such as alcohol consumption and diet have been linked to risks of ACSH (Klatsky, et al., 2005). In addition, studies have shown that smoking is a risk factor for asthma and related lung disorders, including angina, congestive heart failure (CHF) and chronic obstructive pulmonary disease (COPD), all of which are considered to be ambulatory care sensitive conditions (Ansari, et al., 2006). Thus, a high area rate of ACSH may suggest not only an opportunity to improve the accessibility and quality of primary health care, but also an opportunity to enhance public health efforts focused on disease prevention and disease management.

ACSH has been linked to access to health insurance and quality primary care services, and has been associated with barriers to quality health care (Institute of Medicine, 1993). Lack of timely access to primary care has been observed in countries

such as the U.S., where health insurance coverage is not universal for children and the working age population. In Barbados, however, primary care services are available universally, through both public and private general practitioners. The ACSH indicator has also been used in countries with universal health care, including Australia, Canada, and Taiwan (Ansari, et al., 2003; Ansari, et al., 2006; Chen, Laditka, Laditka, & Xirasagar, 2007; Cheng, Chen, & Hou, 2010b; Sanchez, Vellanky, Herring, Liang, & Hui, 2008). Universal access in Barbados should result in fewer barriers in access to primary care, and subsequently lower rates of ACSH than those typically found in the U.S. and other countries without universal health care (Ansari, et al., 2006). Thus, relatively high ACSH rates in Barbados would suggest a need to improve the health care system (Casanova, et al., 1996).

Historical Context of the Health Care System in Barbados

History

Barbados is the most easterly of the Caribbean Islands. Figure 1.1 shows a map of Barbados. Appendix A provides a brief description of each parish. Table 1.1 provides background information about the demographic and health care characteristics of the eleven parishes in Barbados.

Barbados has an aging population. In that respect it differs from countries in the same region. Except for Cuba and Puerto Rico countries such as St. Vincent, Antigua and Barbuda, Trinidad and Tobago and St. Lucia have very different population patterns. Population pyramids are shown in Figures 1.2 through 1.11. It is evidenced in these figures that up until 1991, these countries displayed a very triangular pattern of increasing population size with each consecutive generation (Figure 1.3 to 1.6). Comparatively, the

pattern for Barbados was already becoming less triangular in 1991 (Figure 1.2), indicating the falling fertility rates before this year. As is expected the top of the pyramid for Barbados continues to fill and become even more rectangular with increasing years (Figure 1.7). However, in other countries represented the distribution of the population has remained quite the same in 2008 and has not quite started to show rectangularisation. This is however projected to become more rectangular through to 2025 (Econonmic Commission for Latin America and the Caribbean, 2004).

Barbados has an epidemiological profile similar to that of a developed country. Reports projected populations of about 275,000 in 2005, 16.5% of which were over age 60, and 20.6% that were less than age 15 (PAHO - Health Analysis and Statistics Unit, 2007). More than three quarters of the population are of African descent; about 15% are of mixed African and European descent. The literacy rate is 97.7 % in 2005, one of the highest in the Caribbean (PAHO, 2001). Population density is reported to be 618.8 residents per km^2, making Barbados the most densely populated of the Caribbean islands (PAHO, 2005). Unlike the other Caribbean territories, Barbados remained uninterruptedly under British rule until its independence in 1966 (Corbin, et al., 2004).

Key features of pre-colonial policy still in existence today include the provision of a largely single-payer health system overseen by the government in collaboration with a private health care system (Corbin, et al., 2004; Shankar, et al., 1997). Other than the U.S. and Canada, Barbados is listed as one of the most flourishing countries in the Americas (U.S Department of State, 2011); however, Barbados is still considered to be a developing nation and unindustrialized, based on relative levels of industrialization among nations (Phillips et al, 2007; Shankar et al, 1997).

Revolutionary advancements in the health care sector occurred in the 1950s through to the 1990s, including several attempts at health care reform (Walrond, 2001). Today, Barbados is considered to be one of the healthiest of the developing countries, with observed overall improvements in health outcomes and delivery of care (Walrond, 2001). The state of the system at the start of the 20th century has been linked to the social and political atmosphere in the country after the emancipation of slaves in 1830 (Walrond, 2001). During this period, living conditions in the country were deplorable, with the newly emancipated slaves living without good sanitary and housing conditions (Rodney, 1995; Walrond, 2001). Plantation owners were responsible for providing health care for the public, and quality health care for most of the population was lacking (Walrond, 2001). The infant mortality rate during this period was reported to be 400 per 1,000 live births compared to 100 per 1000 in Britain (Walrond, 2001). In the wake of riots in the first half of the 20th century, steps to address the state of health services were made, with a series of revolutions in the state of education, public health, and hospital services (Shankar, et al., 1997; Walrond, 2001).

Prior to decentralization in the 1960s, the health care system in Barbados had two tiers (Rodney, 1995). Medical services were delivered in the hospital located in the city (Rodney, 1995; Walrond, 2001). Services for patients in rural parishes were delivered at outpatient clinics located at the Queen Elizabeth Hospital (QEH) on a weekly or monthly schedule.

Health education and preventative care were not promoted, even for key chronic conditions such as hypertension, diabetes, anemia and obesity (Rodney, 1995). During the period of 1979 to1983, the health care system was viewed as inequitable and

ineffective in the delivery of services (Rodney, 1995). In the mid 1980s, health care facilities consisted of one acute care hospital, the QEH, and a Psychiatric Hospital (Meditz & Hanratty, 1987b) located in the capital of Bridgetown (Meditz & Hanratty, 1987b), together with five district hospitals located in rural areas and seven polyclinics and four health centers located across the island. These five district hospitals are geriatric institutions that focus on providing long term care for the older adults, and two institutions providing care for children (Barbados Ministry of Health, 2003). These facilities are the St. Michael Geriatric Hospital, Gordon Cummins, St. Lucy, Christ Church and St. Philip District Hospitals, totaling 900 beds, located at the rural district hospital (Barbados Ministry of Health, 2003). The QEH and Psychiatric Hospital each have a bed capacity of approximately 600, with a reported 554 active beds in 2003 (Meditz & Hanratty, 1987a, 1987b). There are two private hospitals providing secondary and tertiary care: The Bayview hospital, with 24 beds, and the Woodside Clinic, with 8 beds (Barbados Ministry of Health, 2003). In 2005, physician supply was 5583 people to each physician (Barbados Ministry of Health, 2007).

Primary health care is considered to be the most important aspect of the country's decentralized health delivery system. Health services and drugs are provided free if a patient receives care from a government paid doctor. Private health insurance is also available for those who can afford it (PAHO - Health Analysis and Statistics Unit, 2007). Universal health care services were implemented through two programs. The first was the General Practitioner Service, which began in 1980 and was aimed at delivering services across the country (Meditz & Hanratty, 1987a). The second was the Barbados

Drug Service, which was aimed at increasing efficiency while reducing cost in the delivery of prescription and over-the-counter medicine (Meditz & Hanratty, 1987b).

In the late 1970s and early 1980s, education and preventive care for chronic conditions were lacking. In the latter part of the 20th century, diabetes mortality and amputation rates in Barbados were reported to be among the highest in the world. Mortality rates for diabetes mellitus in 2000 were 81.8 per 100,000 compared with 22.2 per 100,000 for the U.S. and 24.7 per 100,000 in Canada. In 1998, foot amputations associated with diabetes were 80% of all female surgeries and 50% of all male surgeries at QEH (Walrond & Ramesh, 1998). An important explanation for these high rates was poor continuity of care and inadequate foot inspection for those with diabetes: only 58% had regular professional foot inspections in the past year; 40% of survey respondents reported lack of continuity of care (Meditz & Hanratty, 1987b).

The Health Care System in Barbados

Organization of the Health Care System in Barbados

National health care in Barbados is subsidized by the government. Private care is financed through out-of-pocket payments, or employer and individual based health insurance (PAHO, 1998). The Ministry of Health is responsible for the delivery of health care in the public sector. Health care accounts for about 16% of total government expenditures annually (PAHO, 2005). In 1999 and 2000, annual health expenditures were $148 million in U.S. dollars, with 22% allocated to preventive and public health services (PAHO, 2005). Health care expenditures for secondary and tertiary care accounted for 39%; care for older people 8%; and pharmaceuticals 10%. Primary care is provided through the public and private sector, with the majority of patients seen in the

private sector on a fee for service basis, through out of pocket payments by residents (Pan American Health Organisation, 2005). In the private sector, care is provided by approximately 100 general practitioners and specialists (Barbados Ministry of Health, 2007). There is a referral procedure between public and private primary care facilities to the QEH (Barbados Ministry of Health, 2007).

Public Health Care in Barbados

The public system is governed and organized by the Minister of Health, the Permanent Secretary in this ministry and a Chief Medical Officer, who is supported by two Senior Medical Officers (PAHO, 1998). In addition, public health facilities are managed by the Director of the QEH, and eight medical officers who are responsible for eight polyclinics (PAHO, 1998).

As the rate of foot amputations for patients with diabetes increased in the late 1990s, the Caribbean Health Research Council developed a set of guidelines for all health care professionals, particularly for primary health providers. These guidelines call for foot inspections to be incorporated as part of the routine health care visit for patients with diabetes, every three months (The Caribbean Health Research Council; Pan American Health Organization/World Health Organization, 2006).

The Barbados Ministry of Health is responsible for the delivery of a comprehensive health care system, which was decentralized under the Health Services Act on September 1, 1969, to promote the health of the nation. The Act gave the Minister of Health the ability to divide the country into catchment areas for the purpose of delivering health care services (PAHO, 2001). Primary health care is considered to be the most important aspect of the decentralized system in Barbados (Yeboah, 2002). The

system was decentralized to improve the delivery of health care nationally (Yeboah, 2002). To support health care coverage, a tax levy was imposed, based on individual income as well as company income (Yeboah, 2002). This public system consists of eighteen health care facilities including a network of eight multiservice outpatient polyclinics strategically placed, one nursing home and five district hospitals to provide free comprehensive care across the Island's 11parishes (PAHO, 2001). These polyclinics are multi-service outpatient facilities managed by the Ministry of Health. The polyclinics provide clinical and public health services focused on communicable and infectious diseases, antenatal and neonatal care, pediatric and mental health care, dental services, and in-home care (PAHO - Health Analysis and Statistics Unit, 2007). Barbados currently has 8 polyclinics: The Winston Scott, Randall Phillips, Black Rock, Edgar Cochrane, The Glebe, the St. Philip, Warrens and Maurice Byer polyclinics (Barbados Ministry of Health, 2003).

Until 2003, there were two computed tomography (CT) scan units, one public and one privately owned, and one magnetic resonance imaging (MRI) unit (Corbin, et al., 2004). Under the Barbados Drug Service, essential medications listed on the National Drug Formulary are provided free at all government institutions and participating private pharmacies to residents ages 65+, those under age 16, and those who have been disgnosed with hypertension, diabetes, cancer, asthma or epilepsy (Project Design and Implementation Unit, 2003).

Hospitals

The Barbados General Hospital was established in 1834. The hospital received funding from the government and was run by an independent board of governors

(Walrond, 2001). Ten percent of the beds at this facility provide services to private pay patients; approximately 90% are for public use (Shankar, et al., 1997; Walrond, 2001). As late as the beginning of the 21st Century there was evidence that many residents believed private patients were the only ones given adequate care; many believed that those who needed to use public facilities often received substandard care (Walrond, 2001). Anecdotal evidence continues to suggest that this view is widely held by the public, although there has been no rigorous study of this issue in recent years. The QEH provides outpatient clinic services to approximately 110,194 patients for major chronic illnesses including diabetes, hypertension, cardio-vascular diseases, and also services in ophthalmology and nephrology (PAHO, 2005). The polyclinics provide primary care services, which are free at the point of service. These services include clinical and public health services such as maternal care, pediatric and mental health care, dental services, community mental health, nutrition, health education, in-home care and environmental health services (PAHO, 2005). Five district hospitals provide long term care to older adults.

Polyclinics and Health Centers

The polyclinics in existence now provide primary care services, which are free. These polyclinics provide clinical and public health services including maternal care, pediatric and mental health care, dental services, community mental health, nutrition, health education, in-home care and environmental health services (PAHO, 2005). Medical care is provided at the four health centers also located remotely across the island (Meditz & Hanratty, 1987b).

District Hospitals

The five district hospitals provide long term care for older adults as well rehabilitation to facilitate their possible return to the community. Patients at these facilities include the chronically and mentally ill, disabled as well as those who may have been abandoned by relatives (Barbados Ministry of Health, 2007).

Private Health Care in Barbados

Private health care is available for those who can afford it. From 1995 through 1996, those having private insurance coverage ranged from 18% to 20% of the population (PAHO, 2005). Expenditures in the private health care sector were approximately 30% of the total expenditure budget in 1995 (Project Design and Implementation Unit, 2003). In 2000, two thirds of residents ages 65+ reported using private sector ambulatory care (Pan American Health Organization, 2005). The private sector also accounted for 55% of ambulatory primary care and specialist visits and 87% of dental visits in 1999 (PAHO, 2005). The private system consists of approximately 100 general practitioners and consultant (Barbados Ministry of Health, 2003); there are many private doctors' offices located on the island (Corbin, et al., 2004). The only privately owned hospital, Bayview Hospital, has 24 acute-care beds. It provides services for less acute illnesses, obstetric and gynecological care and outpatient surgery. Long term care is also privately provided by 37 senior citizens' homes (PAHO, 2005).

In 1996 about half of primary care visits for medical services and over 80% of dental services were provided by the private sector; 20% of the population was covered by private health insurance (Project Design and Implementation Unit, 2003). In 2000, two thirds of people age 65+ used the private sector for ambulatory care (Pan American Health Organization, 2005). Several programs integrate the public and private sectors,

resulting in the privatization of certain aspects of the health care system to promote improvements in medical care in Barbados (Shankar, et al., 1997). The Ministry of Health collaborates with the private sector on strategies aimed at improving the health of the nation (Project Design and Implementation Unit, 2003; Shankar, et al., 1997). In 2002, the Ministry of Health, in collaboration with public and private stakeholders, developed The Strategic Plan for Health 2002-2012, which is aimed at health care reform (Project Design and Implementation Unit, 2003). In 2008, the government conducted a study to identify areas of service output currently delivered at the QEH that could be more effectively delivered at the primary health care level. This study ran concurrently with attempts to assess if this additional burden could be appropriately handled by private and public primary health care facilities (Barbados Ministry of Health, 2007).

Overview of ACSH Indicators

The *International Classification of Diseases, Tenth Revision Australian Modification* (ICD-10-AM) codes and categories used in this dissertation research to identify ACSHs for the population ages 20+, are based on the codes for potentially avoidable hospitalizations established by the Victorian Government Department of Human Services (VGDHS, 2004). Victoria is a state in southeastern Australia. The specific definition of ACSHs varies considerably among research studies (Purdy, Griffin, Salisbury, & Sharp, 2009). Most research using the ACSH indicator has used definitions based on the International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM), which continues to be used in the U.S. The QEH uses ICD-10 diagnosis coding. The VGDHS was selected for use in this research because it is based on ICD-10 codes, and because a set of codes representing ambulatory care sensitive conditions that

uses the VGDHS has been validated for use in research on ACSH (Correa-Velez, Ansari, Sundararajan, Brown, & Gifford, 2007). This definition of ACSH differs modestly from the AHRQ definition. The differences are addressed in the empirical research chapters of the dissertation.

The area level pediatric quality indicators (PDIs) were used for the population 19 years and younger. The PDIs are a set of measures established by the United States Agency for Healthcare Research and Quality (AHRQ) to identify ACSH in the pediatric population, which the AHRQ defines as ages under 18 years (AHRQ, 2001). The PDIs have been extensively validated by the AHRQ.

Overview of the Emergency Department Data Base of the Queen Elizabeth Hospital 2003-2008

The data used in this study is emergency department (ED) data obtained from files kept at the QEH. Admissions through the ED to the QEH between 2003 and 2008 were used to determine hospitalizations of the population 0-19 yrs, 20-49 and 50+. No electronic database containing discharges of admitted patients from the QEH exists. ED data can provide key information about ACSH, which often begins with an ED visit (Oster & Bindman, 2003). Voluntary admissions for scheduled procedures have been excluded based on results from previous studies, which suggest that most ACSHs are admissions that originate in the ED. This dissertation research also excludes data from the privately owned Bayview Hospital. Hospitalizations to this private hospital are generally for planned surgical and obstetric services, and account for only about 4% of the acute care bed capacity in Barbados. In addition, research has suggested that hospitalization at private hospitals is unlikely to affect ACSH rates (Alberquilla, 2003).

An ACSH was identified using ICD-10-CM codes, as well as by examining physician narratives of final diagnosis. The data obtained consist of de-identified patient ED visits including walk-ins and referrals, and provides information on admission to the hospital, demographics, arrival times, date of admission, admitting doctor, and pseudo-identifiers for patients. The variables available in this dataset are outlined in Table 1.1.

Overview of Population Demographics and Health Care Characteristics

Demographic data for the analysis were obtained from the 2000 Barbados Census database, and from mid-year population estimates from the Barbados Statistical Service for the years under study. Table 1.2 provides general and background information about the demographic and health care characteristics of the eleven parishes in Barbados. The health care characteristics were obtained from the Ministry of Health and the area (area of each parish) characteristics were obtained from the Barbados Postal Services. This was combined with the Census data to obtain physician and clinic information by parish. The population within each age group is evenly distributed across each parish, showing that generally there is no parish with a disproportionately higher or lower percentage of one age group. Generally across each parish the highest proportion of the population is between ages 20 and 49 years. The most densely populated parish is St. Michael where the capital of Bridgetown is located. This parish is also the most urban of the eleven parishes. Christ Church, St James, St. Philip, St. George, and St. Thomas are, respectively, the most densely populated parishes after St. Michael. The number of physicians and clinics per 10,000 also reflects this population density with the only exception being St. Peter (4.4 physicians and clinics per 10,000, population density 877.3 pop/ (mi^2). This can be explained by the fact that Speightstown, one of the oldest ports,

is located in this parish. One of the only other public hospitals on the island, St. Joseph hospital, was also previously located in very close proximity to this town. In addition, Speightstown is the second largest shopping area and the second transportation hub.

Study Objectives

This dissertation research focuses on geographical variation of ACSH rates in Barbados. There are four research objectives for this study. The first objective is to examine differences in ACSH rates of the adult population (ages 20+) for Barbados for the period 2003-2008. Related to this first objective, I evaluated the ACSH rates for the age groups 20-49 and 50+. The second objective is to examine differences in ACSH rates for the pediatric population (ages 0-19) for Barbados during 2003-2008. In each case, related to the objectives, I evaluated how ACSH rates varied during a period of six-years (2003-2008). Related to both objectives, I also examined differences in ACSH rates for females and males during 2003-2008. A related research objective in each case was to compare the ACSH rates obtained for Barbados to published rates for a number of developed and developing countries.

The history and culture of Barbados is unique and differs from its regional counterparts and can be compared epidemiologically to a developed country. No previous study has used the ACSH measure of health care access in Barbados. A study using the ACSH indicator to assess primary care access in Barbados can provide a better understanding of the health care system in Barbados. Assessing ACSH rates will help to identify ways to improve health care quality and control costs in Barbados.

Findings from this research will provide empirical measures of access to primary care. It will allow for the identification of geographical and disease trends, thereby

providing baseline data for future more detailed examinations of individual behaviors in the health care system. This research will contribute to current knowledge on access to primary health care of reasonable quality in Barbados. Moreover, this study will provide valuable epidemiological information about variation in ACSH rates by age and gender in Barbados. Also, by examining variation in ACSH by location (parish), this research will help to identify specific areas where delivery of health care in Barbados can be improved. The findings of this research can inform policy and assist with the monitoring and planning of health care in Barbados. This dissertation research extends previous research on ACSH by providing useful information about the accessibility and overall effectiveness of primary health care in Barbados. In addition, findings can contribute to increased understanding about the use of the ACSH indicator as a measure of access to quality primary health care in a developing country with a universal health care system.

Figure 1.1 Map of Barbados
(Central Intelligence Agency(CIA) 1980)

Table 1.1: Data elements obtained from Accident and Emergency database at The QEH in Barbados

Variable	Definition
Identifier	Pseudo Identifier
Sex	Male or female
Age	Age in numbers from 0 +
Age Type	Type of entry for Age in years or months
Parish	Abbreviations for 11 parishes as in Table 2
Arrival Date	Date patient arrived at hospital
Doctor	Pseudo Identifier for doctor
Year	Year of visit to hospital
Presenting Complaint	Narrative complaint on presentation at ER from patient on arrival
LAB	Whether patient received blood test
XRAY	Whether patient received x-ray or other
Final Diagnosis	Narrative of final diagnosis by Attending
Anatcode2	ICD-10 code for secondary diagnosis
Anatcode3	ICD-10 code for primary diagnosis
Admitted	Whether patient was admitted or not

Source: Accident and Emergency database, QEH Barbados.

Table 1.2: Descriptive Demographics for Clinics and Population within each Parish in Barbados and Population and Area Mass for Parishes in Barbados

Parish Code	Parish	Clinics /10000	Physicians /10000	Total Population	% Population Under 15 Yrs	% Population Age 15-19 Yrs	% Population Age 20-49 Yrs	% Population Age 50 and Above	Area (mi.^{2})	Population /Area(mi.^{2})
A	St. Andrew	0	0	5613	21.0	7.4	44.9	20.3	14	400.9
E	St. Peter	4.4	4.4	11405	19.9	6.8	44.1	23.0	13	877.3
G	St. George	2.1	2.1	19048	20.7	6.9	43.6	22.5	17	1120.5
J	St. John	1.1	1.1	9448	20.9	6.9	42.9	23.2	13	726.8
L	St. Lucy	0	0	9991	19.8	6.8	44.3	22.5	14	713.6
M	St. Michael	13.0	21.5	91025	20.5	7.1	41.7	22.5	15	6068.3
O	St. Joseph	1.4	1.4	7244	20.3	7.6	43.4	22.7	10	724.4
P	St. Philip	2.8	2.8	24566	20.6	6.9	43.3	22.3	23	1068.1
S	St. James	4.1	6.2	24270	19.5	6.9	44.4	22.9	12	2022.5
T	St. Thomas	0	0	13260	22.1	7.1	43.2	21.1	13	1020
X	Christ Church	4.3	5.7	52922	19.5	6.6	42.7	24.7	22	2405.5

Source: Barbados Postal Services; Barbados Ministry of Health, Barbados Census 2000

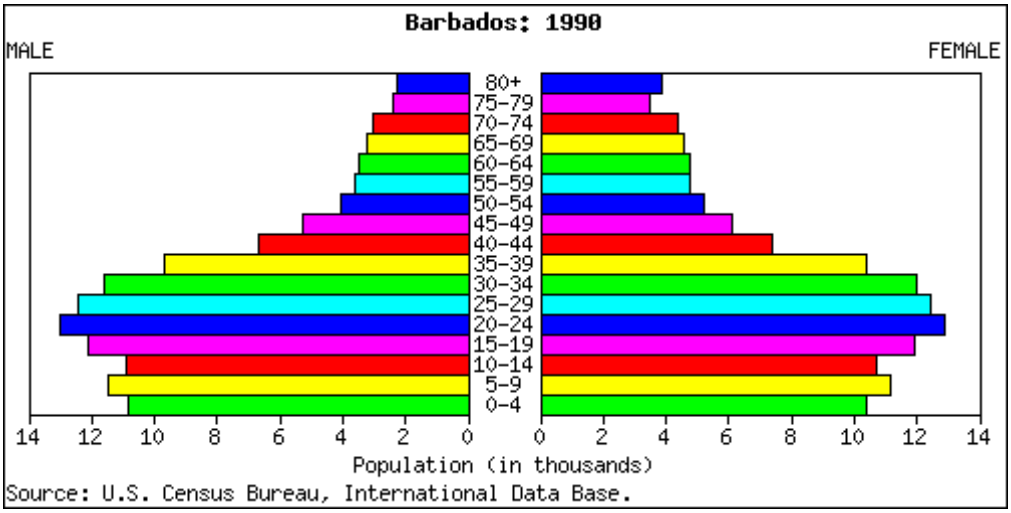

Figure 1.2: Population Pyramid for Barbados, 1990
Source: U.S. Census Bureau, International Data Base

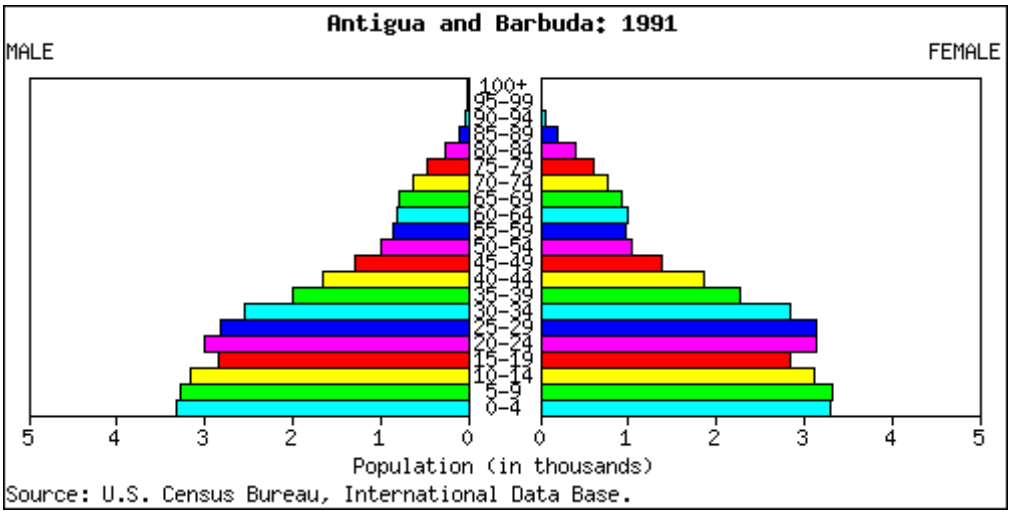

Figure 1.3: Population Pyramid for Antigua, 1991
Source: U.S. Census Bureau, International Data Base

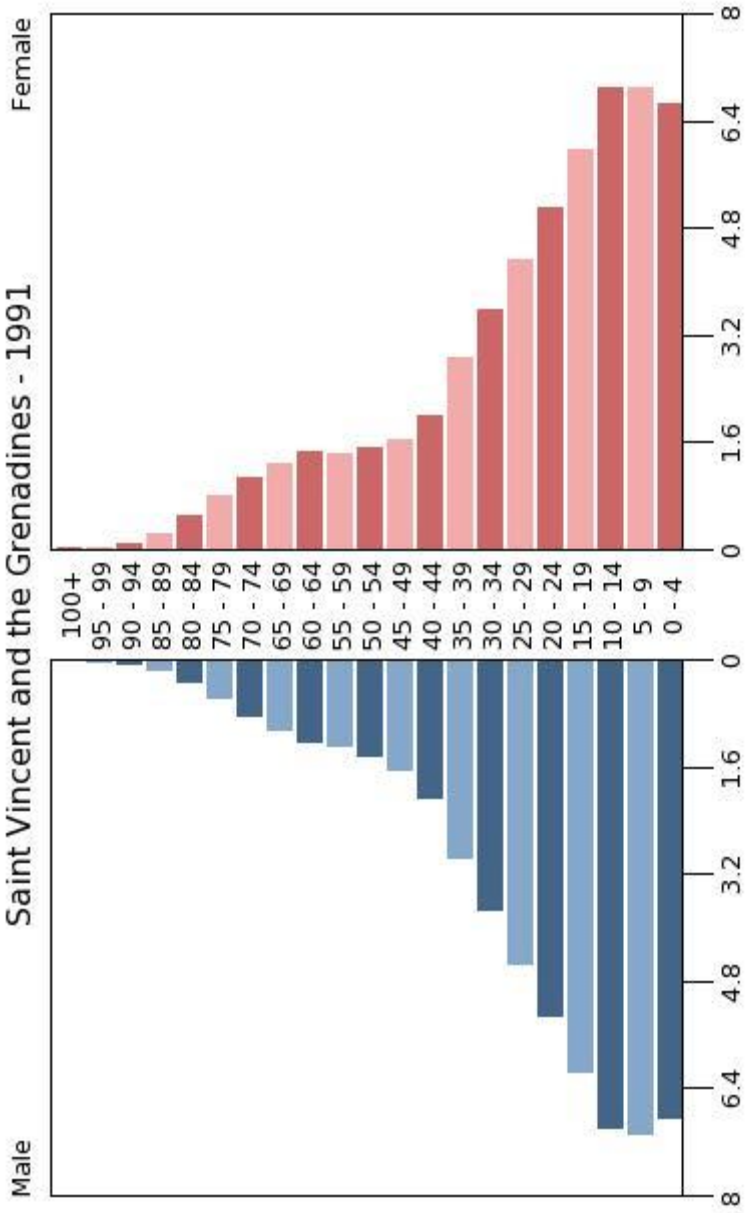

Figure 1.4: Population Pyramid for St.Vincent and the Grenadines, 1991
Source: U.S. Census Bureau, International Data Base

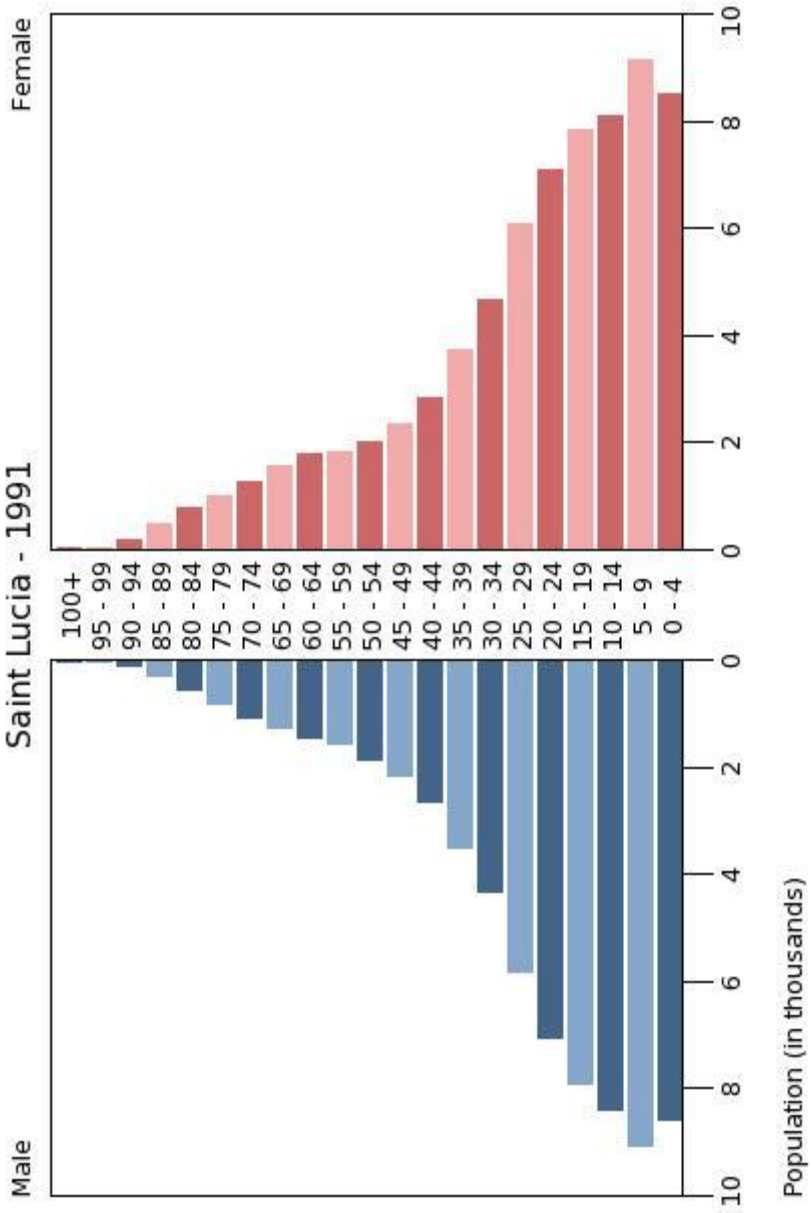

Figure 1.5: Population Pyramid for St. Vincent and the Grenadines, 1991
Source: U.S. Census Bureau, International Data Base

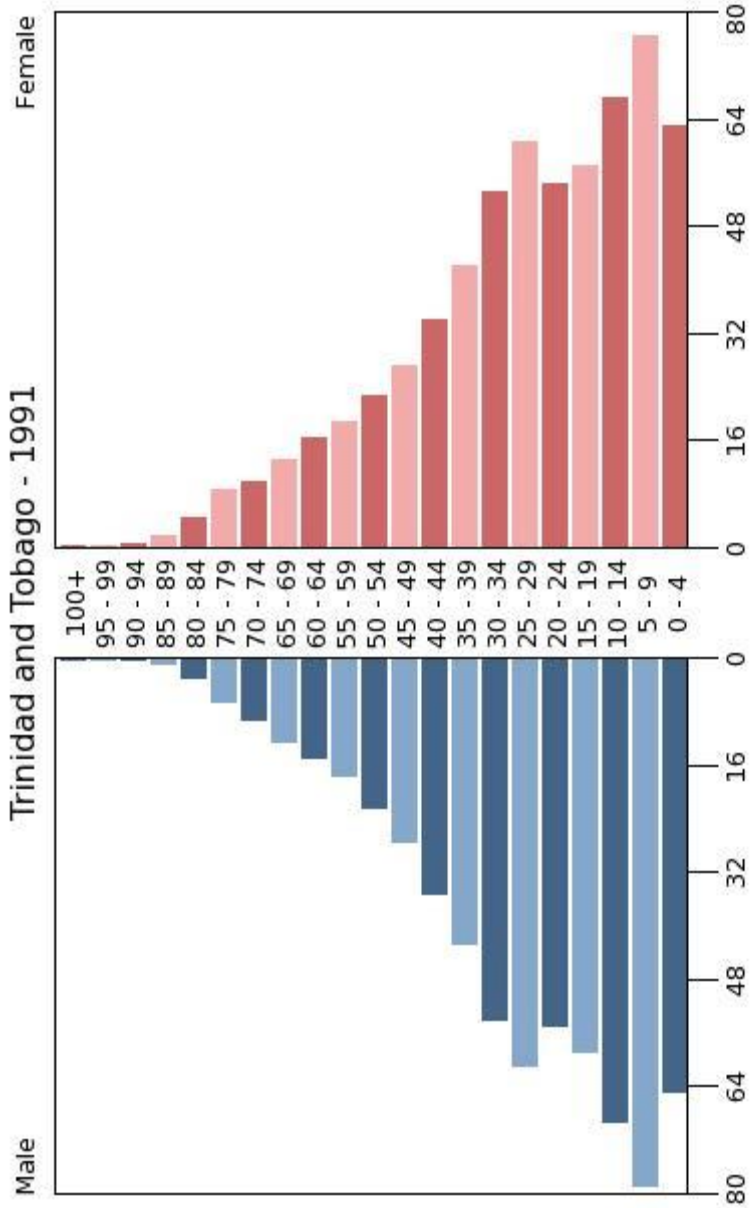

Figure 1.6: Population Pyramid for Trinidad and Tobago, 1991
Source: U.S. Census Bureau, International Data Base

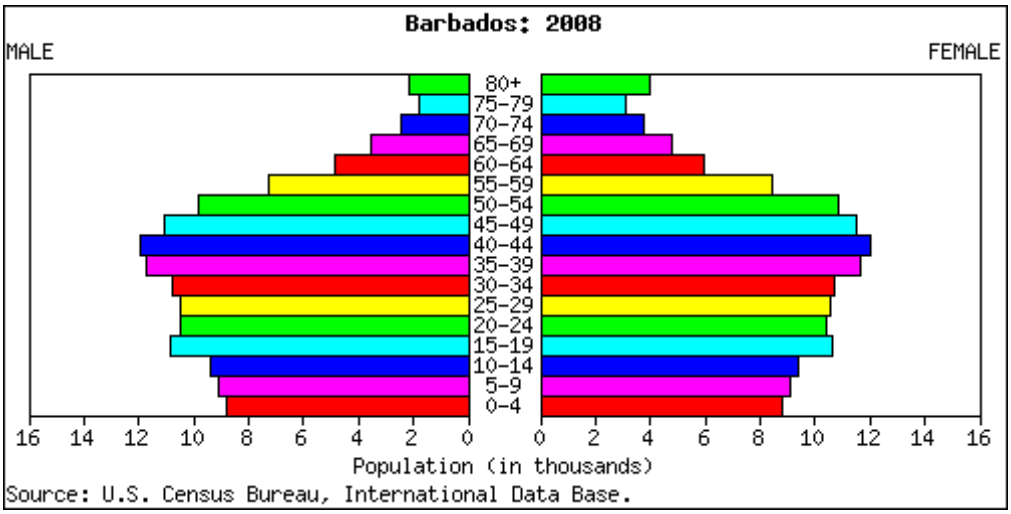

Figure 1.7:Population Pyramid for Barbados 2008
Source: U.S. Census Bureau, International Data Base

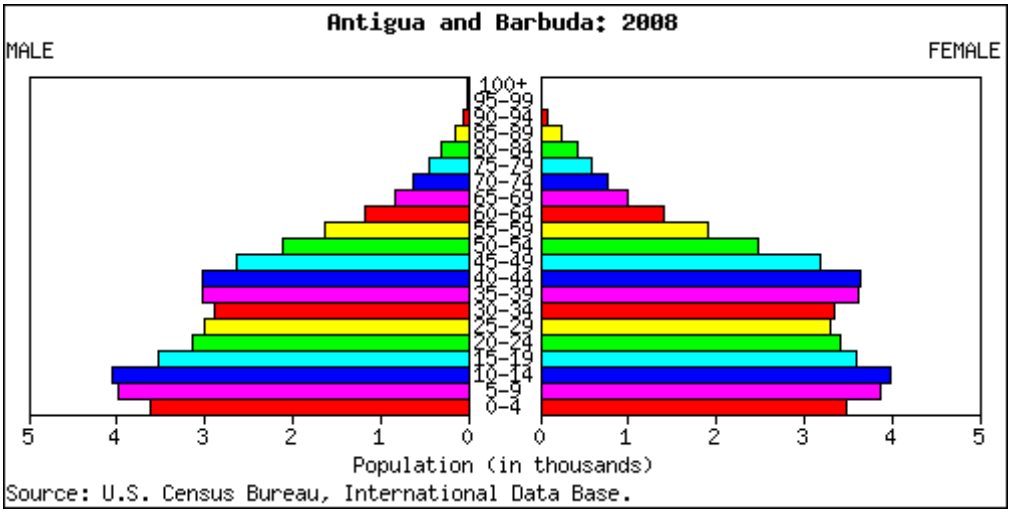

Figure 1.8: Population Pyramid for Antigua and Barbuda 2008
Source: U.S. Census Bureau, International Data Base

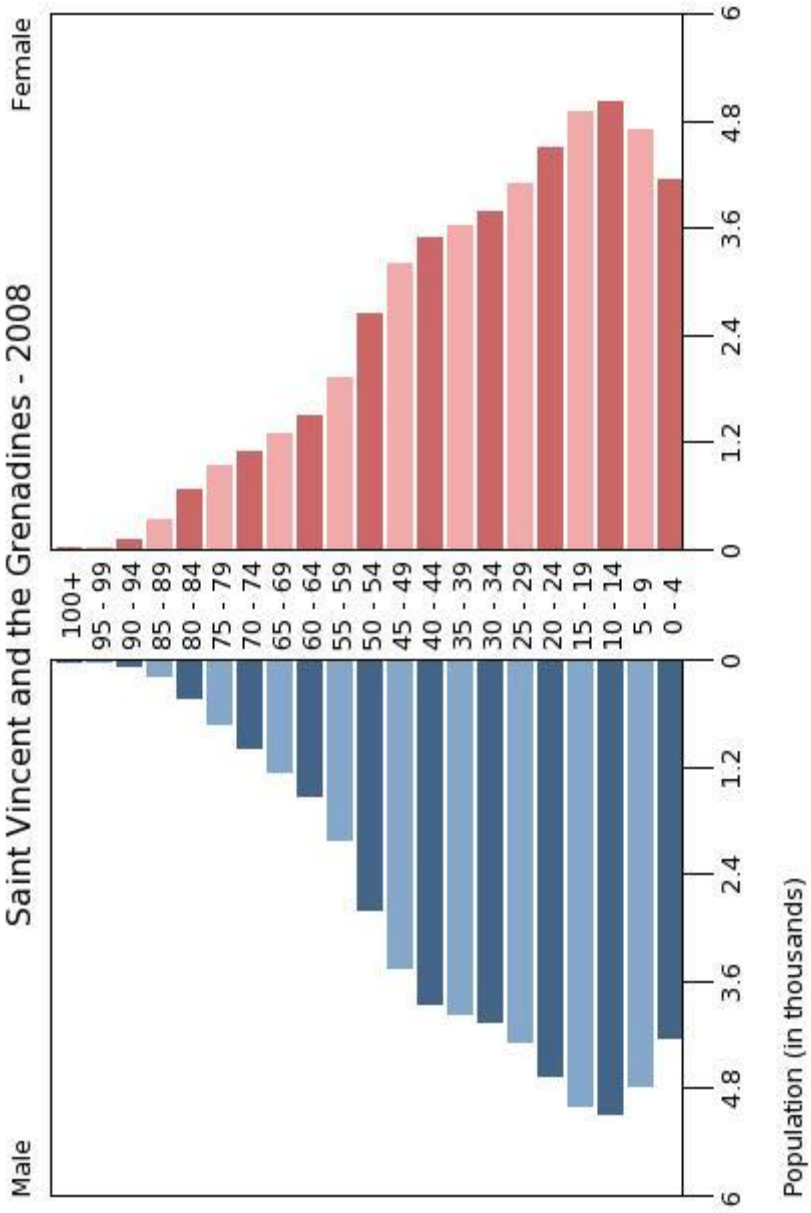

Figure 1.9: Population Pyramid for St. Vincent and the Grenadines, 2008
Source: U.S. Census Bureau, International Data Base.

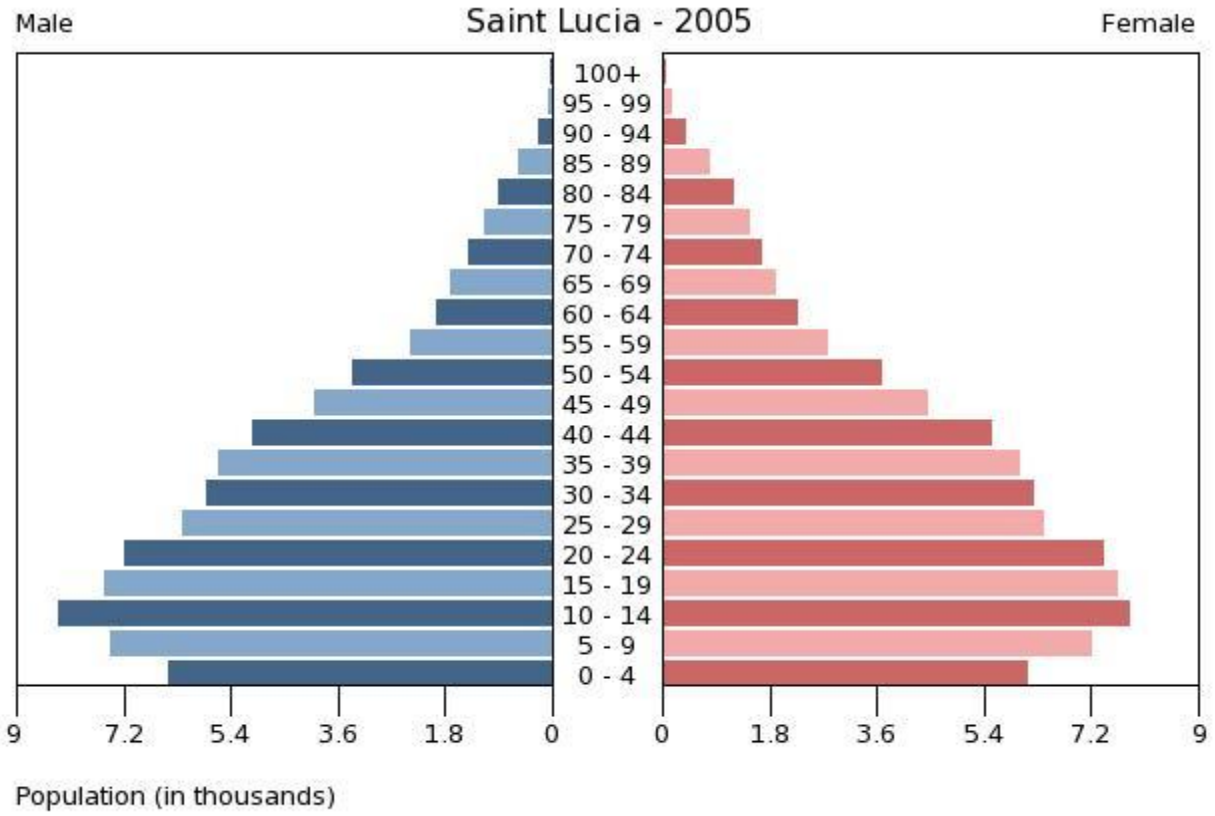

Figure 1.10: Population Pyramid for St. Lucia, 2005
Source: U.S. Census Bureau, International Data Base

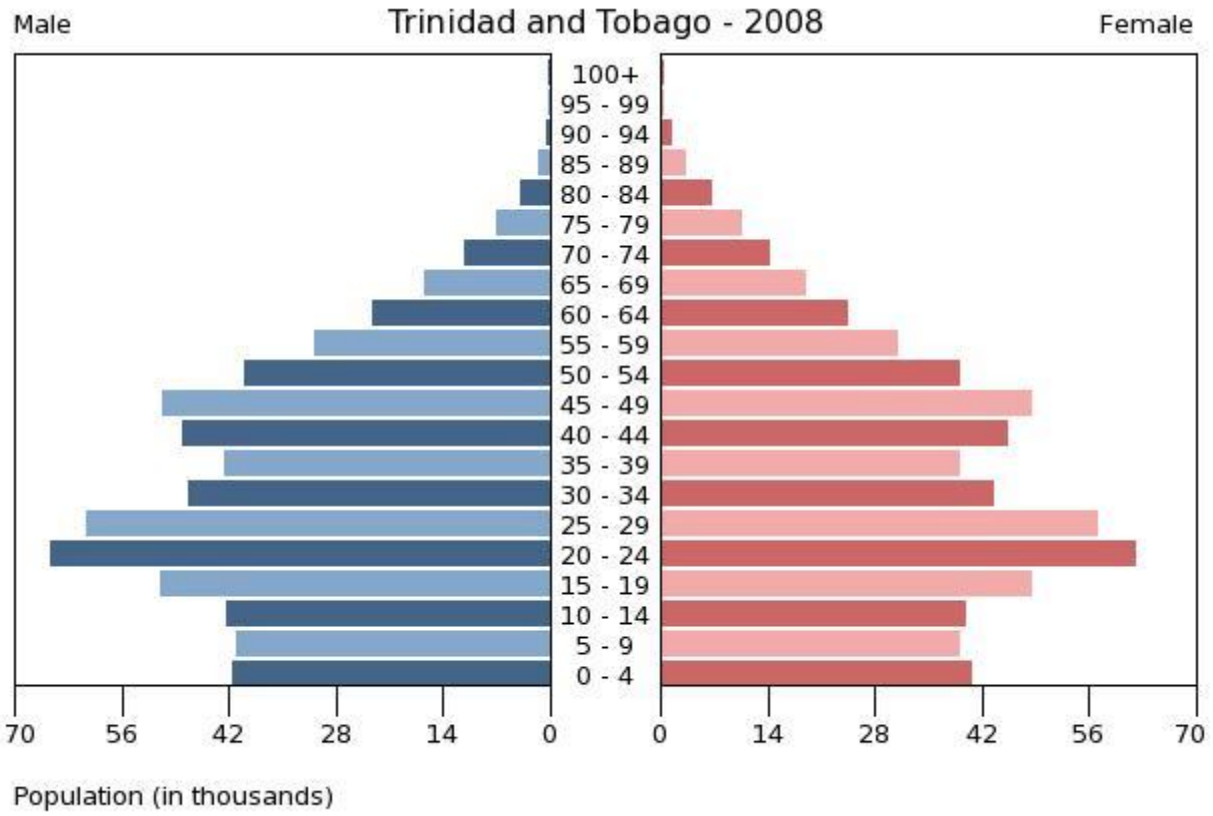

Figure 1.11: Population Pyramid for Trinidad and Tobago, 2008
Source: U.S. Census Bureau, International Data Base

CHAPTER 2: GENDER AND AGE DIFFERENCES IN RATES OF HOSPITALIZATION FOR AMBULATORY CARE SENSITIVE CONDITIONS FOR THE POPULATION AGE 20 AND OVER IN BARBADOS AND A COMPARISON TO SOME DEVELOPED AND DEVELOPING COUNTRIES.

Introduction

Hospitalization for Ambulatory Care Sensitive Conditions (ACSH)

Hospitalization for ambulatory care sensitive conditions (ACSH), also known as potentially preventable hospitalization, has been used in many studies as an indicator of the accessibility and overall quality of primary health care (Ansari, et al., 2006; Billings, et al., 1993; Laditka, et al., 2003; Pappas, et al., 1997; Weissman, et al., 1992). The ACSH indicator has been used internationally to provide evidence-based guidance for health policies aimed at improving health care and controlling the costs of publicly financed health care systems (Ansari, et al., 2006; Ricketts, et al., 2001; Rizza, et al., 2007; Schreiber & Zielinski, 1997a; Silver, et al., 1997).

Ambulatory cares sensitive conditions are conditions for which appropriate quality primary care can often prevent hospitalization or complications that may lead to severe illness (AHRQ, 2001; Ansari, et al., 2002; Billings, et al., 1993; Bindman, et al., 2005; DeLia, 2003; Institute of Medicine, 1993; Laditka & Laditka, 2006; Laditka, et al., 2003; Pappas, et al., 1997; Weissman, et al., 1992). Studies suggest that the accessibility and use of ambulatory care of reasonable quality can reduce hospitalization (AHRQ, 2007). Hospitalizations attributed primarily to conditions such as asthma, diabetes, chronic obstructive pulmonary disease (COPD), and congestive heart failure (CHF)

exemplify chronic ambulatory cares sensitive conditions. When pneumonia or a urinary tract infection is the principal diagnosis, it exemplifies acute ambulatory care sensitive conditions. Although not all hospitalizations for these conditions are avoidable, high rates of hospitalization for these conditions in an area may suggest a problem with the accessibility, quality, or utilization of primary health care (Casanova, Colomer and Starfield, 1996).

A study of ACSH in an Australian population suggested that universal health insurance may facilitate access to primary care services, and consequently lower rates of ACSH (Ansari, et al., 2006). In contrast, other studies have suggested that access to universal health insurance is not always associated with low ACSH rates (Ansari, Barbetti, et al. 2003; Laditka 2003, 2004; Laditka, Laditka, and Mastanduno, 2003). Other factors that researchers have suggested may influence rates of hospitalization for ambulatory care sensitive conditions are the individual's socioeconomic status, community wealth, race, region, gender, and area disease prevalence (Billings et al. 1993; Laditka and Johnston 1999; Laditka and Laditka 1999, 2004; Laditka, Laditka, and Probst 2005). In addition, other factors such as physician supply can influence ACSH rates, especially in rural and inner city areas, with low supply of physicians associated with higher ACSH rates (Basu, Friedman, & Burstin, 2002a; Gulliford, 2002; Laditka, Laditka, & Probst, 2005), a result that is consistent with the expectation that ACSH is an indicator of access. Further, variations in ACSH rates may occur even with universal access to health insurance, due to variation in geographic locations and among populations (Ansari, et al., 2003; Laditka, 2003; Laditka & Laditka, 2004; Laditka, et al., 2003).

In countries without universal health care coverage, such as the U.S., ACSH has been linked to access to health insurance and quality primary care services, and with barriers to quality health care such as socioeconomic status, income, race/ethnicity, physician supply, ability to obtain appointments, wait times, physician-patient interactions, travel times, transportation problems, and provider quality (Institute of Medicine, 1993). In Barbados, primary care services are available universally through free national health care. Free health care should provide broad access to quality primary care, limiting both the national rate of ACSH and variation among areas. Thus, elevated rates of hospitalization for these conditions in Barbados may indicate opportunities to improve the health care system (Casanova, et al., 1996).

Quality Indicators Used in this Study

In this study, specific ambulatory care sensitive conditions used to define ACSH were selected based on the Victorian Ambulatory Care Sensitive Conditions (VACSC) version established by the Victorian Government Department of Human Services (VGDHS, 2004) in southeastern Australia. The VACSC, which is used by state governments throughout Australia, includes chronic and complex conditions, which are manageable with adequate primary care, and acute medical conditions that can be prevented by immunizations and vaccines (VGDHS, 2004). The VACSC has been used to evaluate the accessibility of primary care (Ansari, et al., 2006). Further, this quality indicator can provide useful information on the quality of care and its use, and can also inform policies that improve quality and reduce the cost of health care (Helmer, Tseng, Brimacombe, Rajan, Stiptzaron & Pogach, 2003).

The VACSC includes diseases that can be prevented by vaccinations: including

influenza, pneumonia, and other vaccine preventable diseases. The VACSC also includes chronic conditions such as nutritional deficiencies and iron deficiency anemia, and the following acute conditions: gastroenteritis; convulsions and epilepsy; ear, nose and throat infections; cellulites; dental conditions; perforated/bleeding ulcer; and gangrene. Thus, the VACSC defines ACSH using a list of conditions that closely resembles the list used by Billings et al. (Billings, et al., 1993) and the United States Institute of Medicine (Institute of Medicine, 1993), but offers the advantage for the present research of defining ACSH using an updated set of diagnosis codes that is also used in Barbados. Moreover, the VACSC may be more appropriate for use in developing countries than the more recent ACSH definitions by the U.S. Agency for Healthcare Research and Quality. The latter definitions exclude dental conditions, for example, which rarely cause hospitalization in the United States, whereas in developing countries such conditions are common causes of hospitalization.

Overview of Barbados Health Care System

Barbados is the most easterly of the Caribbean Islands. Figure 2.1 shows a map of Barbados. Appendix A provides a brief description of each parish. The population of Barbados was about 275,000 in 2005, 16.5% of which were over age 60; 20.6% were younger than age 15 (Corbin, et al., 2004; World Health Organization, 2002).

National health care in Barbados is government subsidized, whereas private care is financed through out-of-pocket payments, or employer and individual based health insurance (PAHO, 1998). These private sector services are provided on a fee-for service basis with the private sector consisting of about 100 general practitioners and specialists (Barbados Ministry of Health, 2007). There is a referral procedure between public and

private primary care facilities to the QEH (Barbados Ministry of Health, 2007). There are several programs that integrate the public and private sectors, resulting in the privatization of certain aspects of the health care system to promote improvements in medical care (Shankar, et al., 1997). In 2002, the Ministry of Health, in collaboration with public and private stakeholders, developed The Strategic Plan for Health 2002-2012, which is aimed at health care reform by developing a new approach incorporating all stakeholders in the health care system (Project Design and Implementation Unit, 2003).

ACSH risk is also influenced by the availability and use of prescription drugs, which play a particulalry large role in controlling chronic disease. Most previous research has been unable to control for the availability of prescription drugs. However, in Barbados all citizens have ready access to the drugs used to control several of the conditions that contribute most to ACSH, and older citizens have universal access. Under the Barbados Drug Service, essential medications listed on the National Drug Formulary are free at all government institutions and participating private pharmacies to those 65 years and older or under the age of 16, and to individuals diagnosed with hypertension, diabetes, cancer, asthma, or epilepsy (Project Design and Implementation Unit, 2003).

Estimates in 1996 suggested that approximately 51% of primary care visits for medical services and over 80% of dental services were provided by the private sector with 20% of the population being covered by private health insurance (Project Design and Implementation Unit, 2003). In 2000, two thirds of the over 65 population reported use of the private sector to obtain ambulatory care (Pan American Health Organization, 2005). Although provided by private sector providers, these services are typically

covered by national health insurance.

The Queen Elizabeth Hospital (QEH) is the largest acute care facility in Barbados. It provides outpatient services in clinics generally known as "polyclinics," to approximately 110,194 patients for major chronic illnesses including diabetes, hypertension, cardiovascular diseases, ophthalmology, and nephrology (PAHO, 2005). The polyclinics provide primary care services, which are free at point of service. These services include clinical and public health services such as maternal care, pediatric and mental health care, dental services, community mental health, nutrition, health education, in-home care and environmental health services (PAHO, 2005). The only privately owned hospital, Bayview Hospital, has 24-acute-care beds and is geared towards less acute illnesses, outpatient surgery, and obstetric and gynecological care (PAHO, 2005).

In the latter part of the 20th century, diabetes mortality and amputation rates were reported to be among the highest globally. Mortality rates for diabetes mellitus in 2000 were reported to be 81.8 per 100,000, compared with 22.2 per 100,000 for the US, and 24.7 per 100,000 in Canada (PAHO. Health Analysis and Statistics Unit, 2007). These findings are consistent with research by Walrond and Ramesh (1998) who reported that 80% of female admissions and 50% of male admissions to general surgical wards at the QEH were due to diabetic foot problems. These patients account for most of the 80 to 100 major lower limb amputations within a given year. In this study, Walrond and Ramesh (1998) found that only 58% of these patients had regular professional foot inspections in the past year, with 40% of the respondents reporting lack of continuity of care. The Caribbean Health Research Council has since developed a set of guidelines for all health care professionals, particularly in primary health care, to incorporate foot

inspections as part of the routine health care visit for diabetic patients every three months (The Caribbean Health Research Council; Pan American Health Organization/World Health Organization, 2006).

Health Care Characteristics

Table 2.1 provides background information about the demographic and health care characteristics of each parish. The population within each age group is evenly distributed across each parish, showing that generally there is no parish with a disproportionately higher or lower percentage of any given age group. Generally across each parish the highest proportion of the under 20 population is in the under 15 age group. The most densely populated parish is St. Michael, where the capital of Bridgetown is located. This parish is also the most urban of the eleven parishes. Christ Church, St. James, St. George, St. Philip, and St. Thomas are respectively the most densely populated parishes after St. Michael. The number of physicians and clinics per 10,000 also reflects this population density, with the only exception being St. Peter (4.4 physicians and clinics per 10,000, population density 877.3 pop/mi^2). This can be explained by the fact that Speightstown, one of the oldest ports, is located in this parish. One of the only other public hospitals on the island, St. Joseph Hospital, was also previously located in very close proximity to this town. In addition, Speightstown is the second largest shopping area and the second transportation hub.

Overview of the Literature

ACSH Rates and Age

Research on ACSH has reported considerable variation in rates among different age groups (Laditka, et al., 2003; Laditka, Laditka, & Probst, 2005; Laditka & Laditka,

1999). Several studies have reported clear trends of increasing ACSH risk as age increases, especially among those over age 65 (Laditka & Laditka, 2003; O'Malley, Pham, Schrag, Wu, & Bach, 2007).

Researchers in Europe and the U.S. have found that ACSH rates are higher for adults ages 45-64 than for younger adults (ages 20-44); studies have also found that older adults have a higher risk of ACSH than younger adults (Agabiti, et al., 2009; CSIRO Mathematical and Information Sciences, 2002; Laditka, 2003; Laditka & Laditka, 2003; Laditka & Laditka, 1999; Shi, Samuels, Pease, Bailey, & Corley, 1999). Studies suggest that older adults generally use health care services more than their younger counterparts (Laditka & Laditka, 2009). In addition, with improvements in life expectancy as well as a growing population of older adults, the prevalence of chronic diseases is expected to increase (Project Design and Implementation Unit, 2003). Consequently, the burden on the health care system of managing and treating patients with chronic conditions may increase, which may result in less access to care (Bindman, et al., 1995; Laditka & Laditka, 1999).

This study examines ACSH rates for ages 20-49 and 50+ in Barbados. Results may be useful for examining policies such as improvements in access to needed primary care services, health education, continuity of care, and management and prevention of chronic diseases. This information can also help to inform policy decisions on how health care spending is allocated within the health care system.

ACSH Rates and Gender

It is well established that morbidity and mortality patterns differ substantially between females and males (Laditka & Laditka, 2009). In addition, health seeking

behaviors and health care use are influenced by gender (Laditka, 2003). Studies of ACSH in the U.S have suggested that women have higher rates of visits to primary care physicians than men (Laditka & Laditka, 1999; Lishner, 2000). Other studies conducted in countries with universal health coverage have shown that, compared with men, women use primary care services more, and use hospital services substantially less (Fernandez, Schiaffino, Rajmil, Badia, & Segura, 1999; Magan, Otero, Alberquilla, & Ribera, 2008). Some researchers have attributed these lower hospitalization rates among women to women's role as caregivers; they may tend to avoid hospitalizations because of their responsibilities as caregivers. Others have attributed lower rates of hospitalization for women to their greater use of primary care (Laditka & Laditka, 1999; Lishner, 2000). In a study in Singapore on trends in potentially avoidable hospitalizations from 1991 to 1998 for the population under age 65, men had higher rates of ACSH than women (29.5 per 10,000 population compared with 22.4 per 10,000) (Niti & Ng, 2003). When the avoidable hospitalization was adjusted for "baseline utilization," by dividing the avoidable hospitalization relative rates by the relative rate of total hospitalization, women were still 1.3 times less likely to be hospitalized for ambulatory care sensitive conditions than men (Niti & Ng, 2003). Women are also more likely to be diagnosed with a chronic illness than men (Wolff, Starfield, & Anderson, 2002). Among older adults in Madrid, Spain, (Magan, et al., 2008) the rate of ACSH was significantly higher among men than women (35.37 per 1,000 compared with 20.45 per 1,000 population) (Magan, et al., 2008).

Statistics for Barbados in 2005 reported that women had 26% more primary care visits than men (Pan American Health Organization, 2008). There was little variation in

visits for ambulatory care among age groups; 27% of those ages 45-65 reported using ambulatory care in the year preceding a recent survey, followed by those age 65 and over (25%) and ages 16-45 (24%) (Pan American Health Organization, 2008). Given the observed gender differences across age groups for ACSH in previous studies, it is useful to assess ACSH rates in Barbados separately for females and males. Gender differences in ACSH rates in the older age groups are particularly important as chronic diseases have been observed to result in differences in health care utilization with increasing age (Laditka, 2003; Westaway, 2010).

Trends in ACSH Rates

In a study conducted in the U.S. to examine national trends in preventable hospitalization, an overall increase for ACSH was observed for all ages during 1980 to 1998 (Kozak, Hall, & Owings, 2001b). ACSH rates increased for those ages 15 to 44 and those ages 45 to 64. The increase was particularly large for those ages 65 and over, rising from 364.6 per 10,000 population to 573.5 per 10,000, a result that may be attributable in part to a substantially increasing average age among those ages 65 and over. The increase in the older U.S. population correlates with increases in age-related chronic disease conditions. These may account for the observed sharp increase in ACSH rates during this period, despite stratification by broadly defined age categories. The latter fact supported the need to address residual age confounding in age-stratified analyses within each age stratum.

Other studies have found that ACSH rates differ over time periods in a government subsidized health care system (Niti & Ng, 2003). A study conducted in Singapore that assessed ACSH rates between 1991-1998 showed a decline in rates (Niti

& Ng, 2003). However, the authors of this study suggested caution about generalizing this result. They further noted that while their results may indicate improvements in the quality of primary care, results for the population age 65 and over showed increases in ACSH (Niti & Ng, 2003). A number of factors may explain the differences reported in these two studies, including: (1) the studies were conducted in different populations; (2) and each country has a different health care system, which may influence access to primary care. A limitation of the study conducted in Singapore is that the authors adjusted for area level and individual characteristics using total hospitalization, which may actually underestimate ACSH rates (Niti & Ng, 2003). Analyses conducted in Canada by the Canadian Institute of Health Information (CIHI) showed that after adjusting for population growth and aging over a six year (2000-2007) period, ACSH decreased (Sanchez, et al., 2008).

Life expectancy at birth in Barbados has increased, from 71 years in 1995 to 77.8 years in 2008 (74.3 for males and 79.3 for females) (PAHO. Health Analysis and Statistics Unit, 2007). Although this increase may be due to a variety of factors, among them is improvement in the quality of care, possibly due to the decentralization of the health care system in the late 1960s and early 1970s and increased funding for national health care in Barbados. In addition, several policy initiatives aimed at reducing the prevalence of chronic diseases including diabetes, hypertension and cardiovascular diseases have been implemented by the Ministry of Health in Barbados. However, health care policies in Barbados have not addressed the demand for care that accompanies an aging population, and an expected increase in chronic diseases associated with it. ACSH rates for the older population may reflect the inability to address these changes to date.

Comparative Data on ACSH

The definition and/or grouping of developed nations and developing nations varies in the literature. This variation is important for evaluating comparative rates of ACSH among countries. Generally, the United Nations and the Organization for Economic Cooperation and Development (OECD) identify Japan, Canada, the United States, Australia, New Zealand, and many countries in Europe (including Spain) as developed nations. These countries are characterized based on their high per capita income and the high standard of living enjoyed by their residents (The World Bank Group, 2004). This classification excludes the high income developing countries of Hong Kong, Israel, Kuwait, Singapore, and the United Arab Emirates; these countries are considered transition or emerging countries because of their per capita income or the structure of their economies (The World Bank Group, 2004). According to The World Bank (2004), developing countries are classified as those countries with middle to low GNPs per capita, along with the five high income economy countries listed as transition or emerging countries.

In this study, the five countries described above as emerging countries – Hong Kong, Israel, Kuwait, Singapore, and the United Arab Emirates – are considered developing nations. This definition, used by The World Bank for developed and developing nations, classifies countries based on gross national product (GNP). A search of the literature revealed that peer reviewed articles and aggregate data on ACSH rates are available for all of the developed countries except Japan, allowing for comparisons of ACSH rates among these developed countries. In addition, comparative data is also available for Portugal, Singapore, and Taiwan. ACSH rates in these developing countries

can be compared with the rates in Barbados. The results of this literature search are briefly summarized in Table 2.2. Similar to Barbados, the health care system in all of the comparison countries except the U.S has some form of publicly financed universal health care, where residents have health care coverage. In the U.S. there is nearly universal health care for those ages 65 and older, in the form of Medicare.

Research Objectives

This study examines differences in ACSH rates for women and men, as well as differences across age groups for those ages 20 and over, for each of the eleven parishes in Barbados over the six year period from 2003 through 2008. The rates obtained are compared to published rates for a number of developed and developing countries.

The unique history and culture of Barbados, and lack of previous empirical work for this country using this measure of health care access, does not support hypothesis testing. This study addresses the following research questions, which are informed by previous research on the accessibility and use of primary health care, as well as research on ACSH.

Research Questions

1. What are the differences in ACSH rates for women and men in Barbados for the populations at ages 20-49 and 50+ during 2003-2008? It is well established that morbidity and mortality patterns differ substantially between women and men (Laditka & Laditka, 2009). Research suggests that women have higher rates of diagnoses for chronic conditions than men (Saydah & Eberhardt, 2006). Women have also been found to have higher rates of visits to primary care physicians than men (Laditka & Laditka, 1999; Lishner, 2000), while their use of hospital services is substantially less than that of men

(Fernandez, et al., 1999; Magan, et al., 2008).

2. What are the ACSH rates for persons age 20-49 and 50+ in Barbados? Research on ACSH has reported considerable variation in rates among different age groups (Laditka, et al., 2003; Laditka, Laditka, & Probst, 2005; Laditka & Laditka, 1999). Several studies have reported clear trends of increasing ACSH risk with increasing age, especially among those over age 65 (O'Malley, et al., 2007). Researchers have found that ACSH rates are higher for adults ages 45-64 than for younger adults, those age 20-44; and that adults over age 70 have higher ACSH rates than middle aged adults (Agabiti, et al., 2009; CSIRO Mathematical and Information Sciences, 2002). Studies suggest that older adults generally use health care services more than their younger counterparts. Increased life expectancy suggests an increase in chronic diseases associated with greater longevity.

3. How do the ACSH rates vary over the period 2003-2008 for the population of Barbados? Overall increases in ACSH rates for all ages have been observed in the U.S. during 1980 to 1998 (Kozak, et al., 2001b). However, varying rates have been observed among those 45 to 64, and 65 years and over. Other studies have reported declining rates of ACSH in countries with universal health care (Niti & Ng, 2003). The health care system in Barbados is universally available. There has been substantial reduction in infant mortality rates and increased life expectancy over the past century. These changes in the population profile may point to decreases in ACSH rates in Barbados.

4. How do ACSH rates in Barbados compare to published ACSH rates in developed and developing countries? ACSH rates reported in the literature vary across countries from developed to developing nations. Comparisons of ACSH rates for

Barbados to those of other countries can provide useful baseline data to policy makers in Barbados. Results of this comparison can assist health planners to develop policies aimed at improving the delivery of primary health care in Barbados.

Study Design and Methods

This study used data on admissions through the emergency department (ED) to the Queen Elizabeth Hospital (QEH) between 2003 and 2008. These data were obtained from ED records at the QEH for the specified years. ED records were used for the study because in Barbados there is no electronic database containing discharges of admitted patients from the QEH. However, other than admissions for routine outpatient and inpatient surgeries, or admissions for psychiatric patients, most hospitalizations at the QEH begin with ED visits at the QEH. In addition, ED data can provide key information on ACSH, and ACSHs often begin with ED visits (Oster & Bindman, 2003) and have been used in previous research to assess ACSH rates (Flores, Abreu, Chaisson, & Sun, 2003; Oster & Bindman, 2003). Hospitalizations for ambulatory care sensitive conditions were identified using *International Classification of Diseases, Tenth Revision* codes (ICD-10) along with the narratives for final diagnosis included in the ED records.

Given that Barbados is a developing country, the health informatics capacity of the QEH raises challenges to researchers. The QEH does not have electronic records of discharge diagnoses, which would typically be used for ACSH research in the U.S. and other developed countries. This characteristic of the data accounts for our use of the ED records for diagnoses at admission to the QEH. However, the QEH data also offered narrative discharge diagnoses. These narratives of final diagnoses were scanned as part of the coding used to identify each ambulatory care sensitive condition. When an ACSH

was not identified using the principal diagnosis ICD-10-AM code from the ED record, the final diagnosis narrative offered an opportunity to identify an ACSH from the narrative discharge data. In cases when an ACSH occurrence was identified, but the final diagnosis narrative and ICD-10-AM code did not agree, the ambulatory care sensitive condition judged to be the principal cause of the hospitalization was determined as follows:

- If the principal diagnosis code identified an ACSH occurrence then this case was counted as an ACSH event as identified by the principal diagnosis.
- If the principal diagnosis not did not match the final diagnosis and was not an ACSH event, but the final diagnosis narrative indicated an ACSH, then the case was coded as an ACSH event, with the particular ambulatory care sensitive condition considered to have caused the hospitalization taken from the final diagnosis narrative.

Cross-sectional and time-series analyses of hospitalizations for ambulatory care sensitive conditions for the period of the study were conducted. Rates of ACSH were calculated based on geographic locations specified by the Barbados Statistical Services (BSS) for each parish in Barbados. Since studies suggest that demographic characteristics differ for rural and urban areas in addition to varying primary care access associated with distance, travel time, and other factors, the risks of ACSH were assessed separately for each area (Eberhardt, Ingram, and Makuc 2001; Laditka, Laditka and Probst, 2005).

Demographic data at the parish and population levels were obtained from the 2000 Barbados Census enumeration database, which included projected population

estimates for the years studied in this research. The two data sources (ED data from the QEH and Census 2000) were combined and aggregated at the parish and population levels.

Conceptual Framework

A modified version of Andersen and Aday's behavioral model of health services guided this research (Appendix C). The model was used theoretically to explore factors associated with ACSH (Andersen, 1995). This framework indicates that use of health care services can be predicted or explained by individual characteristics, location, and health system characteristics (Laditka, Laditka, & Probst, 2009). This behavioral model includes three domains: predisposing characteristics, enabling characteristics, and need.

Predisposing characteristics are an indication of an individual's tendency to access primary care, and are usually independent of health needs. Factors such as age, race/ethnicity and gender are associated with a predisposition to use health services and have been associated with trust in providers and institutions, the level of perceived understanding of patients' needs, and efficacy of care (Institute of Medicine, 2003).

Enabling characteristics include factors such as a usual source of care or primary care access, adhering to prescribed regimens, insurance, cost, education, income, and unemployment. In addition, studies have shown that being married typically improves health care access (Laditka, 2004). Individuals who are married are thought to be more inclined to be pro-active in making health care decisions (Laditka, 2004). While the data obtained from the 2000 Census for my dissertation does include data on educational attainment and marital status, those data do not include measurements or estimates at the parish level. In addition, Barbados has a high national literacy level, providing a useful

control for education: the literacy rate for Barbadians was estimated at 99.7% in 2005 for the those 15 and over, 99.7% for males and 99.8% for females (PAHO/AIS, 2005).

Need characteristics associated with ACSH risk include an individual's health, stability or severity of illness, and functional status. Characteristics of need directly influence an individual's access to primary care services and thus affect the risk of an ACSH occurrence (Laditka, 2004). Comorbidities often are associated with a greater need for use of health services and have been shown to be associated with a higher risk of ACSH.

Although the theoretical model just described may be useful when adequate measures are available for all of the characteristics mentioned, only rarely are such measures available (Laditka, 2004). The only measures available for use in analytical model for this research were predisposing characteristics – age, geographic location, and gender – shown in the theoretical model in Appendix C in the ellipse with dashed lines. This limited set of measured variables in the analytical model used for this research is consistent with most research that uses the ACSH indicator. Most of that research has used small area analysis, which focuses on area rates and includes no measures at the level of individuals (Billings, et al., 1993; Bindman, et al., 1995; Laditka & Johnston, 1999; Laditka & Laditka, 1999; Millman, 1993; Parchman & Culler, 1994; Schreiber & Zielinski, 1997a).

Data Sources

The data were extracted from files kept at the Queen Elizabeth Hospital (QEH) for admissions originating from the emergency department (ED) between 2003 and 2008. The data were obtained from ED records from the QEH for the specified years. Records

with missing data or inaccurate data for any enumeration area (for example, residence in a personal care home or other institution) were deleted. Records were also removed if the patient was not a resident of Barbados, or if visit or discharge dates were outside the study period. In addition, the data were cleaned of duplicate records or discrepancies in age or other demographic data. There were 266,640 total visits to the ED during the study period. Of these records 61,886 (23.2%) met these criteria and were excluded from the study dataset. Table 2.3 shows the variables obtained from the Emergency Department database and used in the analysis for this study. This database contains two ICD-10 diagnosis codes and one narrative of the final diagnosis, as well as a pseudo identifier representing the individual, sex, age, age type, parish, arrival date, a pseudo identifier for the attending physician, year of visit, presenting complaint and whether any labs or X-rays were performed in the ED.

Demographic data were obtained from the 2000 Barbadian Census, adjusted for parish boundaries. The two data sources were combined and aggregated at the parish level, providing hospitalization rates at the parish and national level.

Diagnoses indicating ACSH were identified using definitions for ambulatory care sensitive conditions established by the Victorian Government Department of Human Services (AHRQ, 2001; Billings, et al., 1993; Institute of Medicine, 1993; VGDHS, 2004), using the *International Classification of Diseases, Tenth Revision* ICD-10-AM codes shown in Table 2.4.

Study Population

The population studied were persons age 20 years and over in the eleven parishes of Barbados (*n*=218,710). The analysis included all completed data on an individual visit

that was available from the QEH Accident ED data files as well as the Census enumeration data. All patients age 20 years and over who presented to the QEH from January 1, 2003 to December 31, 2008 and who were admitted to the hospital were included in the analytic database. Records for patients who were not residents were identified by a value of zero in the identifier field and removed from the dataset. Of the 266,640 cases with a record in the ED dataset, 32,795 met the exclusion criteria. The sample was further restricted to include only patients who had an ACSH.

Census tract data from year 2000 were extrapolated using mid-year population estimates obtained from Barbados Statistical Services (BSS) for the years 2003-2008, to calculate population estimates for each parish within each year for the study period. The procedure is discussed in more detail later in this chapter.

Outcome Measures

The outcome of interest was hospitalization for an ambulatory care sensitive condition. The outcome measure used was the VACSC established by the Victorian Government Department of Human Services (VGDHS, 2004) in southeastern Australia. Most research using the ACSH indicator has used definitions based on the International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM), which continues to be used in the U.S. The QEH uses ICD-10 diagnosis coding. The VACSC was selected for use in this research because it is based on ICD-10 codes, and because a set of codes representing ambulatory care sensitive conditions that uses the VGDHS has been validated for use in research on ACSH (Correa-Velez, et al., 2007). This definition of ACSH closely resembles the list used by Billings et al.(Billings, et al., 1993) and the United States Institute of Medicine (Institute of Medicine, 1993).

The VACSC are defined as chronic conditions such as diabetes complications, nutritional deficiencies and iron deficiency anemia, hypertension congestive heart failure (CHF), angina, chronic obstructive pulmonary disease (COPD) and asthma; acute conditions: dehydration and gastroenteritis; convulsions and epilepsy; ear, nose and throat infections; cellulites; dental conditions; perforated/bleeding ulcer; ruptured appendix, urinary tract infections (UTI) including pyelonephritis, .pelvic inflammatory disease (PID) and gangrene; and vaccine-preventable: influenza and pneumonia and other vaccine preventable conditions. Table 2.4 shows the ICD-10-AM codes for all adult ACSHs, which were used and the corresponding ICD-9-CM (Victorian Health Information Surveillance System, 2011).

Patient Characteristics

Patient characteristics included all demographic data including age, sex, and parish of residence. All were coded as dichotomous variables. The referent group in the case of place of residence was the parish of St. Michael, which was the parish with the largest population. Age was categorized into the 20-49, and 50 and over. All admissions were coded "1" if there was an incidence of at least one ambulatory care sensitive condition and "0" if no ambulatory care sensitive condition was present.

Population Estimates

Population estimates for individual parishes were required for the denominators used in this research. However, they were not available from the Barbadian Census or from other sources. Population estimates for each parish for each year were calculated in the following manner:

a. We obtained unpublished midyear estimates for the entire Barbados population,

for each year from 2003 through 2008, from the Barbados Statistical Services, which conducts the Barbadian Census.

b. We examined the 1980, 1990, and 2000 Barbadian Census to identify the proportions of women and men in each parish. These proportions did not meaningfully change among these decennial Census measures. Also, the proportions of women and men measured by the decennial Census did not vary meaningfully among parishes; thus, it was reasonable to apply these proportions to estimate populations of women and men in each parish for the years under study.

c. We obtained unpublished population sizes from the decennial Census for specific age categories for women and men for each parish from the Barbados Statistical Services (BSS).

d. We estimated the population sizes for women and men in each age category in each parish for each year using the mid-year population estimates for each parish. The BSS data did not provide specific estimates by age category or parish. To calculate those estimates, we applied the corresponding national proportions obtained from the decennial Census. This procedure was reasonable, given that the national proportions do not change meaningfully among the measured decennial Census data from 1980, 1990, and 2000.

e. When analyzing ACSH rates for the entire study period, 2003-2008, we used the average of the calculated six year estimates.

Statistical Analysis

Cross-sectional and time series analyses of hospitalizations for ACSHs were performed for the period 2003-2008. These rates of ACSHs were differentiated at the parish level as obtained from the Barbados Statistical Services since studies suggest that demographic characteristics and primary care access differ for rural and urban areas, as well as among areas with varying levels of rurality and urbanicity (Eberhardt, Ingram, & Makuc, 2001; Laditka, Laditka, & Probst, 2005; Laditka, et al., 2009).

Sex specific crude hospitalization rates were obtained as the ratio of the number of hospitalizations per 1000 population. Poisson analysis estimated relative rates and provided 95% confidence intervals (and p-values), enabling comparisons of differences in hospitalization rates between women and men, over time, and across parishes. Because the rates derive from count data, Poisson analysis was appropriate for these data. The alpha level for identifying statistically significant results was set at $p<0.05$.

Data were analyzed separately for women and men within the age categories 20-49 and 50 and over. These age groupings were used in part because the 2000 Census Data are limited to these categories for the adult population. We analyzed these age groups separately because populations within these groups generally have different sets of health conditions, and are affected by different degrees of illness severity, and thus have varying propensities to use health services. Age has also been found to be a risk factor for chronic diseases including hypertension and heart disease (National Cancer Institute, 2009).

Analysis within each age group also allowed a degree of control for potential confounding by age. In addition, as shown in Table 2.3, each age group is evenly distributed across each parish, showing that generally there is no parish with a

disproportionately higher or lower percentage of a given age group. For this reason, we did not age-adjust the ACSH rates. This study was approved by the Ethics Committee at QEH and the Institutional Review Board of the University of North Carolina at Charlotte. All analyses were performed using SAS 9.2 (Cary, NC).

Results

Results for Patient Characteristics

Table 2.5 (a,b) and Table 2.6 (a,b) report the frequencies for women and men in the population. Of all women who were admitted to the hospital, 7,913 were age 20-49 and 10,586 were 50 years and over. ACSH accounted for 22.4% and 47.4% of all hospitalizations for women 20-49 and 50+, respectively. Of all hospitalizations for those 20-49 years in each parish, St. Thomas had the highest percentage of hospitalizations that were for ambulatory care sensitive conditions (24.2%), followed by St. Peter (24%) and St. Michael (23.9%). St. Joseph reported the lowest (15.4%) admissions within any parish for women in the 20-49 population. For those 50 years and over, St. Joseph had the highest percent (54.5 %), followed by St. Peter (51.4%), and St. Andrew (50.2%), with St. George (44.3%) showing the lowest reported rate. Generally, in each age group St. Michael showed the highest overall ACSH rates for any parish. Of all men admitted to the hospital, ambulatory care sensitive conditions accounted for 20.4% and 32.9% in the 20-49 and 50+ age categories respectively. St. Thomas (43.1%) had the highest reported ACSH rate within parishes for the 20-49 age category, followed by St. John (38.3%) and St. James (36.9%), while St. Lucy had the lowest (25.0%). For those 50 and over, St. Peter (50.2%) had the highest hospitalization followed by St. Thomas (47.6%) and St. George (47.1%), while St. Lucy again had the lowest. The highest number of

ACSH admissions was from the parish of St. Michael, in both the 20-49 and 50 and over age categories, during the study period of 2003-2008.

Generally across the six year period, ACSH admissions were not substantially different for men and women in both the 20-49 and 50 and over age categories. As shown in Table 2.5a, the highest ACSH as a percent of hospitalisation for women 20-49 years was in 2007 (24.3%) and the lowest was in 2006 (20.0%). The highest ACSH rate for women 50 and over was in 2006 (49.2%) and lowest was in 2004 (45.7%). As shown in Table 2.6a, men ages 20-49 years had the highest ACSH rates in 2005 (35.8%) and lowest in 2007 (31.6%). For those 50 and over, ACSH rates ranged from 47.2% in 2003 to 44.9% in 2006.

As shown in Table 2.5b, among all hospitalizations for ambulatory care sensitive conditions, influenza and pneumonia accounted for the highest percentage of ACSH for women in both the 20-49 (21.5%) and 50+ (24.3%) age categories. For women ages 20-49, following influenza and pneumonia the conditions that accounted for the largest percentages of all ACSHs were asthma (10.6%), diabetes (8.0%), CHF (7.6%) and hypertension (7.0%). For women ages 50 and over, the analogous percentages were CHF (21.5%), diabetes (10.8%), and dehydration (10.0%) and angina (9.4%) reported as the top five admissions for all ambulatory care sensitive conditions in this population.

Of all hospitalizations for ambulatory care sensitive conditions among men between the ages of 20 and 49 years (Table 2.6b), the top six admissions were influenza and pneumonia (9.1%), CHF (2.9%), diabetes (2.7%), convulsions (2.4%) and angina and asthma (2.2%). Among men age 50 and over, the top five conditions were influenza and pneumonia (11.3%), CHF (7.7%), dehydration (5.1%), diabetes (4.6%) and UTI (4.2%).

For women in the 50+ age category there were no reported admissions for ENT, nutrition, PID and anemia. Men in the 50 and over age category showed no reported admissions for ENT, nutrition (and PID). In the 20-49 age category there were no reported admissions for nutrition, ENT and perforated bleeding ulcers for women, and nutrition, ENT (and PID) for men.

ACSH Risk across Years

Tables 2.7 and 2.8 report the risk of hospitalization for women and men in the 20-49 and 50+ age categories during the study period 2003-2008. The tables show population ACSH rates, relative rates comparing each result to 2003 (RR), 95% confidence intervals (CIs), and p-values for each result. Overall when analyzed separately, women between the ages of 20-49 showed higher ACSH rates across the study period 2003-2008 and within each year (Table 2.7). However, for those ages 50 and older, ACSH rates were higher for men than women within each year. Women ages 20-49 years had a significantly higher ACSH rate in 2005, 5.51 per 1000 population (RR 1.24, CI 1.05-1.47), and 2007, 6.06 per 1000 population (RR 1.37, CI 1.17-1.61) than in 2003, 4.43 per 1000. During the study period, women 50 years and over had significantly higher ACSH rates in 2005, 23.52 per 1000 population (RR 1.18, CI 1.06-1.30), 2006, 26.13 per 1000 (RR 1.31, CI 1.19-1.44), 2007, 26.98 per 1000 (RR 1.35, CI 1.23-1.49) and 2008, 26.7 per 1000 (RR 1.34, CI 1.21-1.47) when compared to 2003 (rate 19.98 per 1000).

For men (Table 2.8) ages 20-49 years, across all years other than 2004 the risk of hospitalization for ambulatory care sensitive conditions was significantly higher than in 2003. For men ages 20-49 years, the risk of hospitalization for ambulatory care sensitive

conditions was significantly higher in 2005, 4.61 per 1000 population (RR 1.35, CI 1.12-1.62), 2006, 4.34 per 1000 (RR 1.27, CI 1.06-1.54), 2007, 4.50 per 1000 (RR 1.32, CI 1.10-1.59) and 2008, 4.16 per 1000 (RR 1.22, CI 1.01-1.47) when compared to 2003. Men 50 years and over also had higher ACSH risk, relative to 2003 (ACSH rate 24.01 per 1000 population), in 2005, 28.63 per 1000 (RR 1.19, CI 1.07-1.32), 2006, 28.37 per 1000 (RR 1.18, CI 1.06-1.31), 2007, 30.47 per 1000 (RR 1.27, CI 1.15-1.41) and 2008, 31.36 per 1000 (RR 1.31, CI 1.18-1.45).

Results for ACSH Risk across Parishes

Tables 2.9, 2.10, 2.11 and 2.12 report rates of hospitalization for ambulatory care sensitive conditions for women and men who were ages 20-49, or 50 years and over, across the eleven parishes in Barbados within each year, as well as for the entire study period.

Overall during the study period women (6.88 per 1000 population) and men (5.20 per 1000) ages 20-49 who lived in St. Michael had the highest rates of ACSH for the eleven parishes. Generally when compared to St. Michael, during the period 2003-2008, the risk of hospitalization for ambulatory care sensitive conditions was lower for most parishes and not substantially different compared to St. Michael. When compared to St. Michael, during 2003-2008, women who lived in all other parishes had significantly lower ACSH risk. Men who lived in St. George (RR 0.64, CI 0.51-0.80), St. Lucy (RR 0.66, CI 0.49-0.89), St. Joseph (RR 0.60, CI 0.42-0.86), St. Philip (RR 0.66, CI 0.54-0.81), St. James (RR 0.59, CI 0.47-0.73), and Christ Church (RR .57, CI 0.48-0.67) had significantly lower risk of hospitalization for ambulatory care sensitive conditions relative to St. Michael. Though the highest reported rate during 2003-2008 was for St.

Thomas (6.17 per 1000 population), the risk of ACSH was not statistically significantly higher than that for men who lived in St. Michael in this age category.

In 2005 and 2006 the rates of ACSH for St. Philip (2005 RR 0.53, CI 0.32-0.88; 2006 RR 0.55, CI 0.33-0.91), St. James (2005 RR 0.35, CI 0.19-0.64; 2006 RR 0.55, CI 0.33-0.92) and Christ Church (2005 RR 0.49, CI 0.33-0.72; 2006 RR 0.45, CI 0.30-0.67) were significantly lower than those of St. Michael. In 2007, men who were 20-49 years also had lower risk of hospitalization for an ambulatory care sensitive condition in St. Joseph, St. James, and Christ Church, all compared to St. Michael. However, in 2008 men who lived in St. Thomas (RR 1.79, CI 1.16-2.76) had a significantly higher risk of hospitalization for an ambulatory care sensitive condition than those in St. Michael.

Generally parish rates for women who were 50 years and over showed lower risk of hospitalizations for ambulatory care sensitive conditions when compared to St. Michael. However, in 2006 women who lived in St. Peter (RR 1.4, CI 1.06-1.84) had significantly higher risk of hospitalization with an ambulatory care sensitive condition when compared to women in St. Michael. Additionally, those who lived in the parishes of St. George, St. Lucy, St. James and Christ Church had a significantly lower risk of hospitalization than those in St. Michael. The highest reported rates were for those who lived in the parish of St. Andrew; however this rate was not statistically significantly higher than that of St. Michael. Other than St. Peter, St. John and St. Thomas, when compared to St. Michael, men age 50 over who lived in all other parishes were less likely to be hospitalized for an ambulatory care sensitive condition.

Results for Hospitalization for the Top Six Ambulatory Care Sensitive Conditions across Parishes

Tables 2.13, 2.14, 2.15, and 2.16 show rates of hospitalization for the top six ambulatory care sensitive conditions in Barbados during 2003-2008 for women and men ages 20-49, and 50 and over. These tables show results for each parish during the review period, reporting population rates per 1000, risk ratios, confidence intervals, and p-values.

Generally for these six conditions the risk of hospitalizations for both men and women was lower across parishes when compared to St. Michael. For men and women ages 20-49 and 50 years and over, influenza and pneumonia had the highest admission rates. For women ages 20-49 (Table 2.13), and when compared to St. Michael, there were significantly lower rates of hospitalization for influenza and pneumonia in St. Philip (RR 0.68, CI 0.47-0.99), St. George (RR 0.60, CI 0.38-0.93), Christ Church (RR 0.62 CI 0.45-0.84), and St. James (RR 0.44,CI 0.28-0.68). For men ages 20-49 (Table 2.14), those who lived in St. George (RR 0.55, CI 0.34-0.87) and Christ Church (RR 0.44, CI 0.31-0.62) had significantly lower risks of ACSH when compared to St. Michael. Significantly lower rates were also observed for women with CHF in the parishes of St. George, St. James, and Christ Church, for diabetes in the parishes of St. Philip, St. James, and Christ church, for angina in St. James and Christ Church, and for dehydration in St. James.

For men ages 20-49 (Table 2.14) living in St. Thomas there was 115% greater risk of being hospitalized for CHF compared to those in St. Michael (RR 2.15, CI 1.20-3.85). In addition, men ages 20-49 living in St. Thomas had a substantially higher risk of hospitalization for hypertension relative to their counterparts living in St. Michael (RR 2.70, CI 1.24-5.86).

For women ages 50 and older (Table 2.15), again when compared to residents of St. Michael, there were statistically significantly lower rates of hospitalization for influenza and pneumonia in St. James (RR 0.67, CI 0.53-0.84), and Christ Church (RR 0.61 CI 0.51-0.72). For men ages 50 and older (Table 2.16), those who lived in St. George (RR 0.55, CI 0.34-0.87) and Christ Church (RR 0.44, CI 0.31-0.62) had significantly lower risk of ACSH when compared to St. Michael. Women who lived in St. Joseph (RR 1.52, CI 1.12-2.06) and St. Andrew (RR 1.52, CI 1.06-2.17) had a 52% higher risk of hospitalization with CHF when compared to St. Michael.

Results for Hospitalization for the Top Six Ambulatory Cares Sensitive Conditions across Years

The likelihood measures for hospitalization for the top six ambulatory care sensitive conditions in the adult Barbadian population when compared to 2003 are shown separately for women and men in Tables 2.17, 2.18, 2.19, and 2.20. Generally with the exception of 2004, the rate of hospitalizations for CHF for women 20-49 (Table 2.17) was greater in 2005-2008 relative to 2003, as was the rate for hypertension in 2007 (RR 1.93, CI 1.07-3.46). This greater risk was also observed for men ages 20-49 (Table 2.18), for hospitalization for influenza and pneumonia between 2005 and 2008 relative to 2003, and for hypertension (RR 4.20, CI 1.41-12.48) and dehydration (RR 7.93, CI 3.13-15.08) in 2007.

For the population 50 years and over, women had higher ACSH rates for influenza and pneumonia between 2005 and 2008 relative to 2003 (Table 2.19). This greater likelihood was also observed for men in 2005 (RR 1.27, CI 1.03-1.56) and 2008 (RR 1.38, CI 1.13-1.70) (Table 2.20). Also for ages 50 and over, both men and women

had higher rates of hospitalizations for CHF in 2007 and 2008 relative to 2003. Relative to 2003, women also had higher ACSH rates for angina in 2005-2007 and hypertension in 2006-2008. However rates were lower during 2006-2008 for hospitalizations with diabetes. Men had higher rates of hospitalizations for angina in 2006 and 2007, for hypertension in 2007-2008 and dehydration in 2006. However, as was observed for women within this same age group, men had lower rates of hospitalization for diabetes in 2006 and 2007.

Comparison of ACSH from Developed and Developing Countries

Table 2.21 shows the hospitalization rates of ambulatory care sensitive conditions for Taiwan, Australia, Canada and the United States during the years 2000 to 2009 for various age groups, depending on the country. There was no general trend observed for the population between the ages of 19-64 in Taiwan; however, there was an increase in ACSH rates in the older population, ages 65 and over, during the period 2001 to 2006.

Overall for Canada there was a decline in ACSH rates during the period 2001-2006. In Victoria, Australia, ACSH rates for residents between the ages of 20 and 49, and 50 and over showed an overall decrease from 2003 to 2009; however across the years 2004-2008 there was a gradual increase in reported rates. In the United States, overall ACSH rates decreased in the entire adult population from 2000 to 2007. This decrease was also observed within age groups for the US population.

Tables 2.22 and 2.23 report the ACSH rates for ambulatory care sensitive conditions for Australia and Spain for women and men as well as across age groups. In Victoria, Australia, the top six conditions for women ages 20 to 49 between 2008 and 2009 were for dental conditions (2.40 per 1,000 women), diabetes complications (2.30),

pyelonephritis (2.24), iron deficiency anemia (1.78), dehydration and gastroenteritis (1.26), and asthma, convulsions and ENT (each 1.09). For men in this same age group the top six conditions were for diabetes complications (2.53 per 1,000), dental conditions (1.99), convulsions and epilepsy (1.44), cellulitis (1.33), ENT (0.80) and dehydration and gastroenteritis (together 0.77). For the population 50 and over the top six causes of hospitalization were diabetes complications (30.15 per 1000), COPD (7.74), CHF (7.05), pyelonephritis (6.52), iron deficiency anemia (4.48), and angina (3.81), while for men the top six conditions were for diabetes (41.0), COPD (9.77), CHF (7.75), angina (5.37), pyelonephritis (3.93) and iron deficiency anemia (3.15). Residents in Spain showed the highest rates for CHF (18.7 per 10,000) followed by asthma (5.16), UTI (3.14), hemorrhagic complications (2.97), COPD (1.79) and appendectomy in complicated appendix (1.75).

The hospitalization rates between 2001-2003 for women were reported to be highest for men (356 per 10,000) compared to women (204.5 per 10,000). Men (96.6 per 10,000) compared to women (98.7 per 10,000) were also reported to have higher rates of hospitalization for hypertension and cardiovascular disease, heart failure (men 139.4, women 66.5 per 10,000), and pneumonia (men 95.7 per 10,000, women 33.9 per 10,000). In another study conducted in 2003-2004, women had higher rates of hospitalization for hypertension (1.41 per 10,000 compared to men 1.24 per 10,000).

Table 2.24 reports the rates of hospitalization for ambulatory care sensitive conditions for the US for chronic and acute conditions. Generally ACSH rates decreased from 2000 to 2007 for both acute and chronic conditions. Hospitalizations were highest for those age 65 and older, with men showing higher rates of hospitalization than women

within each year. However, women showed higher rates of hospitalization for acute conditions except in 2000 (women =740.5 per 100,000 population, men=745.8 per 100,000).

Table 2.25 reports rates for the U.S and Singapore. In Singapore, women (29.5 per 10,000) showed higher rates of hospitalizations for ambulatory care sensitive conditions than men (22.4 per 10,000). The population ages 45-64 had the highest rates of hospitalization for the adult populations (587 per 100,000). In the US the highest rates were for the population 85 and over (12,814 per 100,000). Generally hospitalization rates for ambulatory sensitive conditions increased with age for the U.S adult population.

Discussion

Hospitalization for ambulatory care sensitive conditions has been used extensively to evaluate access to primary health care. However, most research in this area has been conducted in developed countries such as the U.S., Canada, and Australia. A few studies have evaluated ACSH rates in developing countries such as Taiwan and Singapore. However no studies have evaluated access to primary care using the ASCH index in a developing Caribbean country such as Barbados. The health care system in Barbados has been decentralized to provide equal access to primary care services to all residents irrespective of the area of residence. This study used data obtained from the ED at the QEH to assess rates of hospitalization for ambulatory care sensitive conditions. These conditions are diseases for which timely primary care should typically avoid complications that progress to hospitalization. This research assessed the rates of ACSH during 2003-2008 for the eleven parishes in Barbados for a set of twenty ambulatory care sensitive conditions, as well as the rates for six of these conditions with the highest

hospitalization rates. Rates reported in the literature for developed and developing countries are varied. In addition, published ACSH rates for Australia, Canada, Singapore, Spain, Taiwan , and the United States were presented and compared in this study to provide useful baseline data to policy makers in Barbados.

Four research questions guided this research. The first research question addressed differences in ACSH rates for women and men in Barbados for the populations ages 20-49 and 50+ during the study period. The results provided strong evidence that rates for ACSH differed for men and women within each age group during the study period. This finding was consistent with previous studies (Magan, et al., 2008; Niti & Ng, 2003). As is the case in developed and some developing countries, women and men in the older adult population 50+ in Barbados had higher rates of hospitalization than women and men aged 20-49. While a higher percentage of hospitalizations for women (47.4%) than for men (32.9%) were ACSH, the rates for men age 50 and over were higher than the rates for women in this same age group.

The second research question addressed the differences in ACSH rates among age groups for the population in Barbados. The results in this study showed that ACSH rates differ for the different populations, with rates in the fifty and over age groups higher than ACSH rates in the 20-49 age categories. This result is consistent with previous research (Canadian Institute of Health Information; Cheng, Chen, & Hou, 2010a; Victorian Health Information Surveillance System, 2011).

The third research question investigated how ACSH rates varied over the six year period in Barbados. Results in the literature are mixed; however, findings in this study are consistent with research findings in studies within the populations in Taiwan and

Australia (Cheng, et al., 2010a; Victorian Health Information Surveillance System, 2011). Generally rates increased from 2003 to 2008 within each age group for both women and men. During the study period, for both men and women 50 years and over, other than for 2004 the risk of ACSH was significantly higher in each year than in 2003. Rates in the 50 and over age group were also higher for both men and women than for their counterparts age 20-49.

The final research question assessed how ACSH rates in Barbados compared to published rates for developing and developed countries. Trends in ACSH rates in Barbados were consistent with some rates observed across countries. However, though the trends over time in ACSH rates for Barbados are consistent with countries such as Taiwan and Australia, the rates in Barbados are lower than those observed in Australia, but higher than rates observed in the U.S for women and men.

Several limitations are acknowledged. This study was limited by the unavailability of information on primary care use, such as usual source of care. Previous research on ACSH has not found this information to be a significant predictor of avoidable illnesses resulting in hospitalizations. In addition, area and individual characteristics, such as disease prevalence, income statistics, and marital status are not available for Barbados. However, studies have shown that residents of varying types differ in how each area characteristic affects their ability to receive quality primary care. This study also did not analyze ACSH for race or ethnicity. This was deliberately omitted due to the racial and ethnic makeup of Barbados which is 90% black, 4% white, and 6% Asian Indian or mixed race. Given the small absolute number of minorities in

Barbados, differences in rates associated with demand for care related to racial and ethnic differences could not be tested.

This study included data from the largest acute care public hospital in Barbados. It excludes data from the small privately owned Bayview Hospital. Hospitalizations to this private hospital are generally for planned surgical and obstetric services and account for approximately 4% of the acute care bed capacity in Barbados. In addition, research has suggested that hospitalizations at private hospitals may have little impact on ACSH rates (Alberquilla, 2003).

The list of ambulatory care sensitive conditions used to define ACSH in this study is not specific to Barbados. The list was developed by VGDHS as an index to examine access to primary care in Australia. This could present a limitation for use in the adult population of Barbados, which may be very different from that of Victoria, Australia. Previous research has suggested that ACSH definitions should be specific to the country under study, given differences in health systems and populations (Caminal, Starfield, Sanchez, Casanova, & Morales, 2004). For example, hospitalizations for ambulatory care sensitive dental conditions were included in the ACSH definition used by Billings (Billings, et al., 1993) and the Institute of Medicine (1993); these conditions were excluded from the later definition developed by the AHRQ (2001). Yet, as reported in the present study, hospitalization for these dental conditions is the leading cause of ACSH in Victoria, Australia. This result illustrates the usefulness of using a comprehensive definition of ambulatory care sensitive conditions when applying the indicator to a country for the first time, as was done here with Barbados. The age groupings chosen in this study were based on those obtained from the 2000 Census.

While further sub grouping was possible in both age categories, to ensure adequate sample sizes for statistical power broad ranges were used for categorizing age. Though the broader age categories were used the analysis still may not have been adequately powered to detect variations across parishes within each year. We also acknowledge that multiple comparisons were performed across parishes and across years in this study, which may have introduced Type II error.

This study used secondary data from the ED augmented with a review of physician narrative comments for final diagnosis, which include descriptions of diagnoses and procedures. The validity of the principal diagnosis at admission and the completeness of variables including home address have not been examined; such a study is beyond the scope of the present analysis. The analytic dataset included all visits to the emergency department that resulted in hospital admissions, including walk-ins and referrals. Voluntary admissions for scheduled procedures were excluded based on results of previous studies suggesting that most ACSHs originate in the ED. In addition, other than for routine or scheduled procedures most admissions to the QEH occur through the ED even if the patient is referred to the hospital from a private or public clinic. It is also assumed that the admission date to the hospital is the same as the date of visit to the ED, since this is the usual procedure for admissions from the ED; admission dates were used to assign each ACSH to a given year; any misclassification due to this assumption would be unlikely to affect the results meaningfully, as it would principally affect only a small proportion of hospitalizations at the beginning or the end of a given year.

Regarding the definition of ACSH, these hospitalizations were defined based on the principal diagnosis code at admission, in combination with scans of the narrative

discharge diagnoses. As a result, any procedures performed during hospitalization were not captured in the ACSH rates. A small subset of ACSH are typically defined using exclusion or inclusion criteria based on procedure codes (AHRQ, 2001; Billings, et al., 1993; Institute of Medicine, 1993). For example, the definition of hypertension has an exclusion criterion for procedures involving heart transplant. The lack of procedure codes in the available data could have resulted in overestimations in the numerator in cases where procedure codes are used to exclude cases, resulting in artificially high ACSH rates. These exclusions typically affect only a small proportion of hospitalizations (AHRQ, 2001), so it is unlikely that this feature of our analysis would affect the results meaningfully.

The data obtained from the Barbados statistical services did not include population estimates at the parish level or for age categories for women and men. These were required for analysis in this study and were therefore calculated using the population estimates provided for Barbados for the years under review. Annual population growth rate remained steady (0.3%) between 1995-2005 (Pan American Health Organization, 2008); this steady growth was assumed to have continued in 2005-2008, with estimates of annual mid-year parish and age-group populations made accordingly.

The major strength of this research is that the ACSH indicator has never been used to examine the accessibility and overall success of primary care in Barbados. The indicator has been extensively validated (AHRQ, 2001; Laditka & Laditka, 2004; Laditka, et al., 2003; Laditka, Laditka, & Probst, 2005; Laditka, et al., 2009; Laditka & Johnston, 1999; Laditka & Laditka, 1999) including the indicator as defined using ICD-

10 (Correa-Velez, et al., 2007) and in application to developing countries (Chen, et al., 2007; Cheng, et al., 2010b{Niti, 2003 #1476). In addition, the data used came from a large nationally representative hospital database. The dataset also included narratives of final diagnosis, which allowed for the identification of ACSHs in the absence of ED information, and also allowed for checks against the ICD-10 codes recorded for principal and secondary diagnoses.

Implications for Policy and Research

Considerable variation in rates of ACSH was found across the eleven parishes in Barbados. These geographic differences suggest the usefulness of developing programs and policy initiatives to address the reasons behind these variations to reduce the ACSH rates and subsequently the burden and cost of these hospitalizations at the QEH. These findings could possibly point to access problems to appropriate care for residents in some geographical locations. There was particularly strong evidence of potential problems in the accessibility or quality of primary care for residents of St. Michael, St. Thomas, St. Philip, and St. Peter. It is possible that the higher ACSH rates in these parishes are attributable to area factors other than primary care. Given the results of this study, it would be useful for researchers to examine the accessibility and quality of primary health care in these areas. In addition, the high admission rates for ambulatory care sensitive conditions as a percent of total admissions in some parishes for the older population may also suggest the need to address preventive and maintenance strategies in primary care, possibly including expanded use of the chronic care model for chronic conditions that were found to have notably high ACSH rates, including angina, CHF, diabetes, and hypertension. Reductions in these admissions and the allocation of beds at the publicly

financed hospital could result in considerable cost reductions, although this possibility must be weighed against any increased cost of improving primary health care.

These findings also underscore the importance of the promotion of population health, and may also suggest the need to increase health education particularly in the area of chronic disease management and prevention of diabetes and hypertension. The high rates of influenza and pneumonia particularly in the population age 50 and over also suggest the need for policies focused on appropriate immunization and early treatment to avoid complications. This finding also suggests the need for possible interventions such as increased health education in health promotion such as early and appropriate antibiotic treatment, early detection, and appropriate immunizations in the case of influenza and pneumonia, and CHF.

This study provides relevant base line data for ACSH rates and suggests the need for future research in this area. The need to assess the reasons for the high variation across parishes underscores the need to assess disease prevalence, income levels and other individual and area level characteristics and their associations with ACSH rates.

Figure 2.1: Map of Barbados
(Central Intelligence Agency(CIA) 1980)

Table 2.1: Descriptive Demographics for Clinics and Population within each Parish in Barbados and Population and Area Mass for Parishes in Barbados

Parish Code	Parish	Clinics /10000	Physicians /10000	Total Population	% Population Under 15 Yrs	% Population Age 15-19 Yrs	% Population Age 20-49 Yrs	% Population Age 50 and Above	Area (mi.^{2})	Population /Area(mi.^{2})
A	St. Andrew	0	0	5613	21.0	7.4	44.9	20.3	14	400.9
E	St. Peter	4.4	4.4	11405	19.9	6.8	44.1	23.0	13	877.3
G	St. George	2.1	2.1	19048	20.7	6.9	43.6	22.5	17	1120.5
J	St. John	1.1	1.1	9448	20.9	6.9	42.9	23.2	13	726.8
L	St. Lucy	0	0	9991	19.8	6.8	44.3	22.5	14	713.6
M	St. Michael	13.0	21.5	91025	20.5	7.1	41.7	22.5	15	6068.3
O	St. Joseph	1.4	1.4	7244	20.3	7.6	43.4	22.7	10	724.4
P	St. Philip	2.8	2.8	24566	20.6	6.9	43.3	22.3	23	1068.1
S	St. James	4.1	6.2	24270	19.5	6.9	44.4	22.9	12	2022.5
T	St. Thomas	0	0	13260	22.1	7.1	43.2	21.1	13	1020
X	Christ Church	4.3	5.7	52922	19.5	6.6	42.7	24.7	22	2405.5

Source: Barbados Postal Services; Barbados Ministry of Health, Barbados Census 2000

Table 2.2: Developed and Developing Countries with available Rates for Ambulatory Care Sensitive Conditions

Country	Developed or Developing Country	Published Studies	Available Aggregate Data Source	Years used in Data Analysis	Population
Australia	Developed	~10	Yes	2001-2005	All
Canada	Developed	~10	Yes	1999-2007	All
France (Paris)	Developed	1	No	Not comprehensive ACSH rate data	All
New Zealand	Developed	5	No	1989-1998 2000-2004 1998-1999,2002-2003	Pediatrics (gender & age) All- not separate by age or gender
Portugal	Developing	1	No	2000-2005	All
Singapore	Developing	2	No	1991-1998	
Spain	Developed	5	No	1992-1993,2001-2003, 2004, 1998	Pediatric, Older adults, All
Taiwan	Developing	2	No	1997-2003	
UK	Developed	3	Yes	2002-2006	All
USA	Developed	>50	Yes	2002-2006	All

Table 2.3. Data elements obtained from Accident and Emergency database of the Queen Elizabeth Hospital, Barbados

Variable	Definition
Identifier	Pseudo Identifier
Sex	Male or female
Age	Age in numbers from 0 +
Age Type	Type of entry for Age in years or months
Parish	Abbreviations for 11 parishes as in Table 2
Arrival Date	Date patient arrived at hospital
Doctor	Pseudo Identifier for doctor
Year	Year of visit to hospital
Presenting Complaint	Narrative complaint on presentation at ER from patient on arrival
LAB	Whether patient received blood test
XRAY	Whether patient received x-ray or other
Final Diagnosis	Narrative of final diagnosis by Attending
Anatcode2	ICD-10 code for secondary diagnosis
Anatcode3	ICD-10 code for primary diagnosis
Admitted	Whether patient was admitted or not

Source: Accident and Emergency database, QEH Barbados.

Table 2.4: ICD Codes for disease groups used to calculate ambulatory care sensitive (ACS) hospitalizations

Group	ICD-9-CM codes (NSW Health)	ICD-10-AM codes (NSW Health)	Explanation of Inclusion/Exclusion Criteria
Vaccine-preventable			
Influenza and pneumonia	481, 482.2, 482.3, 482.9, 483, 487.0, 487.1, 487.8	J10, J11, J13, J14, J15.3, J15.4, J15.7, J15.9, J16.8, J18.1, J18.8	In any diagnosis field (1-5); exclude people under 2 months; ICD-9-CM: exclude cases with secondary diagnosis of 282.6; ICD-10-AM: exclude cases with secondary diagnosis of D57
Other vaccine preventable	032, 033.0, 033.1, 033.8, 033.9, 037, 045, 055, 056, 070.3, 072, 320.0	A35, A36, A37, A80, B05, B06, B16.1, B16.9, B18.0, B18.1, B26, G00.0, M01.4	In any diagnosis field (1-5)
Chronic			
Diabetes complications	250.1-250.9	E10.0-E10.8, E11.0-E11.8, E12.0- E12.8, E13.0-E13.8, E14.0-E14.8	Principal diagnosis only
Nutritional deficiencies	260, 261, 262, 268.0, 268.1	E40-E43, E55.0, E64.3	Principal diagnosis only

(Table 2.4, Continued)

Iron deficiency anaemia	280.1, 280.8, 280.9	D50.1-D50.9	Principal diagnosis only
Hypertension	401.0, 401.9, 402.00, 402.10, 402.90	I10, I11.9	Principal diagnosis only; ICD-9-CM: exclude cases with procedure code of 35, 36, 37.5, 37.6, 37.7, 37.8; ICD-10-AM: exclude cases with procedures in blocks 600-693, 705-707, 717 and procedure codes 38721-00, 38721-01, 90226-00
Congestive heart failure	402.01, 402.11, 402.91, 428, 518.4	I11.0, I50, J81	Principal diagnosis only; ICD-9-CM: exclude cases with procedure code of 35, 36, 37.5, 37.6, 37.7, 37.8; ICD-10-AM: exclude cases with procedures in blocks 600-693, 705-707, 717 and procedure codes 38721-00, 38721-01, 90226-00
Angina	411.1, 411.8, 413	I20, I24.0, I24.8, I24.9	Principal diagnosis only; ICD-9-CM: exclude cases with procedure codes 01 to 86.99; ICD-10-AM: exclude cases with procedure codes in blocks 1-1779
Chronic obstructive pulmonary disease	491, 492, 494, 496, (466.0)	J41-J44, J47, (J20)	Principal diagnosis only; ICD-9-CM: 466.0 only with secondary diagnosis of 491, 492, 494, 496; ICD-10-AM: J20 only with secondary diagnosis of J41, J42, J43, J44, J47
Asthma	493	J45, J46	Principal diagnosis only
Acute			
Dehydration and gastroenteritis	276.5, 558.9	E86, K52.2, K52.8, K52.9	Principal diagnosis only

(Table 2.4, Continued)

Convulsions and epilepsy	345, 642.6, 780.3	G40, G41, O15, R56	Principal diagnosis only
Ear, nose and throat infections	382, 462, 463, 465, 472.1	H66, H67, J02, J03, J06, J31.2	Principal diagnosis only
Dental conditions	521, 522, 523, 525, 528	K02-K06, K08, K09.8, K09.9, K12, K13	Principal diagnosis only
Perforated/bleeding ulcer	531.0-531.2, 531.4-531.6, 532.0-532.2, 532.4-532.6, 533.0-533.2, 533.4-533.6, 534.0-534.2, 534.4-534.6	K25.0- K25.2, K25.4-K25.6, K26.0-K26.2, K26.4-K26.6, K27.0-K27.2, K27.4-K27.6, K28.0-K28.2, K28.4-K28.6	Principal diagnosis only
Ruptured appendix	540	K35.0	In any diagnosis field (1-5)
Urinary tract infections including pyelonephritis	590.0, 590.1, 590.8	N10, N11, N12, N13.6, N39.0	Principal diagnosis only
Pelvic inflammatory disease	614	N70.0, N70.1, N70.9, N73, N74.0-N74.1, N74.2-N74.8	Principal diagnosis only

(Table 2.4, Continued)

Cellulitis	681, 682, 683, 686	L03, L04, L08.0, L08.8, L08.9, L88, L98.0, L98.3	Principal diagnosis only; ICD-9-CM: exclude cases with procedure codes 01 to 86.99 except 86.0 where it is the only listed procedure; ICD-10-AM: exclude cases when any procedure performed from blocks 1-1779 except when the following procedures done as the only ones: blocks: 1604-1606, 1608 and procedures: 90660-00, 30207-00, 30676-00, 30679-00, 34530-01 and 47912-00.
Gangrene	785.4	R02	In any diagnosis field (1-5)

Source: Population Health Division. The health of the people of New South Wales - Report of the Chief Health Officer. Sydney: NSW Department of Health. Available at: www.health.nsw.gov.au/publichealth/chorep/ (Accessed June 4, 2011).

Table 2.5a : Characteristics of Women Who Were Admitted to the Hospital tor Ambulatory Care Sensitive Conditions, Barbados, 2003-2008[a]

	Ages 20-49			Ages 50 and over		
	ACSH N	Hosp. N	ACSH % of All Hosp.	ACSH N	Hosp. N	ACSH % of All Hosp.
Hospitalisations	1769	7913	22.4	5015	10586	47.4
Parish						
Saint Andrew	31	163	19.0	109	217	50.2
Saint Peter	70	292	24.0	273	531	51.4
Saint George	120	535	22.4	320	723	44.3
Saint John	56	250	22.4	190	395	48.1
Saint Lucy	50	245	20.4	179	395	45.3
Saint Joseph	29	188	15.4	162	297	54.5
Saint Philip	142	688	20.6	457	921	49.6
Saint James	106	509	20.8	357	758	47.1
Saint Thomas	96	396	24.2	232	503	46.1
Christ Church	258	1256	20.5	841	1859	45.2
Saint Michael	811	3391	23.9	1895	3987	47.5
Year						
2003	256	1101	23.3	699	1464	47.7

(Table 2.5a, Continued)

2004	255	1199	21.3	677	1481	45.7
2005	314	1391	22.6	826	1765	46.8
2006	286	1430	20.0	919	1868	49.2
2007	353	1454	24.3	951	1979	48.1
2008	305	1338	22.8	943	2029	46.5

[a]Data Source: Queen Elizabeth Hospital, Barbados, 2003-2008, and Barbados Census 2000; ACSH=Ambulatory Cares Sensitive Condition; Hosp.=hospitalizations; n.a.=not applicable; CHF=Congestive Heart Failure; UTI=Urinary Tract Infection; COPD=Chronic Obstructive Pulmonary Disease; PID=Pelvic Inflammatory Disease; ENT=Ear, Nose, and Throat.

Table 2.5b Hospitalizations of Women for each Individual Ambulatory Care Sensitive Condition, Barbados, 2003-2008[a] —Percent is percent of all ACSHs

	Ages 20-49			Ages 50 and over		
	ACSH N	Hosp. N	Diagnosis % of All ACSH	ACSH N	Hosp. N	Diagnosis % of All ACSH
Diagnosis						
Influenza and	380	n.a.	21.5	1220	n.a.	24.3
CHF	135	n.a.	7.6	1079	n.a.	21.5
Diabetes	141	n.a.	8.0	540	n.a.	10.8
Dehydration	82	n.a.	4.6	502	n.a.	10.0
Angina	112	n.a.	6.3	470	n.a.	9.4
Hypertension	123	n.a.	7.0	327	n.a.	6.5
UTI	121	n.a.	6.8	179	n.a.	3.6
Asthma	188	n.a.	10.6	140	n.a.	2.8
Convulsions	95	n.a.	5.4	116	n.a.	2.3
Cellulitis	78	n.a.	4.4	163	n.a.	3.3
Gangrene	1	n.a.	0.1	103	n.a.	2.1
COPD	4	n.a.	0.2	14	n.a.	0.3
Dental	10	n.a.	0.6	7	n.a.	0.1
Perforated Appendix	10	n.a.	0.6	5	n.a.	0.1
Anemia	7	n.a.	0.4	0	n.a.	0
PID	10	n.a.	0.6	0	n.a.	0

(Table 2.5b, Continued)

Perforated Ulcer	0	n.a.	0	9	n.a.	0.2
Vaccine Preventable	1	n.a.	0.1	1	n.a.	0
Nutrition	0	n.a.	0	0	n.a.	0
ENT	0	n.a.	0	0	n.a.	0

[a]Data Source: Queen Elizabeth Hospital, Barbados, 2003-2008, and Barbados Census 2000; ACSH=Ambulatory Cares Sensitive Condition; Hosp.=hospitalizations; n.a.=not applicable; CHF=Congestive Heart Failure; UTI=Urinary Tract Infection; COPD=Chronic Obstructive Pulmonary Disease; PID=Pelvic Inflammatory Disease; ENT=Ear, Nose, and Throat.

Table 2.6a : Characteristics of Men Who Were Admitted to the Hospital for Ambulatory Care Sensitive Conditions, Barbados, 2003-2008[a]

	Ages 20-49			Ages 50 and over		
	ACSH N	Hosp. N	ACSH % of All Hosp.	ACSH N	Hosp. N	ACSH % of All Hosp.
Hospitalisations	1398	4236	20.4	4556	10029	32.9
Parish						
Saint Andrew	33	100	33.0	79	195	40.5
Saint Peter	60	187	32.1	232	462	50.2
Saint George	83	269	30.9	302	641	47.1
Saint John	54	141	38.3	185	399	46.4
Saint Lucy	47	188	25.0	128	335	38.2
Saint Joseph	31	107	29.0	99	235	42.1
Saint Philip	108	361	29.9	382	860	44.4
Saint James	94	255	36.9	317	717	44.2
Saint Thomas	106	246	43.1	249	523	47.6
Christ Church	192	579	33.2	686	1574	43.6
Saint Michael	590	1803	32.7	1897	4088	46.4
Year						
2003	193	565	34.2	653	1385	47.2
2004	197	620	31.8	636	1399	45.5
2005	263	735	35.8	784	1741	45.0
2006	248	750	33.1	778	1732	44.9
2007	258	817	31.6	839	1863	45.0
2008	239	749	31.9	866	1909	45.4

[a]Data Source: Queen Elizabeth Hospital, Barbados, 2003-2008, and Barbados Census 2000; ACSH=Ambulatory Cares Sensitive Condition; Hosp.=hospitalizations; n.a.=not applicable; CHF=Congestive Heart Failure; UTI=Urinary Tract Infection; COPD=Chronic Obstructive Pulmonary Disease;

Table 2.6b: Hospitalizations of Women for Each Individual Ambulatory Care Sensitive Condition, Barbados, 2003-2008[a] —Percent is percent of all ACSHs

	Ages 20-49			Ages 50 and over		
	ACSH N	Hosp. N	Diagnosis % of All	ACSH N	Hosp. N	Diagnosis % of All
Diagnosis						
Influenza and	384	n.a.	9.1	1133	n.a.	11.3
CHF	122	n.a.	2.9	771	n.a.	7.7
Diabetes	113	n.a.	2.7	462	n.a.	4.6
Dehydration	59	n.a.	1.4	510	n.a.	5.1
Angina	91	n.a.	2.2	361	n.a.	3.6
Hypertension	58	n.a.	1.4	270	n.a.	2.7
UTI	51	n.a.	1.2	417	n.a.	4.2
Asthma	92	n.a.	2.2	52	n.a.	0.5
Convulsions	102	n.a.	2.4	151	n.a.	1.5
Cellulitis	86	n.a.	2.0	130	n.a.	1.3
Gangrene	3	n.a.	0.1	47	n.a.	0.5
COPD	3	n.a.	0.1	91	n.a.	0.9
Dental	12	n.a.	0.3	4	n.a.	0.0
Perorated	8	n.a.	0.2	3	n.a.	0.0
Anemia	2	n.a.	0.1	9	n.a.	0.1
PID	0	n.a.	0.0	0	n.a.	0.0
Perforated Ulcer	3	n.a.	0.1	12	n.a.	0.1
Vaccine	2	n.a.	0.1	2	n.a.	0.0
Nutrition	0	n.a.	0.0	0	n.a.	0.0
ENT	0	n.a.	0.0	0	n.a.	0.0

[a]Data Source: Queen Elizabeth Hospital, Barbados, 2003-2008, and Barbados Census 2000; ACSH=Ambulatory Cares Sensitive Condition; Hosp.=hospitalizations; n.a.=not applicable; CHF=Congestive Heart Failure; UTI=Urinary Tract Infection; COPD=Chronic Obstructive Pulmonary Disease; PID=Pelvic Inflammatory Disease; ENT=Ear, Nose, and Throat.

Table 2.7: Risk of Hospitalizations for Ambulatory Care Sensitive Conditions for Women, Barbados, 2003-2008, by Age Group and Year

	Ages 20-49					Ages 50 and over				
Year	Rate per 1000	RR	LB	UB	P-value	Rate per 1000	RR	LB	UB	P-value
2003	4.43	1	1	1		19.98	1	1	1	
2004	4.40	0.99	0.84	1.18	0.9519	19.32	0.97	0.87	1.07	0.5357
2005	5.51	1.24	1.05	1.47	0.0097	23.52	1.18	1.06	1.3	0.0015
2006	4.92	1.11	0.94	1.32	0.2186	26.13	1.31	1.19	1.44	<.0001
2007	6.06	1.37	1.17	1.61	0.0001	26.98	1.35	1.23	1.49	<.0001
2008	5.23	1.18	1	1.39	0.0503	26.7	1.34	1.21	1.47	<.0001

[a]Data Source: Queen Elizabeth Hospital, Barbados, 2003-2008, and Barbados Census 2000; RR= Risk Ratio; UB=Upper Boundary of the 95% Confidence Interval; LB=Lower Boundary; p-value is for comparison of the rate for the given year to the rate for 2003.

Table 2.8: Risk of Hospitalizations for Ambulatory Care Sensitive Conditions for Men, Barbados, 2003-2008, by Age Group and Year

	Ages 20-49					Ages 50 and over				
Year	Rate per 1000	RR	LB	UB	P-value	Rate per 1000	RR	LB	UB	P-value
2003	3.41	1.00	1.00	1.00		24.01	1.00	1.00	1.00	
2004	3.46	1.02	0.83	1.24	0.8750	23.28	0.97	0.87	1.08	0.5785
2005	4.61	1.35	1.12	1.63	0.0014	28.63	1.19	1.07	1.32	0.0009
2006	4.34	1.27	1.06	1.54	0.0116	28.37	1.18	1.06	1.31	0.0017
2007	4.50	1.32	1.10	1.59	0.0035	30.47	1.27	1.15	1.41	<.0001
2008	4.16	1.22	1.01	1.47	0.0402	31.36	1.31	1.18	1.45	<.0001

[a]Data Source: Queen Elizabeth Hospital, Barbados, 2003-2008, and Barbados Census 2000; RR= Risk Ratio; UB= Upper Boundary of the 95% Confidence Interval; LB=Lower Boundary; p-value is for comparison of the rate for the given year to the rate for 2003.

Table 2.9: Risk of Hospitalization for Ambulatory Care Sensitive Conditions for Women Ages 20-49, Barbados, 2003-2008, by Year and Parish

Year	2003-2008					2003				
Parish	Rate per 1000	RR	LB	UB	P-value	Rate per 1000	RR	LB	UB	P-value
Saint Andrew	4.31	0.63	0.44	0.90	0.0107	1.68	0.30	0.07	1.20	0.0882
Saint Peter	4.45	0.65	0.51	0.83	0.0005	6.50	1.15	0.69	1.91	0.5944
Saint George	4.70	0.68	0.56	0.83	<.0001	5.17	0.91	0.58	1.45	0.7032
Saint John	4.71	0.69	0.52	0.90	0.0062	3.03	0.54	0.24	1.22	0.1372
Saint Lucy	3.75	0.55	0.41	0.73	<.0001	1.80	0.32	0.12	0.86	0.0248
Saint Joseph	3.16	0.46	0.32	0.67	<.0001	4.59	0.81	0.38	1.74	0.5920
Saint Philip	4.24	0.62	0.52	0.74	<.0001	3.41	0.60	0.37	0.98	0.0415
Saint James	3.05	0.44	0.36	0.54	<.0001	3.80	0.67	0.43	1.06	0.0889
Saint Thomas	5.41	0.79	0.64	0.97	0.0268	3.39	0.60	0.31	1.14	0.1209
Christ Church	4.25	0.62	0.54	0.71	<.0001	3.57	0.63	0.43	0.92	0.0163
Saint Michael	6.88	1				5.65	1			

Year	2004					2005				
Parish	Rate per 1000	RR	LB	UB	P-value	Rate per 1000	RR	LB	UB	P-value
Saint Andrew	3.35	0.63	0.23	1.70	0.3588	2.50	0.35	0.11	1.09	0.0711
Saint Peter	4.58	0.86	0.47	1.56	0.6132	3.87	0.54	0.28	1.03	0.0595

(Table 2.9 Continued)

Saint George	4.93	0.92	0.58	1.47	0.7383	4.77	0.66	0.42	1.06	0.0871
Saint John	3.53	0.66	0.31	1.42	0.2897	5.13	0.71	0.38	1.36	0.3031
Saint Lucy	6.30	1.18	0.68	2.06	0.5602	5.03	0.70	0.38	1.29	0.2558
Saint Joseph	1.31	0.25	0.06	0.99	0.0489	7.18	0.56	0.25	1.26	0.1585
Saint Philip	4.30	0.81	0.52	1.25	0.3379	2.50	0.51	0.32	0.81	0.0045
Saint James	2.59	0.48	0.28	0.83	0.0087	3.87	0.44	0.27	0.72	0.0010
Saint Thomas	2.03	0.38	0.17	0.87	0.0212	4.77	1.05	0.67	1.65	0.8225
Christ Church	4.45	0.83	0.59	1.18	0.3071	5.13	0.77	0.56	1.05	0.1003
Saint Michael	5.34	1				5.03	1			

(Table 2.9 Continued)

Year	2006					2007				
Parish	Rate per 1000	RR	LB	UB	P-value	Rate per 1000	RR	LB	UB	P-value
Saint Andrew	10.84	1.68	0.95	2.98	0.0736	3.33	0.35	0.13	0.94	0.0377
Saint Peter	3.04	0.47	0.23	0.97	0.0397	4.17	0.44	0.24	0.81	0.0079
Saint George	4.91	0.76	0.48	1.21	0.2515	6.07	0.64	0.42	0.96	0.0320
Saint John	3.52	0.55	0.26	1.17	0.1201	6.02	0.63	0.35	1.14	0.1250
Saint Lucy	3.59	0.56	0.27	1.14	0.1091	3.58	0.38	0.19	0.76	0.0068
Saint Joseph	1.30	0.20	0.05	0.82	0.0251	4.56	0.48	0.23	1.02	0.0560
Saint Philip	5.18	0.80	0.54	1.20	0.2900	2.67	0.28	0.17	0.48	<.0001
Saint James	2.92	0.45	0.27	0.75	0.0022	2.57	0.27	0.16	0.46	<.0001
Saint Thomas	4.72	0.73	0.42	1.27	0.2706	8.75	0.92	0.61	1.39	0.6901
Christ Church	3.94	0.61	0.43	0.87	0.0069	4.03	0.42	0.30	0.59	<.0001
Saint Michael	6.44					9.51				

Year	2008

(Table 2.9 Continued)

Parish	Rate per 1000	RR	LB	UB	P-value
Saint Andrew	4.15	0.58	0.24	1.42	0.2361
Saint Peter	4.54	0.64	0.35	1.15	0.1355
Saint George	2.33	0.33	0.17	0.62	0.0006
Saint John	7.01	0.99	0.57	1.71	0.9575
Saint Lucy	2.23	0.31	0.13	0.77	0.0109
Saint Joseph	7.12	0.46	0.19	1.11	0.0847
Saint Philip	3.25	0.87	0.60	1.27	0.4770
Saint James	6.22	0.46	0.28	0.74	0.0014
Saint Thomas	3.25	0.85	0.52	1.39	0.5137
Christ Church	6.04	0.57	0.40	0.80	0.0013
Saint Michael	4.03				

[a]Data Source: Queen Elizabeth Hospital, Barbados, 2003-2008, and Barbados Census 2000; RR= Risk Ratio; UB= Upper Boundary of the 95% Confidence Interval; LB=Lower Boundary; p-value is for comparison of the rate for the given parish to the rate for Saint Michael.

Table 2.10: Risk of Hospitalization for Ambulatory Care Sensitive Conditions for Men Ages 20-49, Barbados, 2003-2008, by Year and Parish

Year	2003-2008					2003				
Parish	Rate per 1000	RR	LB	UB	P-value	Rate per 1000	RR	LB	UB	P-value
Saint Andrew	4.04	0.78	0.55	1.10	0.1563	2.96	0.72	0.26	1.97	0.5231
Saint Peter	4.02	0.77	0.59	1.01	0.0565	2.43	0.59	0.26	1.36	0.2157
Saint George	3.31	0.64	0.51	0.80	0.0001	3.14	0.76	0.43	1.38	0.3716
Saint John	4.21	0.81	0.61	1.07	0.1378	2.36	0.57	0.23	1.42	0.2298
Saint Lucy	3.45	0.66	0.49	0.89	0.0066	4.88	1.19	0.63	2.23	0.5931
Saint Joseph	3.10	0.60	0.42	0.86	0.0051	1.82	0.44	0.14	1.40	0.1659
Saint Philip	3.45	0.66	0.54	0.81	<.0001	2.32	0.57	0.31	1.04	0.0659
Saint James	3.05	0.59	0.47	0.73	<.0001	3.34	0.81	0.48	1.38	0.4405
Saint Thomas	6.17	1.19	0.96	1.46	0.1067	4.22	1.03	0.56	1.89	0.9281
Christ Church	2.95	0.57	0.48	0.67	<.0001	3.07	0.75	0.50	1.12	0.1605
Saint Michael	5.20					4.10				

Year	2004					2005				
Parish	Rate per 1000	RR	LB	UB	P-value	Rate per 1000	RR	LB	UB	P-value
Saint Andrew	5.15	1.23	0.57	2.66	0.6005	2.94	0.47	0.18	1.28	0.1424
Saint Peter	2.42	0.58	0.25	1.32	0.1937	6.43	1.04	0.62	1.75	0.8875

(Table 2.10 Continued)

Saint George	1.44	0.34	0.15	0.79	0.0118	4.32	0.70	0.42	1.14	0.1541
Saint John	4.23	1.01	0.51	2.01	0.9820	5.62	0.91	0.50	1.64	0.7487
Saint Lucy	2.21	0.53	0.21	1.30	0.1640	3.96	0.64	0.32	1.26	0.1965
Saint Joseph	3.01	0.72	0.29	1.77	0.4741	3.01	0.49	0.20	1.19	0.1135
Saint Philip	2.12	0.50	0.27	0	0.0337	3.26	0.53	0.32	0.88	0.0136
Saint James	3.13	0.75	0.44	1.28	0.2852	2.15	0.35	0.19	0.64	0.0008
Saint Thomas	5.60	1.34	0.78	2.29	0.2901	7.34	1.18	0.74	1.88	0.4752
Christ Church	3.42	0.82	0.55	1.21	0.3076	3.04	0.49	0.33	0.72	0.0003
Saint Michael	4.19					6.19				

Year	2006					2007				
Parish	Rate per 1000	RR	LB	UB	P-value	Rate per 1000	RR	LB	UB	P-value
Saint Andrew	4.40	0.74	0.32	1.67	0.4657	6.58	1.16	0.59	2.28	0.6757
Saint Peter	3.61	0.60	0.31	1.19	0.1465	4.80	0.84	0.46	1.53	0.5766
Saint George	4.31	0.72	0.44	1.19	0.1988	3.58	0.63	0.37	1.08	0.0928
Saint John	4.68	0.78	0.41	1.49	0.4584	4.66	0.82	0.43	1.57	0.5464
Saint Lucy	2.64	0.44	0.19	1.00	0.0510	4.38	0.77	0.40	1.47	0.4291
Saint Joseph	5.40	0.90	0.46	1.78	0.7722	1.79	0.32	0.10	0.99	0.0487
Saint Philip	3.26	0.55	0.33	0.91	0.0198	5.35	0.94	0.62	1.42	0.7707
Saint James	3.31	0.55	0.33	0.92	0.0233	3.10	0.55	0.32	0.92	0.0238
Saint Thomas	4.88	0.82	0.47	1.42	0.4771	5.91	1.04	0.62	1.73	0.8843
Christ Church	2.67	0.45	0.30	0.67	0.0001	2.75	0.48	0.32	0.73	0.0004
Saint Michael	5.97					5.69				

Year	2008				
Parish	Rate per 1000	RR	LB	UB	P-value
Saint Andrew	2.19	0.43	0.14	1.37	0.1540
Saint Peter	4.39	0.87	0.47	1.62	0.6620
Saint George	3.09	0.61	0.34	1.10	0.0984
Saint John	3.72	0.74	0.36	1.52	0.4076
Saint Lucy	2.62	0.52	0.23	1.19	0.1199
Saint Joseph	3.58	0.71	0.31	1.62	0.4155
Saint Philip	4.38	0.87	0.55	1.37	0.5444
Saint James	3.29	0.65	0.39	1.09	0.1045
Saint Thomas	9.01	1.79	1.16	2.76	0.0086
Christ Church	2.74	0.54	0.36	0.82	0.0037
Saint Michael	5.04				

[a]Data Source: Queen Elizabeth Hospital, Barbados, 2003-2008, and Barbados Census 2000; RR= Risk Ratio; UB= Upper Boundary; LB=Lower Boundary; p-value is for comparison of the rate for the given parish to the rate for St. Michael.

Table 2.11: Risk of Hospitalization for Ambulatory Care Sensitive Conditions for Women Ages 50 and Over, Barbados, 2003-2008, by Year and Parish

Year	2003-2008					2003				
Parish	Rate per 1000	RR	LB	UB	P-value	Rate per 1000	RR	LB	UB	P-value
Saint Andrew	20.91	1.17	0.94	1.47	0.1610	24.59	1.08	0.65	1.78	0.7728
Saint Peter	18.21	1.02	0.87	1.20	0.7962	16.36	0.72	0.47	1.09	0.1180
Saint George	13.46	0.75	0.65	0.88	0.0002	16.46	0.72	0.52	1.01	0.0539
Saint John	17.13	0.96	0.80	1.15	0.6728	21.95	0.96	0.65	1.43	0.8469
Saint Lucy	14.28	0.80	0.66	0.97	0.0267	28.43	1.25	0.88	1.76	0.2161
Saint Joseph	16.37	1.05	0.86	1.27	0.6550	29.40	1.29	0.87	1.90	0.2026
Saint Philip	12.72	0.92	0.81	1.04	0.1865	17.16	0.75	0.56	1.01	0.0596
Saint James	15.80	0.71	0.62	0.82	<.0001	14.00	0.61	0.45	0.84	0.0026
Saint Thomas	13.27	0.89	0.75	1.05	0.1675	20.08	0.88	0.61	1.28	0.4996
Christ Church	17.82	0.74	0.68	0.82	<.0001	17.64	0.77	0.63	0.95	0.0152
Saint Michael	18.64					22.83				

Year	2004					2005				
Parish	Rate per 1000	RR	LB	UB	P-value	Rate per 1000	RR	LB	UB	P-value
Saint Andrew	24.55	1.11	0.67	1.83	0.6956	35.22	1.28	0.84	1.96	0.2515
Saint Peter	19.74	0.89	0.61	1.31	0.5488	27.17	0.99	0.71	1.37	0.9430
Saint George	12.74	0.57	0.40	0.83	0.0035	24.61	0.89	0.68	1.18	0.4296
Saint John	22.73	1.02	0.69	1.51	0.9046	20.25	0.74	0.49	1.11	0.1408
Saint Lucy	22.08	0.99	0.67	1.47	0.9789	20.46	0.74	0.50	1.11	0.1470
Saint Joseph	16.78	0.76	0.46	1.25	0.2768	24.06	0.88	0.57	1.34	0.5364
Saint Philip	16.80	0.76	0.56	1.02	0.0689	21.37	0.78	0.60	1.01	0.0636
Saint James	15.25	0.69	0.50	0.93	0.0168	19.33	0.70	0.53	0.92	0.0116
Saint Thomas	30.40	1.37	1.00	1.87	0.0471	24.53	0.89	0.64	1.25	0.5053
Christ Church	16.16	0.73	0.59	0.90	0.0038	18.64	0.68	0.56	0.83	0.0001
Saint Michael	22.20					27.50				

(Table 2.11 Continued)

Year	2006					2007				
Parish	Rate per 1000	RR	LB	UB	P-value	Rate per 1000	RR	LB	UB	P-value
Saint Andrew	24.4	0.8	0.5	1.3	0.492	35.09	0.10	0.88	2.30	0.1485
Saint Peter	40.7	1.4	1.0	1.8	0.017	46.70	1.33	0.95	1.88	0.1001
Saint George	23.3	0.8	0.6	1.0	0.120	29.43	1.02	0.75	1.39	0.9135
Saint John	31.5	1.0	0.7	1.5	0.639	25.83	0.92	0.59	1.43	0.7129
Saint Lucy	24.3	0.8	0.5	1.2	0.338	29.01	0.77	0.48	1.23	0.2802
Saint Joseph	36.5	1.2	0.8	1.7	0.201	29.19	1.03	0.64	1.64	0.9103
Saint Philip	29.5	1.0	0.8	1.2	0.909	34.73	1.17	0.90	1.53	0.2472
Saint James	20.2	0.6	0.5	0.9	0.007	22.74	0.79	0.58	1.07	0.1299
Saint Thomas	23.2	0.8	0.5	1.1	0.192	23.80	0.83	0.55	1.26	0.3888
Christ Church	19.4	0.6	0.5	0.8	<.000	18.71	0.70	0.56	0.89	0.0031
Saint Michael	29.1					28.16				

Year	2008				
Parish	Rate per 1000	RR	LB	UB	P-value
Saint Andrew	22.8	0.7	0.4	1.2	0.2562
Saint Peter	34.4	1.1	0.8	1.5	0.4545
Saint George	24.4	0.7	0.6	1.0	0.0985
Saint John	31.4	1.0	0.7	1.4	0.9063
Saint Lucy	16.4	0.5	0.3	0.8	0.0051
Saint Joseph	33.2	1.0	0.7	1.5	0.6736
Saint Philip	30.4	0.9	0.7	1.2	0.9105
Saint James	21.4	0.7	0.5	0.9	0.0060
Saint Thomas	27.6	0.9	0.6	1.2	0.4960
Christ Church	20.5	0.6	0.5	0.8	<.0001
Saint Michael	30.8				

[a]Data Source: Queen Elizabeth Hospital, Barbados, 2003-2008, and Barbados Census 2000; RR= Risk Ratio; UB= Upper Boundary; LB=Lower Boundary; p-value is for comparison of the rate for the given parish to the rate for Saint Michael.

Table 2.12: Risk of Hospitalization for Ambulatory Care Sensitive Conditions for Men Ages 50 and Over, Barbados, 2003-2008, by Year and Parish

Year	2003-2008					2003				
Parish	Rate per 1000	RR	LB	UB	P-value	Rate per 1000	RR	LB	UB	P-value
Saint Andrew	26.13	0.75	0.60	0.94	0.0117	18.00	0.60	0.31	1.16	0.1307
Saint Peter	32.54	0.93	0.81	1.07	0.3127	31.38	1.04	0.74	1.47	0.8037
Saint George	26.20	0.75	0.66	0.85	<.0001	17.32	0.58	0.40	0.83	0.0028
Saint John	31.07	0.89	0.77	1.04	0.1304	20.31	0.68	0.43	1.06	0.0911
Saint Lucy	21.04	0.60	0.50	0.72	<.0001	13.92	0.46	0.27	0.79	0.0050
Saint Joseph	23.11	0.66	0.54	0.81	<.0001	21.17	0.70	0.42	1.19	0.1872
Saint Philip	25.34	0.73	0.65	0.81	<.0001	22.47	0.75	0.56	1.00	0.0478
Saint James	21.28	0.61	0.54	0.69	<.0001	23.95	0.80	0.60	1.06	0.1148
Saint Thomas	32.21	0.92	0.81	1.05	0.2337	22.69	0.76	0.51	1.11	0.1507
Christ Church	19.93	0.57	0.52	0.62	<.0001	19.50	0.65	0.52	0.81	0.0001
Saint Michael	34.90	1				30.04	1			

Year	2004					2005				
Parish	Rate per 1000	RR	LB	UB	P-value	Rate per 1000	RR	LB	UB	P-value
Saint Andrew	15.93	0.56	0.28	1.13	0.1058	21.85	0.61	0.33	1.11	0.1050
Saint Peter	26.17	0.92	0.63	1.33	0.6586	30.32	0.84	0.60	1.19	0.3353
Saint George	16.19	0.57	0.39	0.83	0.0030	29.71	0.83	0.62	1.10	0.1862
Saint John	27.29	0.96	0.64	1.43	0.8353	29.25	0.81	0.56	1.19	0.2893
Saint Lucy	23.75	0.83	0.55	1.27	0.3959	22.71	0.63	0.41	0.97	0.0336
Saint Joseph	22.48	0.79	0.48	1.31	0.3597	26.64	0.74	0.47	1.18	0.2054
Saint Philip	25.16	0.88	0.67	1.16	0.3796	26.30	0.73	0.56	0.95	0.0209
Saint James	17.38	0.61	0.44	0.84	0.0027	22.17	0.62	0.46	0.82	0.0009
Saint Thomas	32.71	1.15	0.83	1.59	0.4039	34.96	0.97	0.71	1.33	0.8659
Christ Church	16.44	0.58	0.46	0.73	<.0001	20.59	0.57	0.46	0.71	<.0001
Saint Michael	28.47	1				35.92	1			

(Table 2.12 Continued)

Year	2006					2007				
Parish	Rate per 1000	RR	LB	UB	P-value	Rate per 1000	RR	LB	UB	P-value
Saint Andrew	51.57	1.40	0.94	2.08	0.1019	27.66	0.71	0.42	1.22	0.2182
Saint Peter	36.17	0.98	0.71	1.34	0.8927	30.16	0.78	0.55	1.10	0.1547
Saint George	25.50	0.69	0.51	0.93	0.0152	34.21	0.88	0.68	1.15	0.3590
Saint John	28.20	0.76	0.52	1.12	0.1687	40.13	1.04	0.75	1.44	0.8272
Saint Lucy	18.73	0.51	0.32	0.80	0.0039	21.60	0.56	0.36	0.86	0.0080
Saint Joseph	23.80	0.64	0.40	1.05	0.0765	19.52	0.50	0.30	0.86	0.0121
Saint Philip	24.27	0.66	0.50	0.86	0.0025	26.55	0.69	0.53	0.89	0.0047
Saint James	19.73	0.53	0.40	0.72	<.0001	23.26	0.60	0.46	0.79	0.0003
Saint Thomas	34.14	0.92	0.67	1.26	0.6195	33.23	0.86	0.63	1.18	0.3464
Christ Church	18.64	0.50	0.41	0.63	<.0001	22.04	0.57	0.47	0.70	<.0001
Saint Michael	36.96	1				38.69	1			

Year	2008				
Parish	Rate per 1000	RR	LB	UB	P-value
Saint Andrew	21.67	0.55	0.30	1.01	0.0525
Saint Peter	40.93	1.04	0.77	1.41	0.7809
Saint George	34.11	0.87	0.67	1.13	0.2962
Saint John	41.01	1.05	0.76	1.44	0.7886
Saint Lucy	25.46	0.65	0.44	0.97	0.0332
Saint Joseph	25.03	0.64	0.40	1.02	0.0627
Saint Philip	27.26	0.69	0.54	0.90	0.0056
Saint James	21.19	0.54	0.40	0.72	<.0001
Saint Thomas	35.45	0.90	0.66	1.23	0.5166
Christ Church	22.32	0.57	0.47	0.70	<.0001
Saint Michael	39.23	1			

[a]Data Source: Queen Elizabeth Hospital, Barbados, 2003-2008, and Barbados Census 2000; RR= Risk Ratio; UB= Upper Boundary of the 95% Confidence Interval; LB=Lower Boundary; p-value is for comparison of the rate for the given parish to the rate for Saint Michael.

Table 2.13: Risk of Hospitalization for Top Six Ambulatory Care Sensitive Conditions for Women Ages 20-49, Barbados, 2003-2008, by Parish

	Influenza and Pneumonia					CHF				
Parish	Rate per 1000	RR	LB	UB	P-value	Rate per 1000	RR	LB	UB	P-value
Saint Andrew	9.18	1.06	0.58	1.95	0.8487	1.67	0.50	0.12	2.03	0.3299
Saint Peter	6.87	0.79	0.49	1.29	0.3526	1.91	0.57	0.23	1.41	0.2230
Saint George	5.17	0.60	0.38	0.93	0.0230	0.70	0.21	0.07	0.67	0.0082
Saint John	7.07	0.82	0.47	1.41	0.4676	1.51	0.45	0.14	1.43	0.1774
Saint Lucy	5.40	0.62	0.35	1.12	0.1154	1.35	0.40	0.13	1.28	0.1230
Saint Joseph	3.93	0.45	0.20	1.03	0.0574	1.96	0.58	0.18	1.86	0.3637
Saint Philip	5.91	0.68	0.47	0.99	0.0456	1.97	0.59	0.31	1.11	0.1019
Saint James	3.80	0.44	0.28	0.68	0.0003	0.86	0.26	0.10	0.64	0.0034
Saint Thomas	6.09	0.70	0.43	1.14	0.1573	4.74	1.41	0.79	2.51	0.2419
Christ Church	5.34	0.62	0.45	0.84	0.0021	1.98	0.59	0.36	0.97	0.0384
Saint Michael	8.65					3.36				

	Diabetes					Angina				
Parish	Rate per 1000	RR	LB	UB	P-value	Rate per 1000	RR	LB	UB	P-value
Saint Andrew	1.67	0.42	0.10	1.71	0.2264	1.67	0.00	0.00	0.00	0.4280
Saint Peter	4.20	1.06	0.56	1.99	0.8615	1.14	0.57	0.14	2.32	0.1098
Saint George	2.35	0.59	0.31	1.14	0.1184	1.88	0.39	0.12	1.24	0.2313
Saint John	4.04	1.02	0.49	2.11	0.9624	0.50	0.64	0.30	1.33	0.0800
Saint Lucy	0.00	0.00	0.00	0.00	0.9998	0.45	0.17	0.02	1.24	0.0624
Saint Joseph	0.00	0.00	0.00	0.00	0.9998	1.96	0.15	0.02	1.10	0.4918
Saint Philip	1.43	0.36	0.17	0.75	0.0061	1.43	0.67	0.21	2.12	0.0556
Saint James	1.04	0.26	0.11	0.60	0.0015	1.21	0.49	0.23	1.02	0.0256
Saint Thomas	1.69	0.43	0.17	1.05	0.0647	2.71	0.41	0.19	0.90	0.8194
Christ Church	1.29	0.32	0.18	0.58	0.0002	1.29	0.92	0.44	1.92	0.0068
Saint Michael	3.97					2.95				

(Table 2.13 Continued)

	Dehydration					Hypertension				
Parish	Rate per 1000	RR	LB	UB	P-value	Rate per 1000	RR	LB	UB	P-value
Saint Andrew	0.83	0.48	0.07	3.52	0.4724	1.67	0.63	0.15	2.59	0.5225
Saint Peter	2.29	1.32	0.56	3.15	0.5266	0.76	0.29	0.07	1.18	0.0845
Saint George	2.11	1.22	0.59	2.55	0.5929	2.58	0.98	0.51	1.87	0.9429
Saint John	3.03	1.75	0.74	4.17	0.2059	1.01	0.38	0.09	1.57	0.1813
Saint Lucy	0.90	0.52	0.13	2.17	0.3698	1.80	0.68	0.25	1.88	0.4589
Saint Joseph	2.62	1.51	0.54	4.27	0.4327	1.31	0.49	0.12	2.03	0.3290
Saint Philip	0.54	0.31	0.10	1.01	0.0523	2.15	0.81	0.43	1.52	0.5176
Saint James	0.52	0.30	0.09	0.97	0.0452	2.07	0.78	0.42	1.47	0.4445
Saint Thomas	1.69	0.98	0.38	2.50	0.9633	2.71	1.02	0.49	2.15	0.9515
Christ Church	0.89	0.51	0.25	1.07	0.0766	1.58	0.60	0.34	1.05	0.0726
Saint Michael	1.73					2.64				

[a]Data Source: Queen Elizabeth Hospital, Barbados, 2003-2008, and Barbados Census 2000; ACSH=Ambulatory Cares Sensitive Condition; CHF=Congestive Heart Failure; RR= Risk Ratio; UB= Upper Boundary; LB=Lower Boundary; p-value is for comparison of the rate for the given parish to the rate for Saint Michael.

Table 2.14: Risk of Hospitalization for Top Six Ambulatory Care Sensitive Conditions for Men Ages 20-49, Barbados, 2003-2008, by Parish

	Influenza and Pneumonia					CHF				
Parish	Rate per 1000	RR	LB	UB	P-value	Rate per 1000	RR	LB	UB	P-value
Saint Andrew	6.60	0.75	0.38	1.47	0.4054	2.94	1.21	0.43	3.35	0.71
Saint Peter	6.02	0.69	0.40	1.16	0.1624	1.61	0.66	0.24	1.83	0.42
Saint George	4.79	0.55	0.34	0.87	0.0105	2.40	0.99	0.50	1.95	0.96
Saint John	8.42	0.96	0.59	1.56	0.8673	0.94	0.38	0.09	1.58	0.18
Saint Lucy	7.04	0.80	0.48	1.34	0.398	3.08	1.27	0.57	2.80	0.56
Saint Joseph	5.41	0.62	0.31	1.20	0.1566	0.60	0.25	0.03	1.79	0.16
Saint Philip	6.33	0.72	0.50	1.05	0.0859	1.73	0.71	0.35	1.45	0.34
Saint James	6.04	0.69	0.47	1.01	0.0559	1.56	0.64	0.30	1.36	0.24
Saint Thomas	8.72	0.99	0.65	1.51	0.9768	5.23	2.15	1.20	3.85	0.01
Christ Church	3.87	0.44	0.31	0.62	<.0001	1.47	0.61	0.34	1.07	0.08
Saint Michael	8.78	1	1	1		2.43				

	Diabetes					Angina				
Parish	Rate per 1000	RR	LB	UB	P-value	Rate per 1000	RR	LB	UB	P-value
Saint Andrew	0.00	0.00	0.00	*	0.9996	3.67	1.87	0.74	4.77	0.1871
Saint Peter	2.01	0.74	0.30	1.87	0.5289	0.80	0.41	0.10	1.70	0.22
Saint George	1.68	0.62	0.28	1.37	0.2386	1.20	0.61	0.24	1.56	0.3032
Saint John	0.94	0.35	0.08	1.43	0.142	1.40	0.72	0.22	2.33	0.5801
Saint Lucy	0.88	0.33	0.08	1.34	0.1201	0.88	0.45	0.11	1.87	0.2707
Saint Joseph	2.40	0.89	0.32	2.46	0.8238	1.20	0.61	0.15	2.55	0.5016
Saint Philip	1.34	0.50	0.23	1.10	0.0834	2.49	1.27	0.68	2.40	0.4526
Saint James	1.17	0.43	0.19	1.01	0.0527	1.36	0.70	0.31	1.56	0.381

(Table 2.14, Continued)

Saint Thomas	4.54	1.68	0.91	3.09	0.0942	1.40	0.71	0.25	2.00	0.5211
Christ Church	1.47	0.55	0.31	0.96	0.0351	1.01	0.52	0.26	1.02	0.0555
Saint Michael	2.70	1	1	1		1.96	1	1	1	
	Hypertension					Dehydration				
Parish	Rate per 1000	RR	LB	UB	P-value	Rate per 1000	RR	LB	UB	P-value
Saint Andrew	2.94	2.52	0.87	7.32	0.0887	2.20	1.57	1.77	1.26	0.5140
Saint Peter	0.40	0.35	0.05	2.56	0.2982	0.00	1.81	2.27	1.64	0.9999
Saint George	0.24	0.21	0.03	1.53	0.1223	0.72	1.74	1.87	1.49	0.2342
Saint John	0.47	0.40	0.05	2.98	0.373	0.47	1.46	1.89	1.41	0.2576
Saint Lucy	0.44	0.38	0.05	2.80	0.3414	0.88	1.02	1.76	1.35	0.4767
Saint Joseph	0.00	0.00	0.00	0.00	0.9998	0.00	1.09	1.38	1.13	0.9999
Saint Philip	1.53	1.32	0.59	2.96	0.503	0.96	1.00	2.12	1.68	0.3707
Saint James	0.97	0.84	0.32	2.21	0.7198	0.78	1.00	1.87	1.51	0.2297
Saint Thomas	3.14	2.70	1.24	5.86	0.0121	1.05	1.62	1.95	1.48	0.5682
Christ Church	0.55	0.48	0.19	1.17	0.1062	0.92	1.02	1.82	1.56	0.1979
Saint Michael	1.16	1	1	1		1.48				

[a]Data Source: Queen Elizabeth Hospital, Barbados, 2003-2008, and Barbados Census 2000; ACSH=Ambulatory Cares Sensitive Condition; CHF=Congestive Heart Failure; RR= Risk Ratio; UB= Upper Boundary; LB=Lower Boundary; p-value is for comparison of the rate for the given parish to the rate for Saint Michael.

Table 2.15: Risk of Hospitalization for Top Six Ambulatory Care Sensitive Conditions for Women Ages 50 and Older, Barbados, 2003-2008, by Parish

	Influenza and Pneumonia					CHF				
Parish	Rate per 1000	RR	LB	UB	P-value	Rate per 1000	RR	LB	UB	P-value
Saint Andrew	42.84	1.07	0.73	1.57	0.7107	48.96	1.52	1.06	2.17	0.0239
Saint Peter	50.22	1.26	0.99	1.61	0.0645	38.01	1.18	0.89	1.56	0.2564
Saint George	33.60	0.84	0.67	1.07	0.1540	19.26	0.60	0.44	0.81	0.0008
Saint John	28.33	0.71	0.50	1.00	0.0515	34.81	1.08	0.79	1.48	0.6430
Saint Lucy	40.10	1.01	0.75	1.34	0.9667	26.73	0.83	0.58	1.18	0.2900
Saint Joseph	32.41	0.81	0.57	1.17	0.2645	49.13	1.52	1.12	2.06	0.0067
Saint Philip	39.75	1.00	0.82	1.22	0.9789	30.22	0.94	0.74	1.17	0.5655
Saint James	26.60	0.67	0.53	0.84	0.0006	24.39	0.75	0.59	0.96	0.0243
Saint Thomas	39.34	0.99	0.76	1.29	0.9243	36.12	1.12	0.84	1.48	0.4360
Christ Church	24.17	0.61	0.51	0.72	<.0001	28.27	0.87	0.74	1.03	0.1177
Saint Michael	39.86					32.31				
	Diabetes					Angina				
Parish	Rate per 1000	RR	LB	UB	P-value	Rate per 1000	RR	LB	UB	P-value
Saint Andrew	12.24	0.68	0.34	1.39	0.2918	22.95	1.69	1.00	2.87	0.0516
Saint Peter	19.68	1.10	0.75	1.62	0.6303	14.93	1.10	0.70	1.72	0.6737
Saint George	14.75	0.82	0.58	1.17	0.2846	13.52	1.00	0.69	1.45	0.9863
Saint John	23.48	1.31	0.89	1.93	0.1703	12.95	0.95	0.57	1.60	0.8595
Saint Lucy	18.08	1.01	0.66	1.55	0.9612	13.37	0.99	0.60	1.62	0.9534
Saint Joseph	18.82	1.05	0.65	1.70	0.8376	12.54	0.92	0.51	1.66	0.7932
Saint Philip	16.10	0.90	0.66	1.23	0.5047	18.40	1.36	1.00	1.84	0.0499
Saint James	11.08	0.62	0.43	0.89	0.0087	12.98	0.96	0.68	1.35	0.8017
Saint Thomas	16.12	0.90	0.60	1.36	0.6227	8.38	0.62	0.35	1.09	0.0951
Christ Church	10.17	0.57	0.44	0.74	<.0001	11.23	0.83	0.64	1.08	0.1583
Saint Michael	17.89					13.57				

(Table 2.15, Continued)

Parish	Dehydration					Hypertension				
	Rate per 1000	RR	LB	UB	P-value	Rate per 1000	RR	LB	UB	P-value
Saint Andrew	9.18	0.51	0.23	1.15	0.1045	7.65	0.73	0.30	1.79	0.4967
Saint Peter	14.93	0.83	0.54	1.29	0.4071	12.90	1.24	0.76	2.00	0.3895
Saint George	11.06	0.62	0.41	0.92	0.0175	8.61	0.83	0.52	1.31	0.4155
Saint John	15.38	0.86	0.54	1.37	0.5148	15.38	1.47	0.91	2.39	0.1151
Saint Lucy	16.51	0.92	0.59	1.44	0.7102	7.86	0.75	0.40	1.44	0.3902
Saint Joseph	7.32	0.41	0.19	0.86	0.0193	10.45	1.00	0.53	1.91	0.9946
Saint Philip	13.47	0.75	0.54	1.05	0.0905	8.87	0.85	0.56	1.29	0.4456
Saint James	13.93	0.78	0.56	1.07	0.1241	6.33	0.61	0.38	0.97	0.0386
Saint Thomas	10.32	0.57	0.35	0.95	0.0323	10.96	1.05	0.63	1.75	0.8469
Christ Church	11.49	0.64	0.50	0.82	0.0004	7.40	0.71	0.52	0.97	0.0330
Saint Michael	17.98					10.43				

[a]Data Source: Queen Elizabeth Hospital, Barbados, 2003-2008, and Barbados Census 2000; ACSH=Ambulatory Cares Sensitive Condition; CHF=Congestive Heart Failure; RR= Risk Ratio; UB= Upper Boundary; LB=Lower Boundary; p-value is for comparison of the rate for the given parish to the rate for Saint Michael.

Table 2.16: Risk of Hospitalization for Top Six Ambulatory Care Sensitive Conditions for Men Ages 50 and Older, Barbados, 2003-2008, by Parish[a]

Influenza and Pneumonia						CHF				
Parish	Rate per 1000	RR	LB	UB	P-value	Rate per 1000	RR	LB	UB	P-value
Saint Andrew	33.74	0.66	0.41	1.08	0.097	33.7	0.97	0.60	1.58	0.903
Saint Peter	57.22	1.13	0.87	1.45	0.358	33.6	0.97	0.70	1.35	0.8459
Saint George	31.76	0.63	0.48	0.82	0.000	27.0	0.78	0.58	1.04	0.0944
Saint John	48.36	0.95	0.71	1.28	0.747	15.1	0.43	0.26	0.73	0.0016
Saint Lucy	24.66	0.49	0.32	0.73	0.000	33.5	0.96	0.68	1.37	0.8402
Saint Joseph	36.41	0.72	0.48	1.06	0.098	14.0	0.40	0.21	0.76	0.0046
Saint Philip	42.59	0.84	0.68	1.03	0.101	20.3	0.58	0.43	0.78	0.0004
Saint James	31.42	0.62	0.49	0.79	<.000	28.6	0.82	0.64	1.06	0.1365
Saint Thomas	51.23	1.01	0.78	1.31	0.947	44.2	1.27	0.96	1.69	0.0944
Christ Church	30.85	0.61	0.51	0.72	<.000	19.0	0.55	0.44	0.68	<.0001
Saint Michael	50.78					34.7				

Diabetes						Angina				
Parish	Rate per 1000	RR	LB	UB	P-value	Rate per 1000	RR	LB	UB	P-value
Saint Andrew	15.88	0.76	0.38	1.54	0.449	9.92	0.57	0.23	1.39	0.2143
Saint Peter	18.51	0.89	0.57	1.38	0.595	14.3	0.82	0.50	1.35	0.4372
Saint George	18.74	0.90	0.63	1.28	0.555	10.9	0.63	0.40	0.99	0.0443
Saint John	25.19	1.21	0.80	1.83	0.376	11.0	0.64	0.34	1.17	0.1458
Saint Lucy	9.86	0.47	0.25	0.89	0.020	9.86	0.57	0.30	1.07	0.0804
Saint Joseph	11.20	0.54	0.26	1.09	0.084	5.60	0.32	0.12	0.87	0.0249
Saint Philip	11.54	0.55	0.37	0.82	0.003	13.1	0.75	0.52	1.10	0.1383

(Table 2.16 Continued)

Saint James	9.67	0.46	0.30	0.71	0.000	10.8	0.62	0.41	0.94	0.0233
Saint Thomas	17.85	0.86	0.55	1.32	0.480	11.6	0.67	0.39	1.13	0.1346
Christ Church	15.34	0.74	0.57	0.95	0.017	10.4	0.60	0.45	0.81	0.0007
Saint Michael	20.87					17.4				

	Hypertension					Dehydration				
Parish	Rate per 1000	RR	LB	UB	P-value	Rate per 1000	RR	LB	UB	P-value
Saint Andrew	9.92	0.84	0.34	2.06	0.703	15.8	0.65	0.32	1.31	0.2267
Saint Peter	6.73	0.57	0.28	1.17	0.125	19.3	0.83	0.54	1.27	0.3811
Saint George	12.50	1.06	0.68	1.65	0.803	21.3	0.89	0.64	1.24	0.4867
Saint John	10.08	0.85	0.45	1.63	0.630	20.1	0.86	0.54	1.35	0.5059
Saint Lucy	7.89	0.67	0.33	1.37	0.270	22.6	0.96	0.62	1.47	0.8385
Saint Joseph	12.60	1.07	0.54	2.11	0.851	16.8	0.66	0.37	1.19	0.1660
Saint Philip	11.94	1.01	0.67	1.52	0.958	15.1	0.66	0.47	0.93	0.0180
Saint James	6.04	0.51	0.30	0.88	0.015	13.6	0.57	0.40	0.82	0.0022
Saint Thomas	10.09	0.85	0.48	1.52	0.591	16.3	0.72	0.46	1.12	0.1437
Christ Church	7.15	0.60	0.42	0.87	0.006	11.6	0.47	0.36	0.61	<.0001
Saint Michael	11.81					24.6				

[a]Data Source: Queen Elizabeth Hospital, Barbados, 2003-2008, and Barbados Census 2000; ACSH=Ambulatory Cares Sensitive Condition; CHF=Congestive Heart Failure; RR= Risk Ratio; UB= Upper Boundary; LB=Lower Boundary; p-value is for comparison of the rate for the given parish to the rate for Saint Michael.

Table 2.17: Risk of Hospitalizations for Top Six Ambulatory Care Sensitive Conditions for Women Ages 20-49, Barbados, 2003-2008, by Year

	Influenza and Pneumonia					CHF				
Year	Rate per 1000	RR	LB	UB	P-value	Rate per 1000	RR	LB	UB	P-value
2008	1.11	0.96	0.68	1.35	0.8205	0.46	3.82	1.66	8.78	0.0016
2007	1.12	0.96	0.68	1.35	0.83	0.45	3.69	1.60	8.50	0.0022
2006	1.02	0.88	0.62	1.24	0.4593	0.50	4.12	1.81	9.41	0.0008
2005	1.16	1.00	0.71	1.40	0.9937	0.53	4.34	1.91	9.89	0.0005
2004	1.00	0.86	0.61	1.23	0.4167	0.28	2.28	0.94	5.55	0.0686
2003	1.16					0.12				

	Diabetes					Angina				
Year	Rate per 1000	RR	LB	UB	P-value	Rate per 1000	RR	LB	UB	P-value
2008	0.45	1.12	0.64	1.96	0.692	0.09	0.23	0.09	0.59	0.0026
2007	0.45	1.12	0.64	1.97	0.6865	0.34	0.90	0.49	1.65	0.7403
2006	0.26	0.65	0.34	1.24	0.1926	0.55	1.45	0.84	2.49	0.1819
2005	0.46	1.15	0.65	2.01	0.6341	0.37	0.97	0.53	1.76	0.9142
2004	0.43	1.09	0.62	1.91	0.7767	0.21	0.54	0.27	1.10	0.0905
2003	0.40					0.38				

	Dehydration					Hypertension				
Year	Rate per 1000	RR	LB	UB	P-value	Rate per 1000	RR	LB	UB	P-value
2008	0.21	0.85	0.39	1.84	0.678	0.38	1.28	0.68	2.41	0.4413

(Table 2.17, Continued)

2007	0.38	1.56	0.80	3.05	0.1931	0.57	1.93	1.07	3.46	0.0279
2006	0.17	0.71	0.32	1.60	0.4096	0.31	1.05	0.54	2.04	0.8773
2005	0.23	0.94	0.44	2.00	0.8753	0.37	1.25	0.66	2.37	0.4905
2004	0.19	0.78	0.36	1.73	0.5471	0.21	0.70	0.34	1.48	0.3536
2003	0.24					0.29				

[a]Data Source: Queen Elizabeth Hospital, Barbados, 2003-2008, and Barbados Census 2000; ACSH=Ambulatory Cares Sensitive Condition; CHF=Congestive Heart Failure; RR= Risk Ratio; UB= Upper Boundary; LB=Lower Boundary; p-value is for comparison of the rate for the given year to the rate for 2003.

Table 2.18: Risk of Hospitalizations for Top Six Ambulatory Care Sensitive Conditions for Men Ages 20-49, Barbados, 2003-2008, by Year

	Influenza and Pneumonia					CHF				
Year	Rate per 1000	RR	LB	UB	P-value	Rate per 1000	RR	LB	UB	P-value
2008	1.20	1.79	1.20	2.66	0.004	0.42	0.98	0.56	1.73	0.9581
2007	1.33	1.98	1.34	2.92	0.0006	0.35	0.82	0.45	1.49	0.5206
2006	1.07	1.59	1.06	2.39	0.0245	0.42	0.99	0.56	1.75	0.9769
2005	1.46	2.17	1.48	3.18	<.0001	0.32	0.74	0.40	1.37	0.3448
2004	1.00	1.49	0.99	2.25	0.0556	0.21	0.50	0.25	1.00	0.0484
2003	0.67					0.42				
	Diabetes					Angina				
Year	Rate per 1000	RR	LB	UB	P-value	Rate per 1000	RR	LB	UB	P-value
2008	0.23	0.61	0.31	1.22	0.1609	0.19	0.90	0.40	2.05	0.8066
2007	0.28	0.75	0.39	1.44	0.3919	0.31	1.48	0.71	3.08	0.2913
2006	0.42	1.13	0.63	2.04	0.6753	0.37	1.74	0.85	3.53	0.1277
2005	0.28	0.76	0.39	1.45	0.4008	0.33	1.57	0.76	3.24	0.2196
2004	0.40	1.09	0.60	1.97	0.7747	0.18	0.83	0.36	1.92	0.6625
2003	0.37					0.21				
	Hypertension					Dehydration				
Year	Rate per 1000	RR	LB	UB	P-value	Rate per 1000	RR	LB	UB	P-value
2008	0.17	2.46	0.77	7.85	0.1277	0.14	7.60	3.05	14.31	0.4250
2007	0.30	4.20	1.41	12.48	0.0098	0.28	7.93	3.13	15.08	0.0247
2006	0.21	2.97	0.96	9.22	0.0590	0.25	4.80	2.32	8.21	0.0500
2005	0.12	1.74	0.51	5.94	0.3778	0.16	5.99	2.65	10.74	0.2976
2004	0.14	1.99	0.60	6.61	0.2608	0.12	3.35	1.88	5.31	0.5708
2003	0.07					0.09	3.24	1.00	1.00	

[a]Data Source: Queen Elizabeth Hospital, Barbados, 2003-2008, and Barbados Census 2000; CHF=Congestive Heart Failure; RR= Risk Ratio; UB= Upper Boundary; LB=Lower Boundary; p-value is for comparison of the rate for the given year to the rate for 2003.

Table 2.1 9: Risk of Hospitalizations for Top Six Ambulatory Care Sensitive Conditions for Women Ages 50 and Older, Barbados, 2003-2008, by Year

Influenza and Pneumonia						CHF				
Year	Rate per 1000	RR	LB	UB	P-value	Rate per 1000	RR	LB	UB	P-value
2008	5.86	1.23	1.0	1.5	0.048	6.09	1.3	1.12	1.6	0.002
2007	7.01	1.47	1.2	1.7	0.000	5.56	1.2	1.02	1.5	0.034
2006	6.45	1.35	1.1	1.6	0.003	5.26	1.1	0.96	1.4	0.114
2005	6.12	1.28	1.0	1.5	0.015	4.64	1.0	0.84	1.3	0.676
2004	4.48	0.94	0.7	1.1	0.569	4.71	1.0	0.85	1.3	0.584
2003	4.77					4.43				
	Diabetes					Angina				
Year	Rate per 1000	RR	LB	UB	P-value	Rate per 1000	RR	LB	UB	P-value
2008	2.32	0.73	0.5	0.9	0.027	1.81	1.2	0.88	1.8	0.208
2007	2.30	0.72	0.5	0.9	0.023	2.70	1.8	1.34	2.6	0.000
2006	1.88	0.59	0.4	0.7	0.000	3.53	2.4	1.78	3.4	<.000
2005	2.71	0.85	0.6	1.1	0.227	2.68	1.8	1.33	2.6	0.000
2004	2.97	0.93	0.7	1.2	0.579	1.23	0.8	0.57	1.2	0.464
2003	3.20					1.43				
			Dehydration			Hypertension				
Year	Rate per 1000	RR	LB	UB	P-value	Rate per 1000	RR	LB	UB	P-value
2008	2.32	1.59	1.1	2.1	0.002	2.18	2.2	1.50	3.3	<.000
2007	2.61	1.30	0.9	1.7	0.093	1.67	1.7	1.13	2.6	0.011
2006	2.53	1.27	0.9	1.7	0.141	1.62	1.6	1.09	2.5	0.018
2005	2.05	1.02	0.7	1.4	0.883	1.42	1.4	0.95	2.2	0.085
2004	1.91	0.96	0.6	1.3	0.791	1.43	1.4	0.95	2.2	0.083
2003	2.00					0.97				

[a]Data Source: Queen Elizabeth Hospital, Barbados, 2003-2008, and Barbados Census 2000; RR= Risk Ratio; UB= Upper Boundary; LB=Lower Boundary; p-value is for comparison of the rate for the given year to the rate for 2003.

Table 2.20: Risk of Hospitalizations for Top Six Ambulatory Care Sensitive Conditions for Men Ages 50 and Older, Barbados, 2003-2008, by Year

Influenza and Pneumonia						CHF				
Year	Rate per 1000	RR	LB	UB	P-value	Rate per 1000	RR	LB	UB	P-value
2008	7.93	1.38	1.13	1.70	0.0020	6.34	1.54	1.21	1.95	0.0004
2007	7.01	1.22	0.99	1.51	0.0623	5.30	1.29	1.01	1.65	0.0440
2006	7.07	1.23	1.00	1.52	0.0513	4.38	1.06	0.82	1.37	0.6445
2005	7.27	1.27	1.03	1.56	0.0269	4.24	1.03	0.79	1.33	0.8312
2004	6.30	1.10	0.88	1.36	0.4000	3.73	0.91	0.69	1.19	0.4735
2003	5.74					4.12				
Diabetes						Angina				
Year	Rate per 1000	RR	LB	UB	P-value	Rate per 1000	RR	LB	UB	P-value
2008	2.68	0.75	0.56	1.02	0.0641	1.70	0.96	0.65	1.44	0.8599
2007	2.36	0.66	0.48	0.91	0.0101	3.01	1.71	1.20	2.44	0.0031
2006	1.79	0.50	0.36	0.71	<.0001	2.99	1.69	1.19	2.42	0.0037
2005	3.10	0.87	0.65	1.16	0.3498	2.45	1.39	0.96	2.01	0.0841
2004	3.37	0.94	0.71	1.26	0.6928	1.24	0.71	0.45	1.09	0.1190
2003	3.57					1.76				
Hypertension						Dehydration				
Year	Rate per 1000	RR	LB	UB	P-value	Rate per 1000	RR	LB	UB	P-value
2008	2.03	1.72	1.12	2.66	0.0140	3.40	1.36	1.00	1.86	0.0526
2007	2.07	1.76	1.14	2.71	0.0105	3.27	1.31	0.95	1.79	0.0951
2006	1.57	1.33	0.84	2.11	0.2188	4.12	1.65	1.22	2.23	0.0011
2005	1.79	1.52	0.97	2.37	0.0651	3.36	1.34	0.98	1.84	0.0647
2004	1.21	1.03	0.63	1.67	0.9159	1.94	0.78	0.54	1.11	0.1660
2003	1.18					2.50	1.00	1.00	1.00	.

[a]Data Source: Queen Elizabeth Hospital, Barbados, 2003-2008, and Barbados Census 2000; RR= Risk Ratio; UB= Upper Boundary; LB=Lower Boundary; p-value is for comparison of the rate for the given year to the rate for 2003.

Table 2.21: Ambulatory care sensitive Conditions across years for Canada, Taiwan, Australia and United States

Taiwan, ACSH Rates [a]

	Age Group		
ACSH	≤ 18	19-64	65+
No.(%)	(n=8581	(n=18,436)	(n=3813)
2001	362 (4.2)	259(1.4)	177(4.6)
2002	340(4.0)	294(1.6)	184(4.8)
2003	248(2.9)	256(1.4)	204(5.4)
2004	199(2.3)	271(1.5)	243(6.4)
2005	210(2.4)	305(1.7)	256(6.7)
2006	121(1.4)	271(1.5)	330(8.7)

Canada, ACSH per 100,000[b]

		Age Group		
	overall	0-18	19-64	65+
2001-02	459			
2002-03-	428			
2003-04	417			
2004-05	401			
2005-06	385			
2006-07				

Australia/Victoria ACSH rates per 1,000[c]

	Age Group		
	0-19	20-49	50+
2003-04	16.96	14.65	78.47
2004-05	17.47	16.32	100.67
2005-06	17.15	16.20	102.59
2006-07	16.83	16.51	108.50
2007-08	18.09	17.35	112.79
2008-09	17.25	13.92	75.71

United States, ACSH rates per 100,000 [d]

		Age Group			Gender	
	Total	18-44	45-64	65 and over	Male	Female
2000	1,944.30	474.3	1,637.90	7,166.90	1,998.10	1,939.40
2004	1,843.70	444.4	1,593.20	6,928.90	1,848.30	1,864.20
2005	1,833.50	447.7	1,552.80	6,942.70	1,839.40	1,850.50
2006	1,760.50	446.7	1,526.50	6,558.20	1,770.50	1,773.80
2007	1,702.50	448	1,491.30	6,278.70	1,709.20	1,716.40

[a] Source:(Cheng, et al., 2010b)

[b] Source: Hospital Morbidity Database and Discharge Abstract Database; Canadian Institute of Health Information

[c] Source:(Victorian Health Information Surveillance System, 2011)

[d] Source: Healthcare Cost and Utilization Project, Nationwide Inpatient Sample; and AHRQ Quality Indicators, version 3.1.

Table 2.22 :Australian\Victoria Standardized Rate per 1,000 _2008-2009

	Men			Women		
	Age Group			Age Group		
	0-19	20-49	50+	0-19	20-49	50+
Diagnosis						
Angina	0	0.50	5.37	0	0.23	3.81
Asthma	4.77	0.49	0.55	3.21	1.09	1.61
Cellulitis	0.73	1.33	3.11	0.52	0.67	3.16
Chronic Obstructive Pulmonary Disease (COPD)	0.07	0.18	9.77	0.06	0.30	7.74
Congestive cardiac failure	0.03	0.16	7.75	0.01	0.06	7.05
Convulsions and epilepsy	1.70	1.44	1.63	1.57	1.09	1.28
Dehydration and gastroenteritis	0.30	0.77	2.07	0.34	1.26	2.88
Dental conditions	4.59	1.99	2.98	4.81	2.40	2.76
Diabetes complications	0.67	2.53	41.00	0.87	2.30	30.15
Ear, nose and throat infections	3.48	0.80	0.58	3.10	1.09	0.67
Gangrene	0.05	0.24	0.76	0.03	0.11	0.65
Hypertension	0.05	0.09	0.40	0.04	0.10	0.88
Influenza and pneumonia	0.35	0.31	1.06	0.31	0.36	0.78
Iron deficiency anemia	0.08	0.35	3.15	0.16	1.78	4.48
Nutritional deficiencies	0.01	0	0.02	0	0	0.03
Other vaccine-preventable conditions	0.13	0.33	0.64	0.12	0.16	0.22
Pelvic inflammatory disease	0	0	0	0.13	0.80	0.20
Perforated/bleeding ulcer	0.02	0.14	0.82	0.01	0.07	0.56
Pyelonephritis	0.62	0.48	3.93	1.61	2.24	6.52

[c] Source:(Victorian Health Information Surveillance System, 2011)

Table 2.23: Rates of Hospitalization for Ambulatory care Sensitive Conditions per Spain 2001,2003-2004

	Overall	Gender		Age Group			
		Women	Men	> 60	65-74	75-84	85+
Madrid/Spain,2001-2003 [a] *per 1,000*							
Overall		35.6	20.45				
Diagnosis							
Hypertensive Cardiovascular		8.97	9.66				
Heart Failure		6.65	13.94				
Pneumonia		3.39	9.57				
Gender (2001-2003) [b]							
Women					10.26	22.33	52.57
Men					21.95	46.29	74.77
Spain,2003-2004 [c] *per 10,000*							
Diagnosis							
Asthma	5.16	7.39	2.74	9.56			
Uncontrolled Diabetes	0.51	0.48	0.51	0.81			
Hypertension	1.34	1.41	1.24	2.72			
Acute Diabetes	0.27						
CHF	18.7						
COPD	1.79						
Hemorrhagic Complications	2.97						
Appendectomy in complicated Appendix	1.75						
UTI	3.41						

[a] Source:(Magan, et al., 2008)
[b]Source:(Magán, Alberquilla, Otero, & Ribera, 2011)
[c] Source:(*Quality of Ambulatory care in the Spanish National health System: Analysis of three OECD indicators and some alternatives*, 2009)

Table 2.24: Rates of Hospitalization for Acute and Chronic Ambulatory care Sensitive Conditions per 100,000, United States 2000,2004-2007

Acute conditions							Chronic conditions						
Year	Total	Age Group			Gender			Total	Age Group			Gender	
		18-44	45-64	65 and over	Male	Female	Year		18-44	45-64	65 and over	Male	Female
2000	731.1	189.5	485.7	2,875.00	745.8	740.5	2000	1,213.30	284.8	1,152.30	4,292.60	1,252.50	1,199.00
2004	707.8	174.4	493.6	2,877.40	688.2	737.7	2004	1,136.00	270	1,099.70	4,052.10	1,160.20	1,126.50
2005	741.4	180.4	512.8	3,030.80	716.8	774.3	2005	1,092.20	267.2	1,040.20	3,912.40	1,122.70	1,076.40
2006	682.9	169	483.3	2,767.50	656.7	715.9	2006	1,077.60	277.7	1,043.40	3,791.10	1,113.90	1,058.00
2007	665.9	170.1	477.5	2,676.80	632.9	703	2007	1,036.80	277.9	1,013.90	3,602.50	1,076.40	1,013.50

[a] Source: Healthcare Cost and Utilization Project, Nationwide Inpatient Sample; and AHRQ Quality Indicators, version 3.1.

Table 2.25:Rates of Ambulatory Care Sensitive Conditions for United States and Singapore

	United States[a]		Singapore[b]	
Population group		Rate per 100,000	Population Group	Rate per 100,000
Total		1,704.78		
Age	18-44	448.75	15-24	108
	45-64	1,482.70	25-44	119
	65 and over	6,311.41	45-64	587
Age	65-69	3,306.60	>65	260
	70-74	4,578.67		
	75-79	6,333.11		
	80-84	8,945.30		
	85 and over	12,814.11		
Gender	Male	1,717.52	Male	224
	Female	1,713.33	Female	295

[a]Source: Healthcare Cost and Utilization Project, Nationwide Inpatient Sample; and AHRQ Quality Indicators, version 3.1.
[b] Source:(Niti & Ng, 2003)

CHAPTER 3: GENDER, AGE, AREA, AND TEMPORAL DIFFERENCES IN ACSH RATES FOR CHILDREN IN BARBADOS AND A COMPARISON TO SOME DEVELOPED AND DEVELOPING COUNTRIES

Introduction

Hospitalization for Ambulatory Care Sensitive Conditions (ACSH)

Hospitalization for ambulatory care sensitive conditions (ACSH), also known as potentially preventable hospitalization, has been used in many studies as an indicator of the accessibility and overall quality of primary health care (Ansari, et al., 2006; Billings, et al., 1993; Laditka, et al., 2003; Pappas, et al., 1997; Weissman, et al., 1992). Ambulatory care sensitive conditions are conditions for which timely ambulatory care can potentially reduce, though not eliminate, the risk of hospitalization (AHRQ, 2001; Ansari, et al., 2002; Billings, et al., 1993; Bindman, et al., 2005; DeLia, 2003; Institute of Medicine, 1993; Laditka & Laditka, 2006; Laditka, et al., 2003; Pappas, et al., 1997; Parker & Schoendorf, 2000; Weissman, et al., 1992). The ACSH indicator has been used internationally to provide evidence-based guidelines for health related policy decisions, including the identification of opportunities for improving health care and controlling the costs of publicly financed health care systems (Ansari, et al., 2006; Ricketts, et al., 2001; Rizza, et al., 2007; Schreiber & Zielinski, 1997a; Silver, et al., 1997).

According to the Agency for Healthcare Research and Quality (AHRQ), hospitalizations in the pediatric population attributed primarily to conditions such as asthma, diabetes, gastroenteritis, perforated appendix, and urinary tract infections

exemplify ambulatory care sensitive conditions (Agency for Healthcare Research and Quality (AHRQ), 2006). Although not all hospitalizations for these conditions can be avoided, exceptionally high rates of hospitalization for these conditions in an area may suggest a problem with the accessibility, quality, or utilization of primary health care (Casanova, Colomer and Starfield, 1996).

Some studies have suggested that the provision of universal health care in a country may facilitate access to primary care services, resulting in low ACSH rates (Ansari, et al., 2006). Others suggest that variations in ACSH rates may not be due to access to health insurance, but rather to differences in geographic locations and among populations (Ansari, et al., 2003; Laditka, 2003; Laditka & Laditka, 2004; Laditka, et al., 2003). Other than access to primary care, factors suggested to influence rates of hospitalization for ambulatory care sensitive conditions include socioeconomic status, community wealth, race, region, gender, and disease prevalence (Billings, et al., 1993; Laditka & Laditka, 2004; Laditka, Laditka, & Probst, 2005; Laditka & Johnston, 1999; Laditka & Laditka, 1999). Physician supply has also been suggested to influence ACSH rates, especially in rural and inner city areas, where the supply of physicians has been found to be negatively associated with ACSH rates (Basu, et al., 2002a; Gulliford, 2002; Laditka, Laditka, & Probst, 2005). Within the pediatric population, caregiver characteristics are also likely to play a role in the propensity to seek care for these conditions.

In Barbados, primary care services are available universally through free national health care. Health care is provided by both public and private general practitioners as well as specialists. This should result in reduced barriers in access to primary care, with

subsequent lower overall rates of ACSH (Ansari, et al., 2006). Thus, elevated rates of hospitalization for these conditions may indicate areas for improving the health care system (Casanova, et al., 1996). The usefulness of ACSH as an indicator of access to primary health care has been suggested by many studies (Billings et al. 1993; Laditka and Johnston 1999). While many studies have focused on ACSH rates in older adults and in the population as a whole, few have focused on pediatric populations.

Quality Indicators Used in this Study

In this dissertation, ambulatory care sensitive conditions were selected based on the area level quality indicators developed by the AHRQ--the pediatric quality indicators (PDIs) (Agency for Healthcare Research and Quality (AHRQ), 2006). This set of quality indicators were established by the AHRQ to identify problems which may be preventable in health care systems at the area level based on problems experienced by the population 17 years and under (Agency for Healthcare Research and Quality (AHRQ), February 2006.). The PDIs are part of a set of indicators which were released to the public in 2006. The conditions include admissions for asthma, short-term diabetes complications, gastroenteritis, perforated appendix, and urinary tract infections.

Previous literature has explored the use of ACSH indicators that included hospitalizations for conditions such as pneumonia, seizures, cellulites, and upper respiratory infections using the established list developed by Billings et al (1993) and other modifications of this list (Billings, et al., 1993; Casanova, et al., 1996; Garg, Probst, Sease, & Samuels, 2003; Parker & Schoendorf, 2000; Steiner, et al., 2003).

Overview of Barbados Health Care System

Barbados is the most easterly of the Caribbean Islands. Barbados has an aging

population, which is somewhat different from its regional counterparts with an epidemiological profile somewhat similar to a developed country. Reports in March of 2008 projected a population of about 295,000 inhabitants, 15.7% of which are over age 60, and 17.4% less than age 15 (Corbin, et al., 2004; World Health Organization, 2002). National health care in Barbados is government subsidized, whereas private care is financed through out-of-pocket payments, or employer and individual based health insurance (PAHO, 1998). These private sector services are provided on a fee-for service basis with the private sector consisting of over 100 general practitioners and specialists (Barbados Ministry of Health, 2007). Health care accounts for about 16% of total government expenditures (PAHO, 2005). In 1999 and 2000 this was US $148 million, with 22% allocated to preventative and public health services (PAHO, 2005). There is a referral procedure between public and private primary care facilities to the QEH (Barbados Ministry of Health, 2007). There are several integrated programs between of the public and private sectors, resulting in the privatization of certain aspects of the health care system to promote improvements in medical care in Barbados (Shankar, et al., 1997). In 2002, the Ministry of Health, in collaboration with public and private stakeholders, developed The Strategic Plan for Health 2002-2012, which is aimed at health care reform by developing a new approach incorporating all stakeholders in the health care system (Project Design and Implementation Unit, 2003).

Under the Barbados Drug Service, essential medications listed on the National Drug Formulary are free at all government institutions and participating private pharmacies to those 65 years and older, under the age of 16 and individuals disgnosed for hypertension, diabetes, cancer, asthma and epilepsy (Project Design and Implementation

Unit, 2003). Estimates in 1996 suggest that approximately 51% of primary care visits for medical services and over 80% of dental services are provided by the private sector with 20% of the population being covered by private health insurance (Project Design and Implementation Unit, 2003). In addition, in 2000, two thirds of the over 65 population reported use of the private sector to obtain ambulatory care (Pan American Health Organization, 2005).

The Queen Elizabeth Hospital is the largest acute care facility in Barbados, and provides outpatient clinics to approximately 110,194 patients for major chronic illnesses including diabetes, hypertension, cardiovascular diseases, ophthalmology and nephrology (PAHO, 2005). The polyclinics provide primary care services, which are free at point of service. These services include clinical and public health services such as maternal care, pediatric and mental health care, dental services, community mental health, nutrition, health education, in-home care and environmental health services (PAHO, 2005). The only privately owned hospital, Bayview Hospital, has 24 acute-care beds and is geared towards less acute illnesses, outpatient surgery, and obstetric and gynecological care (PAHO, 2005).

Overview of the Literature

Research on ACSH has reported considerable variation in rates among various age groups (Laditka, et al., 2003; Laditka, Laditka, & Probst, 2005; Laditka & Laditka, 1999). Some researchers have found that older children have higher hospitalization rates than younger children (Laditka & Johnston, 1999; Shi, et al., 1999). Other studies have found that younger children have higher ACSH rates than older children (Garg, et al., 2003; Parker & Schoendorf, 2000; Shi & Lu, 2000; Shi, et al., 1999). A study on patients

hospitalized in 1995 in South Carolina using data from the 1995 Hospital Encounter Data Base and analyzed the population s separately for children 0-17 years and adults 18-64 years. The authors found that 34% of all hospitalizations in the pediatric population were for ambulatory care sensitive conditions (Shi, et al., 1999). This study underscored the use of the ACSH indicator as a measure of access to primary care (Shi, et al., 1999).

Previous studies in the US, Canada, and Europe suggest that rates may be linked to the fact that adolescents tend to experience various emotional and physical changes leading to independence, and the desire to maintain confidentiality. Consequently, children may avoid using preventive care services, increasing their use of the emergency department (ED) and related hospitalizations. This pattern of behavior is expected to be consistent for adolescents in Barbados, with adolescents having similar behaviors as those in the U.S., Canada and Europe (Maharaj, Nunes, & Renwick, 2009). In some countries, for children 0-14 years, family physician offices and polyclinics have generally been reported as their usual source of care (Casanova, et al., 1996). In addition, it has been suggested that physicians may be more apt to hospitalize infants than older children (Casanova, et al., 1996), which may influence ACSH rates for the 0-14 age-group. Further, in Barbados, the leading causes of hospitalizations in the 0-5 age group were reported to be for respiratory diseases including asthma and/or chronic obstructive airway disease (Barbados Ministry of Health, 2007). Admissions for asthma attacks were reported to have increased from 1% to 3% between 1997 and 2003 (Barbados Ministry of Health, 2003).

My dissertation research examines ACSH rates for children ages 0-19. Results from this analysis can provide information about health services use by the pediatric

population in Barbados, and may be useful for examining policies aimed at improving access to needed primary care services, health education, continuity of care, and prevention and management of chronic diseases. This information can also influence policy decisions on how health care spending is allocated within the health care system.

ACSH Rates and Gender

In general studies on the adult population have established that morbidity and mortality patterns differ substantially between females and males (Laditka & Laditka, 2009). Studies of ACSH rates in the U.S. have suggested that women have higher rates of visits to primary care physicians than men (Laditka & Laditka, 1999; Lishner, 2000). Other studies conducted in a system where health care coverage is universal have shown that while women use primary care services more than men, their use of hospital services is substantially less than that of men (Fernandez, et al., 1999; Magan, et al., 2008). Studies have also found gender differences in health service use in the pediatric populations in the U.S. Klein et al. (1999), in a nationally representative study of self-reported access to health care in a nationally representative sample of 6748 school children surveyed aged 10-19 in the U.S, found that boys were less likely to report a usual source of primary care than girls, and also reported higher ED use as a usual source. This result is consistent with research conducted by Marcell et al (2002): adolescent boys of all ages showed significantly less use of all health care services including primary care. Klein et al (1999) also found that girls reported higher rates of forgoing needed care than boys, due to their interest in maintaining confidentiality from parents (Klein, Wilson, McNulty, Kapphahn, & Scott-Collins, 1999).

Potentially avoidable hospitalization was found to be higher for males than females in a sample of children in South Carolina (Garg, et al., 2003). In contrast, a study on the pediatric population ages 0-14 in Valencia, Spain, where access to primary health care is universally available, found that ACSH rates for females (51%) and males (49%) were essentially the same (Casanova, et al., 1996). Given the mixed results in observed gender differences across age groups for ACSH in previous studies, investigating ACSH rates in Barbados separately for females and males is useful.

Geographic Variations and Trends in ACSH Rates

In a study conducted in the U.S. to examine national trends in preventable hospitalizations, an increase for ACSH was observed for all ages during 1980 to 1998 (Kozak, et al., 2001b). In this study, the authors reported no significant overall change among people younger than age 65. However, ACSH rates decreased among those ages 0 to 14, but increased for those 15 to 44. In addition, declining hospitalization rates for ambulatory care sensitive conditions were also reported for children under age 15 in Singapore from 1991 to 1998 (Niti & Ng, 2003).

Garg et al. (2003) also suggested a trend of declining ACSH rates with age as a proportion of all hospitalizations among children in South Carolina from 1997-1998. In this study children living in rural areas, underserved health counties, Medicaid insurance coverage, poorer neighborhoods had higher ACSH rates (Garg, et al., 2003). The highest hospitalization rates were for bacterial pneumonia, asthma, dehydration, gastroenteritis and convulsions within this population (Garg, et al., 2003).

Significant variations in ACSH rates were found in a study conducted on the pediatric population in the states of Florida, Iowa, Kentucky, North Carolina, Oregon,

and Washington after adjusting for rurality, poverty, insurance status, and physician supply (Casey, 2007). In this study, rates for asthma, short-term diabetes complications, gastroenteritis, and urinary tract infection were significantly higher for children living in rural areas than for those living in urban areas (Casey, 2007).

The health care system in Barbados is similar to that of Singapore, where health care is universally delivered. The reduction in ACSH rates observed in Singapore may be similar to rates in Barbados, particularly for children. This may be the case because there have been substantial reductions in infant mortality in Barbados, while life expectancy has increased. Life expectancy at birth in Barbados increased from age 71 in 1995 to age 77.8 in 2008 (74.3 for males and 79.3 for females) (PAHO. Health Analysis and Statistics Unit, 2007). There was also a marked decrease in mortality rates from for children under age 5 from 1995 (19 per 1,000 births) to 2008 (12 per 1,000 births) (PAHO. Health Analysis and Statistics Unit, 2007). These improvements in mortality indicators suggest improvement in the quality of care, possibly due to the decentralization of the health care system in the late 1960s and early 1970s and increased funding for national health care in Barbados. In addition, several policy initiatives have been implemented by the Barbados' Ministry of Health, aimed at reducing the prevalence of chronic diseases.

Comparative data on ACSH

The definition and grouping of developed nations and developing nations vary in the literature. Generally, the United Nations and the Organization for Economic Cooperation and Development (OECD) identifies Japan, Canada, the United States, Australia, New Zealand, and many countries in Europe (including Spain) as developed

nations. These countries are characterized based on their high per capita income and the high standard of living enjoyed by their residents (The World Bank Group, 2004). This classification excludes the high income developing countries of Hong Kong, Israel, Kuwait, Singapore, and the United Arab Emirates; these countries are considered transition or emerging countries because of their per capita income or the structure of their economies (The World Bank Group, 2004). According to The World Bank (2004), developing countries are classified as those countries with middle to low GNPs per capita along with the five high income economy countries listed as transition or emerging countries.

The five countries described above as emerging countries – Hong Kong, Israel, Kuwait, Singapore, and the United Arab Emirates – are considered developing nations, and hence will be identified as developing for the purpose of this study. This definition, used by The World Bank for developed and developing nations, classifies countries based on gross national product (GNP). A search of the literature revealed that peer reviewed articles and aggregate data on ACSH rates for the pediatric population are available for the U.S., Australia, and Spain, allowing for comparisons of ACSH rates among these developed countries. In addition, comparative data is also available for Singapore and Taiwan.

A study on hospitalizations for ambulatory care sensitive conditions among children in Spain has reported that universal access to health care is associated with lower ACSH rates, compared to children in countries such as the U.S (Casanova & Starfield, 1995).

There are few cross national comparisons of ACSH rates in the literature for

pediatric populations. The ACSH indicators used in most previous studies were defined using modified versions of the indicator established by Billings et al. (Billings, et al., 1993; Casanova, et al., 1996; Garg, et al., 2003; Niti & Ng, 2003), which had been defined for use primarily with adult populations. Though the conditions in the present study of ACSH rates for Barbados are not identical to those studied in each of these countries, a cross national comparison can provide useful baseline data to policy makers in Barbados. Results of a comparison across countries can assist health planners in policy development aimed at improving the delivery of primary health care and reducing the burden of bed usage for ambulatory care sensitive conditions in this population.

Research Objectives

This study examines differences in ACSH rates for children in Barbados, separately for girls and boys as well as combined. Differences across each of the eleven parishes in Barbados over a six year period (2003-2008) are also examined. The rates obtained are compared to published rates for a number of developed and developing countries.

The unique history and culture of Barbados, and lack of previous empirical work for this country using this measure of health care access, does not support hypothesis testing. This study addresses the following research questions, which are informed by previous research on the accessibility and use of primary health care, as well as research on ACSH.

Research Questions

1. What are the differences in ACSH rates for girls and boys in Barbados for the population ages 0-19 during 2003-2008? Previous studies on ACSH in pediatric

populations have suggested differences in hospitalization rates for ambulatory care sensitive conditions for girls and boys (Casanova, et al., 1996; Garg, et al., 2003; Shi, et al., 1999). Research has also suggested gender differences in the use of health services in the pediatric population (Klein, et al., 1999; Marcell, Klein, Fischer, Allan, & Kokotailo, 2002).

2. What are the ACSH rates for the population 0-19 years for each individual ambulatory care sensitive diagnosis during 2003-2008 in Barbados? Prior research has suggested differences in hospitalization rates for individual ACSH depending on geographic locations and the environment among children (Casey, 2007; Garg, et al., 2003; Shapiro & Stout, 2002). Research has also suggested differences in rates of hospitalizations for conditions such as asthma and diabetes based on quality of care (Homer, et al., 1996; Niti & Ng, 2003; Shapiro & Stout, 2002).

3. How do the ACSH rates vary over the period 2003-2008 for the population of Barbados ages 0 to 19? Overall increases in ACSH rates for all ages have been observed in the U.S. during 1980 to 1998 (Kozak, et al., 2001b). Another study has reported declining rates of ACSH for children younger than 15 years in Singapore, a country with universal health care (Niti & Ng, 2003). The health care system in Barbados is universally available. There has been a substantial reduction in infant mortality rates over the past century, and increased life expectancy (Pan American Health Organization, 2008; Walrond, 2001). These changes in the population profile, suggesting improved health, may point to decreases in ACSH rates in Barbados.

4. How do ACSH rates for the population ages 0-19 in Barbados compare to published ACSH rates for pediatric populations in developed and developing countries?

ACSH rates reported in the literature vary across countries from developed to developing nations. Comparisons of ACSH rates for Barbados to those of other countries can provide useful baseline data to policy makers in Barbados. Results of this comparison can assist health planners to develop policies aimed at improving the delivery of primary health care in Barbados.

Study Design and Methods

In this study, data on admissions through the emergency department (ED) to the Queen Elizabeth Hospital (QEH) between 2003 and 2008 were used. This data were obtained from ED records at the QEH for the specified years. ED records were used for the study because in Barbados there is no electronic database containing discharges of admitted patients from the QEH. However, other than admissions for routine outpatient and inpatient surgeries, or admissions for psychiatric patients, most hospitalizations at the QEH begin with ED visits at the QEH. In addition, ED data can provide key information on ACSH, and ACSHs often begin with ED visits (Oster & Bindman, 2003)and have been used in previous research to assess ACSH rates (Flores, et al., 2003; Oster & Bindman, 2003). Hospitalizations for ambulatory care sensitive conditions were identified using *International Classification of Diseases, Tenth Revision* codes (ICD-10). Rates of ACSH were calculated based on geographic locations specified by the Barbados Statistical Services (BSS) for each parish in Barbados. Hospitalizations for ambulatory care sensitive conditions were identified using *International Classification of Diseases, Tenth Revision* codes (ICD-10), along with the narratives for final Diagnosis included in the ED records.

These narratives of final diagnosis were scanned as part of the SAS coding used

to identify each ambulatory care sensitive condition. When an ACSH was not identified using the principal diagnosis ICD-10-AM code, the final diagnosis allowed for identification of and ACSH occurrence. In cases when and ACSH occurrence was identified and the final diagnosis narrative and ICD-10-AM code did not agree: if the principal diagnosis code identified an ACSH occurrence then this case was counted as an ACSH event as identified by the principal diagnosis. If the principal diagnosis not did not match the final diagnosis and was not an ACSH event then the final diagnosis narrative was kept and the case was coded as an ACSH event.

Cross-sectional and time-series analyses of hospitalizations for ambulatory care sensitive conditions for the period of the study were conducted. Rates of ACSH were calculated based on geographic locations specified by the Barbados Statistical Services (BSS) for each parish in Barbados. Since studies suggest that demographic characteristics differ for rural and urban areas in addition to varying primary care access associated with distance, travel time, and other factors, the risks of ACSH were assessed separately for each area (Eberhardt, et al., 2001; Laditka, Laditka, Bennett, & Probst, 2005).

Demographic data at the parish and population levels were obtained from the 2000 Barbados Census enumeration database, which included projected population estimates for the years studied in this research. The two data sources (ED data from the QEH and Census 2000) were combined and aggregated at the parish and population levels.

Conceptual Framework

A modified version of Andersen and Aday's behavioral model of health services

guided this research. The model was used theoretically to explore factors associated with ACSH (Andersen, 1995). This framework indicates that use of health care services can be predicted or explained by individual characteristics, location, and health system characteristics (Laditka, Laditka, & Probst, 2005; Laditka, et al., 2009). This behavioral model includes three domains: predisposing characteristics, enabling characteristics, and need.

Predisposing characteristics are an indication of an individual's tendency to access primary care, and are usually independent of health needs. Factors such as age, race/ethnicity and gender are associated with a predisposition to use health services and have been associated with trust in providers and institutions, the level of perceived understanding of patients' needs, and efficacy of care (Institute of Medicine, 2003).

Enabling characteristics include factors such as a usual source of care or primary care access, adhering to prescribed regimens, insurance, cost, education, income, and unemployment. Barbados has a high national literacy level, providing a useful control for education: the literacy rate for Barbadians was estimated at 99.7% in 2005 for the those 15+, 99.7% for males and 99.8% for females (PAHO/AIS, 2005).

Need characteristics associated with ACSH risk include an individual's health, stability or severity of illness, and functional status. Characteristics of need directly influence an individual's access to primary care services and thus affect the risk of an ACSH occurrence (Agency for Healthcare Research and Quality (AHRQ), 2008; Laditka, 2004). Comorbidities, often are associated with a greater need for use of health services, have been shown to be associated with a higher risk of ACSH.

Although the theoretical model just described may be useful when adequate

measures are available for all of the characteristics mentioned, only rarely are such measures available (Laditka, 2004). The only measures available for use in analytical model for this research were predisposing characteristics – age, geographic location, and gender – shown in the theoretical model in Appendix C in the ellipse with dashed lines. This limited set of measured variables in the analytical model used for this research is consistent with most research that uses the ACSH indicator. Most of that research has used small area analysis, which focuses on area rates and includes no measures at the level of individuals (Billings, et al., 1993; Bindman, et al., 1995; Laditka & Johnston, 1999; Laditka & Laditka, 1999; Millman, 1993; Parchman & Culler, 1994; Schreiber & Zielinski, 1997 .

Data Sources

The data were extracted from files kept at the Queen Elizabeth Hospital (QEH) for admissions originating from the emergency department (ED) between 2003 and 2008. The variables available in this dataset are outlined in Table 3.2. The data were obtained from ED records obtained from the QEH for the specified years. Records with missing data or inaccurate data for any enumeration area (for example, residence in a personal care home or other institution) were deleted. Records were also removed if the patient was not a resident of Barbados, or if visit or discharge dates were outside the study period. In addition, the data were cleaned of duplicate records or discrepancies in age or other demographic data. There were 78,502 total visits to the ED during the study period. Of these records, 61,886 (23.2%) met these criteria and were excluded from the study dataset.

Demographic data were obtained from the 2000 Barbadian Census, adjusted for

parish boundaries. The two data sources will be combined and aggregated at the parish level. This will provide hospitalization rates at the parish and national level.

Diagnoses indicating ACSH were identified using definitions for ambulatory care sensitive conditions established by the Agency for Healthcare and Quality (Agency for Healthcare Research and Quality (AHRQ), 2006). The AHRQ definitions use the *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM) codes. We mapped those codes to the *International Classification of Diseases, Tenth Revision* (ICD-10-CM). These ICD-10-CM codes, which were used to indentify each ACSH diagnosis, are shown in Table 3.3.

Study Population

The population studied consist of persons ages 19 years and under in the eleven parishes of Barbados (*n*=74,041). The analysis included all completed data on an individual visit that was available from the QEH ED data files as well as the Census enumeration data. All patients age 19 years and under who presented to the QEH from January 1, 2003 to December 31, 2008, and who were admitted to the hospital were included in the hospital database. Records for patients who were not residents were identified by a value of zero in the identifier field and removed from the dataset. Of the ED dataset, 78,502 cases were 19 years and younger; of those, 27% (n=21,326) had missing values for identifiers and parish of residence and therefore were excluded from the dataset. Thus, the data set included 57,176 cases that met the inclusion criteria for visits to the ED and were legal residents of Barbados. The sample was further restricted to include only patients who were admitted to the hospital (5975).

Census tract data from year 2000 were extrapolated using mid-year population

estimates obtained from Barbados Statistical Services (BSS) for the years 2003-2008, to calculate population estimates for each parish within each year for the study period. The procedure is discussed in more detail later in this chapter.

Outcome Measures

The outcome of interest was hospitalization for an ambulatory care sensitive condition. The definitions for the outcome measures were the area level Pediatric Quality Indicators (PDIs) developed by AHRQ for the pediatric population less than 18 years in the US.

The PDIs were defined through technical review by a group from the University of California, San Francisco–Stanford University Evidence-Based Practice Center (AHRQ 2006). PDIs were defined as: asthma, gastroenteritis, perforated appendix, short-term diabetes complications, and urinary tract infections (Table 3.3). Analysis was conducted at the hospital, population, and parish level. At the hospital level ACSH were identified as a proportion of all admissions in the pediatric populations. Although not an indicator of the accessibility of primary health care at the population level, this proportion provides a useful context for understanding ACSH in Barbados, and provides useful knowledge for policy makers and health care planners. Census estimates were used for the years under review, to identify the total population of children in each year. At the national level, Census estimates were again used as the denominator for the period under review.

The denominator used in the definition of the rate for perforated appendix differed from that specified by the AHRQ's PDI in that the population considered to be at risk in this research was the entire population. AHRQ used the admitted population with a

diagnosis of appendicitis as its denominator. In addition, AHRQ's PDIs definition removes the population 0-2 for pediatric asthma and for short-term diabetes complications, 0-4 months for pediatric gastroenteritis, and 0-4 months for urinary tract infection (Agency for Healthcare Research and Quality (AHRQ), 2008). In addition, the Census data did not permit for the estimation of ACSH rates for each individual condition for age groups younger than age 5 as is specified AHRQ's PDI definition. This is because census data obtained from BSS was aggregate data, and already subcategorized into age groups. All residents younger than 5 years were grouped into one category in the population. Categories used in 2000 census were: 5-9 years,10-14 years and 15-19 years. Thus, the rates were estimated for ages 0-19 years.

Patient Characteristics

Patient characteristics included age, sex and parish of residence. All variables were coded as dichotomous. The referent group in the case of place of residence was the parish of St. Michael, which was the parish with the largest population. All admissions were coded "1" if the principal diagnosis or final diagnosis narrative indicated an ambulatory care sensitive condition, for all conditions except gastroenteritis. For gastroenteritis, in addition to a principal diagnosis for gastroenteritis, the hospitalization was considered to be an ACSHS if a secondary diagnosis of gastroenteritis in addition to a principal diagnosis of dehydration occurred; this definition is consistent with that used to define the PQIs. ACSH was coded as"0" if no ambulatory care sensitive condition was present, as described.

Population Estimates

Population estimates for individual parishes were required for the denominators

used in this research. However, they were not available from the Barbadian Census or from other sources. Population estimates for each parish for each year were calculated in the following manner:

f. We obtained unpublished midyear estimates for the entire Barbados population, for each year from 2003 through 2008, from the Barbadian Statistical Services, which conducts the Barbadian Census.

g. We examined the 1980, 1990, and 2000 Barbadian Census to identify the proportions of girls and boys in each parish. These proportions did not meaningfully change among these decennial Census measures. Also, the proportions of girls and boys measured by the decennial Census did not vary meaningfully among parishes; thus, it was reasonable to apply these proportions to estimate populations of girls and boys in each parish for the years under study.

h. We obtained unpublished population sizes from the decennial Census for girls and boys 0-19 years for each parish from the Barbadian Statistical Services (BSS).

i. We calculated the population sizes for girls and boys in each age category in each parish for each year using the mid-year population estimates for each parish. The BSS data did not provide specific estimates by age category or parish. To calculate those estimates, we applied the corresponding national proportions obtained from the decennial Census. This procedure was reasonable, given that the national proportions do not change meaningfully among the measured decennial Census data from 1980, 1990, and 2000.

j. When analyzing ACSH rates for the entire study period, 2003-2008, we used the average of the calculated six year estimates.

Statistical Analysis

Cross-sectional and time series analyses of hospitalizations for ACSHs were performed for the period 2003-2008. Rates of ACSHs were calculated at the parish level, with denominators obtained from the Barbados Statistical Services.

Sex specific crude hospitalization rates were obtained as the ratio of the number of hospitalizations per 1000 population. Poisson analysis estimated relative rates and provided 95% confidence intervals (and p-values), enabling comparisons of differences in hospitalization rates between women and men, across years, and across parishes. Because the rates derive from counts, Poisson analysis is appropriate for these data. The alpha level for identifying statistically significant results was set at $p<0.05$ level.

Data were analyzed separately for girls and boys ages 0-19 years. This grouping was used in part because the 2000 Census Data are limited in the categories available. In addition, the numbers within the age group 0-19 in the hospital data set were too small to support sub-group analyses across parish, year, and gender. The data were analyzed separately for girls and boys because they typically have been affected by different degrees of illness severity, and thus have varying propensities to use health services.

This study was approved by the Ethics Committee at QEH and the Institutional Review Board of the University of North Carolina at Charlotte. All analyses were performed using SAS 9.2 (Cary, NC).

Description of Parishes

Table 3.1 provides information on the characteristics of the eleven parishes in Barbados. The population within each age group is evenly distributed across parishes, showing that generally there is no parish with a disproportionately higher or lower

percentage of one age group. Generally across each parish the highest proportion of the 0-19 population is in the under 15 age group. The most densely populated parish is St. Michael, where the capital of Bridgetown is located. This parish is also the most urban of the eleven parishes. Christ Church, St James, St. George, St. Philip, and St. Thomas, respectively, are the most densely populated parishes following St. Michael. The number of physicians per 10,000 varies substantially, ranging from no physicians in St. Andrew, St., Lucy, and St. Thomas, to 21.5 per 10,000 in St. Michael.

Variables and ICD 10 Codes

Table 3.2 shows the variables obtained from the Emergency Department database; several of these variables were used in the analysis. This database contains two ICD-10 diagnosis codes and one narrative of the final diagnosis, as well as a pseudo identifier, sex, age, age type parish, arrival date, a pseudo identifier for the attending physician, year of visit, presenting complaint and whether any labs or X-rays were performed in the ED.

Table 3.3 shows the ICD 10 CM codes for all pediatric ambulatory conditions, used in this study, which were obtained by using the specified ICD-9-CM codes for the PDI's defined by AHRQ's Quality Indicators Technical Specifications Version 4, which were then mapped to the ICD-10-CM codes shown in the table. Diagnoses in the Barbados QEH are recorded using ICD-10-CM codes.

Results

Results for Patient Characteristics

Tables 3.4a and 3.4b report the frequencies for all children 0-19 in Barbados as well as the separate frequencies for girls and boys. Of all those 0-19 (5975) who were admitted to the hospital (n=5975) there were more instances of ACSH for boys (842) than

for girls (504). St. John had the highest percent of hospitalizations that were for ACSH, at 25.28% of all admissions. This was reflected in the population of boys with St. John showing the highest proportion of hospitalizations that were ACSH, 34.38%. St. Peter had the lowest proportion of hospitalizations that were ACSH, 14.55%. There was considerable ACSH variation among the populations of girls: St. Lucy had the highest proportion of hospitalizations that were ACSH, 24.59%; St. Peter showed the lowest, 9.88%. During the study period, the highest proportion of hospitalizations that were ACSH was for 2008: for all children, 26.89%, as well for the girls (21.58%) and boys (30.86%). when examined separately as a percent of hospitalizations for each year. The lowest percentage of ACSH admissions was in 2005; this result was true for girls (14.08%) and boys (15.64%).

Table 3.4b shows the percentage of all ACSHs that is accounted for by each of the individual ambulatory care sensitive conditions. Asthma accounted for the highest proportion of hospitalizations that were ACSH in the pediatric population, 65.53% of all ACSHs, followed by gastroenteritis (16.64%) and perforated appendix (11.81%).

ACSH Risk across Years

Table 3.5 reports population-based rates of hospitalization for the 0-19 population, as well as separately for boys and girls during the study period 2003-2008. The table shows population ACSH rates, relative rates (RRs) comparing each year's rate to that for 2003, 95% confidence intervals (CIs) for the relative rates, and p-values for each result. Overall, in results without regard to gender, the highest rate of hospitalization for ambulatory care sensitive conditions was in 2008, at 4.61 per 1000, where the relative rate compared to 2003 was 1.96 (CI 1.63-2.35). Overall rates were

significantly greater than those of 2003 in all years from 2005 through 2008. Among girls, the ACSH rate in 2008 was 67% higher than that of 2003 (RR 1.67, CI 1254-2.24). Among boys, the ACSH rate was substantially higher in 2008 than in 2003 (RR 2.15, CI 1.71-2.71), and also higher in 2006 and 2007.

Tables 3.6, 3.7, and 3.8 report population-based rates of ACSH for the total population of children, as well as results separately for girls and boys, for each individual ambulatory care sensitive condition. Table 3.6 shows that asthma had the highest rate of hospitalizations in 2008, at 3.59 per 1000 population. This rate of hospitalization was 102% higher than the corresponding rate in 2003 (RR 2.02, CI 1.64-2.49). Compared with 2003, the rates of hospitalization for perforated appendix were substantially higher in 2006 (RR 2.75, CI 1.46-5.19) and 2007 (RR 2.97, CI 1.59-5.57). In results specifically for girls (Table 3.7), again compared with 2003, the rates of hospitalization for asthma were higher in 2008 (RR 1.67, CI 1.18-2.36), although substantially lower in 2005 (RR 0.43, CI 0.26-0.71). Girls also had significantly higher rates of hospitalization compared with 2003 for gastroenteritis in 2006 (RR 2.87, CI 1.35-6.13) and in 2007 RR (2.43, CI 1.12-5.27). The risk of hospitalization for perforated appendix was also significantly higher in all years compared with 2003, excepting 2008.

Table 3.8 shows the analogous results for boys. The risk of hospitalization for asthma and gastroenteritis showed considerable variability across years. The highest rate for asthma was in 2008, 4.88 per 1000 boys, with a relative rate compared to 2003 of 2.23 (CI 1.72-2.90). There were no statistically significant differences among years for diabetes, perforated appendix, or urinary tract infections.

Results for ACSH Risk across Parishes

Tables 3.9, 3.10, and 3.11 show the risk of hospitalization for the 0-19 population, as well as separately for girls and boys, across the eleven parishes in Barbados for each year, and also for the entire study period. Generally for the population, as well as when taken separately for girls and boys, the risk of hospitalization varied significantly across parishes, and was substantially lower for most parishes when compared to St. Michael. Saint Peter, the parish with the lowest ACSH rate, had only about one-third the rate of St. Michael (RR 0.33, CI 0.22-0.50). Generally ACSH rates were higher for boys than for girls across the parishes for the study period (Tables 3.10 and 3.11).

The results for each individual ambulatory care sensitive condition analyzed by parish for study period are shown in Tables 3.12. Tables 3.13 and 3.14 show analogous results for girls and boys, respectively. Generally asthma had the highest absolute rates of hospitalization, both overall and for girls and boys when analyzed separately. There was considerable variation in the ACSH rates for asthma across parishes, ranging from 5.17 per 1000 population in St. Peter (RR 033, CI 0.20-0.55) to 15.47 per 1000 in St. Michael. The parishes of Christ Church, St. James and St. Peter showed significantly lower rates of hospitalizations for asthma when compared to St. Michael for both girls and boys.

Comparison of ACSH Rates for Developed and Developing Countries

Table 3.15 shows pediatric hospitalization rates of ambulatory care sensitive conditions for Taiwan, Australia, and Singapore during the years 2001 to 2009 for various age groups, depending on the country. There was no general annual trend observed for the population eighteen years and younger in Taiwan. There was also no general annual trend for the population ages 0-19 in Victoria, Australia. Though it is not

shown in Table 3.15, there was a reported decline in ACSH rates in the populations younger than fifteen and 15-24 in Singapore between 1991-1998 (Niti & Ng, 2003). A comparison of the overall ACSH rates for Barbados, i.e., the rates for the combined indicator that includes all of the conditions (Table 3.5), with those of other countries shown in Table 3.15, suggests that the rates for Barbados are substantially lower than those in Taiwan, Victoria Australia, and especially Singapore.

Tables 3.16 and 3.17 show the hospitalization rates for each individual ambulatory care sensitive condition for girls and boys in Victoria, and the pediatric population in the U.S. Generally, for boys in Victoria, the top five ambulatory care sensitive conditions were asthma, dental conditions, ear nose and throat, convulsions and epilepsy, and cellulitis across the years 2003-2009. The top five hospitalizations for girls were for dental conditions, asthma, ear nose and throat, pyelonephritis, convulsions and epilepsy and complications for diabetes during the period 2003-2009. In the U.S the top hospitalization rates were for asthma and gastroenteritis across the years. A comparison of these rates in Table 3.16 and 3.17 to the overall and gender specific rates for Barbados (Tables 3.6, 3.7 and 3.8), shows that asthma is one of the conditions with the highest reported hospital rates in Vitoria, Australia (Table 3.15) and the U.S (Table 3.16). Except for males in 2008, the rates for asthma were almost twice as high in Victoria compared to Barbados (Table 3.8). Dental conditions, ENT, cellulites, convulsions and epilepsy were among the top five hospitalizations. These latter conditions were not included in AHRQ PDI definition and hence were not evaluated in the Barbados pediatric population. Asthma rates in the U.S (Table 3.16) were comparable to those in Barbados (Table 3.6); however gastroenteritis, UTIs and diabetes were higher than the individual

rates for these conditions in Barbados. Diabetes rates were almost twice as high as those in Barbados.

Discussion

Admissions to the hospital for ambulatory care sensitive conditions among adults and older adults have been studied extensively in countries such as Australia, the United States, Spain, Taiwan, and Canada. However, relatively few studies have focused on ASCH among younger populations. This study examined ACSH rates among residents in Barbados ages 0-19 during 2003-2008, comparing ACSH rates by gender, parishes, and years. In addition, results from the 0-19 population in Barbados were compared to published ACSH rates for Australia, Singapore, Taiwan and the United States to provide useful baseline data to policy makers in Barbados.

This study investigated four research questions. The first research question examined differences in ACSH rates for girls and boys for the years 2003-2008. The results suggest that ACSH rates were higher for boys than for girls. This finding is consistent with prior research that suggested health service use and admissions are often higher among boys than girls (Garg, et al., 2003; Shi & Lu, 2000; Starfield, et al., 1985).

The second question examined ACSH rates individually for five ambulatory care sensitive conditions. Few studies of children have reported condition specific rates, which can be useful for identifying high volume conditions that may provide opportunities to effectively manage costs to the public health care system. In most studies where condition specific rates have been reported for pediatric populations, asthma rates have either been the highest, or higher than all other conditions except for bacterial pneumonia, dental conditions, and gastroenteritis (Casey, 2007; Falik,

Needleman, Wells, & Korb, 2001; Flores, et al., 2003; Shi, et al., 1999). The variation observed among condition-specific rates in this study supports the usefulness of analyzing ACSH rates by condition for pediatric populations (Casey, 2007). The usefulness of this research is underscored by the relatively high admission rates observed for asthma, gastroenteritis, and perforated appendix across the eleven parishes of Barbados. These relatively high rates suggest opportunities for interventions to reduce such hospitalizations, which might help to control costs to Barbados' public health care system.

The third research question investigated how ACSH rates varied over the six year study period. Results showed significant differences in ACSH rates for most years when compared to 2003, in both the overall population and in separate analyses for girls and boys. Although there was no clear trend or gradient of consistently increasing rates across the study years, we did find evidence of generally higher rates in the later years. For several of the later study years, the ACSH rates were two or more times the comparable rates for 2003. This result suggests that there may be opportunities to improve access to primary care services.

Findings of studies of trends in ACSH rates for pediatric populations in other countries are mixed. Studies were conducted in time periods that differ from the present research. ACSH rates in Singapore declined from 1991 to 1998 for the populations younger than 15 years (Niti & Ng, 2003); there were also reported decreases in ACSH rates in Canada during 2000-2007 (Sanchez, et al., 2008) and in the state of South Carolina in the U.S during 1997-1998 (Garg, et al., 2003). The study in South Carolina was limited to one year; thus, trends in ACSH were not investigated; the authors

suggested further analysis was need for the following years to substantiate declining rates (Garg, et al., 2003). However, a study of national trends in preventable hospitalization during 1980-1998 reported decreasing ACSH rates among the population 0 to 14 years in the U.S (Kozak, Hall, & Owings, 2001a). When the combined overall ACSH rates for Barbados are compared to the rates Taiwan, Victoria Australia and Singapore, the rates for Barbados are substantially lower than those all three countries, especially Singapore. However, the definitions of the indicators used in each of the countries reported here varied across countries. For example in Singapore the ACSH indicator used here included hospitalizations for the chronic diseases asthma, congestive heart failure, chronic obstructive pulmonary disease, diabetes, and hypertension (Niti & Ng, 2003).

Disease prevalence, variability in physician supply, and practice patterns, as well as propensity to seek care may play a part in the ACSH rates obtained in this study (Billings, et al., 1993; Laditka, Laditka, & Probst, 2005; Schreiber & Zielinski, 1997b). In some cases ASCH rates were low in parishes with high physician to population ratios: Christ Church (14.82 per 1000), St. James (13.94 per 1000) and St. Peter (7.75 per 1000). The physician to population ratios for these parishes was Christ Church (5.7 per 10,000), St. James (6.2 per 10,000) and St. Peter (4.4 per 10,000). Other than St. Michael (rate-23.52 per 1000), the parishes of St. John (20.98 per 1,000), St. George (18.10 per 1,000), St. Philip (16.88 per 1000), and St. Andrew (16.65 per 1,000) had some of the highest ACSH rates. The physician to population ratios for these parishes ranged from 0 in St. Andrew to 2.8 in St. Philip. In addition, the parishes of Christ Church, St. James and St. Peter showed significantly lower rates of hospitalizations for asthma when compared to St. Michael for both girls and boys. Physician to population ratios in these parishes

suggest that residents in Christ Church, St. James and St. Peter may have better access to primary care. Though it was not one of the objectives of this study to examine effects of physician supply, the negative relationship between physician supply and ACSH risk has been found in some studies (Laditka, Laditka, & Probst, 2005).

In the period from approximately 1995 to 2009 Barbados sought to enhance quality of care (Pan American Health Organization, 2008). Several policy initiatives were implemented by the Barbados' Ministry of Health, aimed at reducing the prevalence of chronic diseases (Pan American Health Organization, 2008; Project Design and Implementation Unit, 2003). The initiatives included a meeting of stakeholders in 2002 to develop the Barbados Strategic Plan for Health to formulate health policies. One of these policies was geared towards chronic disease management. This team of stakeholders developed a specific policy to reduce the national obesity levels in adolescents by 30% by the year 2012 (Project Design and Implementation Unit, 2003). The National Task Force on Chronic non-communicable diseases (CNDC) was also established between 2002-2004 to develop policies for the prevention and maintenance of chronic diseases including: the development of a Health Promotion Unit, a post of Senior Medical Officer of Health (CNCDs) and to establish the National Commission on CNDC- this was established in 2007(Cumberbatch, 2007). Our expectation was that decentralization of the health care system, which occurred in 1969, would contribute to better quality and accessibility of care. Given these changes at the policy level, we expected that ACSH rates in Barbados's younger population would have declined over the period of this study. However, the results from this study suggest otherwise.

There were significantly higher rates of admissions for asthma in St. Michael for boys and girls combined, compared to all other parishes. The high rates of ACSH in St. Michael, which is the most urban parish in Barbados, may reflect use of the ED as a substitute for primary care offices for populations in this parish. In addition, asthma rates in Barbados have been reported to be one of the highest in the world (Prospero, et al., 2008), with emergency room visits for asthma increasing from 1,886 in to 10,903 annually from 1973 to 1996 (Howitt, 1998).

Urbanicity in Barbados has increased, as with many developing countries; Barbados is now reported to have 53% urbanization (World Health Organisation, 2009). Increased rates of asthma have been reported to be directly related to modernization and increased urbanization (Bousquet, Bousquet, Godard, & Daures, 2005; Bousquet, Ndiaye, Aït-Khaled, Annesi-Maesano, & Vignola, 2003; Howitt, 1998; World Health Organisation(WHO), 2009). The increases in the prevalence of asthma, and ASCH rates due to asthma, may be associated with the increasing urbanization in Barbados and changes to more modern lifestyles including changes in diet, housing and the environment (Bousquet, et al., 2003; Howitt, 1998). These factors have been widely associated with increased asthma risk (Von Hertzen & Haahtela, 2004)

Several limitations of this analysis are acknowledged. This study was limited by a lack of information about primary care use, such as usual source of care. Previous research on ACSH has not found this information to be a significant predictor of avoidable illnesses resulting in hospitalizations. In addition, area and individual characteristics such as disease prevalence and income are not available for Barbados. The ACSH indicator is susceptible to several biases, including propensity to seek care,

cultural beliefs, prevalence of diseases, prevalence of smoking and obesity, socioeconomic status and education. Thus, it would be useful to include risk-adjustments in small area analyses such as this, although in the present study the limited number of parishes did not provide adequate statistical power to support multivariate analyses. This study also did not analyze ACSH rates for race or ethnicity. Race and ethnicity was not included in the analysis due to the ethnic makeup of Barbados, which is 90% black, 4% white, and 6% Asian Indian or mixed race. Given the small absolute number of minorities in Barbados, differences in rates among ethnic groups could not be tested. This study includes data from the largest acute care public hospital, and excludes data from the privately owned Bayview Hospital. Hospitalizations to this private hospital are generally for planned surgical and obstetric services and account for approximately 4% of the acute care bed capacity in Barbados.

ACSH has long been used internationally as an index to evaluate timely access to primary health care of reasonable quality. Although relatively few studies have used this indicator with pediatric populations (Casanova, et al., 1996; Casanova & Starfield, 1995), the conditions defining the pediatric indicator are well-established. Beginning with the set of conditions developed in the seminal article by Billings et al (Billings, et al., 1993), several modifications have been used when assessing the state of the health care system cross nationally. This study used the more conservative ACSH definition developed in 2006 by AHRQ (Agency for Healthcare Research and Quality (AHRQ), 2006) specifically for the populations 17 years and younger within the U.S. Further research is needed to assess the use of this set of conditions within the pediatric population in Barbados. In addition, though the definition for the ACSH indicator should be specific to

each country it also needs to be sensitive to the age of the population being studied. Some studies that assessed access to primary care using the ACSH indicator did not use an indicator which was defined for the pediatric population. Thus, ACSH rates in some studies conducted in other countries may be over estimated. Thus, caution is suggested in cross national comparisons.

This study used secondary data from the ED. Limitations related to the validity of the principal diagnosis at admission and the completeness of variables including home address may have affected the results. The dataset used included all visits to the ED, including walk-ins and referrals. Voluntary admissions for scheduled procedures were excluded based on results from previous studies, which suggest that most ACSHs are admissions that originate in the ED. Since procedure codes are not collected in the hospital ED data, procedure codes were not used to identify ambulatory care sensitive conditions as part of the coding definitions. Thus, ACSHs were defined based on the principal diagnosis code at admission. As a result, any procedures performed during hospitalization were not captured in the ACSH rates; this could have resulted in a modest over-estimation in the ACSH rates, because a few procedures are included in the AHRQ ACSH definition as exclusion criteria. This possibility is limited by the fact that we also examined all discharge narratives, which included physician notes about procedures that were performed during the hospitalization.

The measure for physician supply in this study included all physicians in each parish and not just primary care physicians in that area. Thus, specialists are also included in the physician to population ratio, and may account for some of the high ratios

recorded for St. Michael, which is the most urban area and where the acute care facilities are located. Many specialist facilities are also located in this parish.

Despite these considerations, this is the first study to use the ACSH indicator to examine access to primary care in Barbados. This research provides new information about the health status of the younger population, and provides a foundation for future ACSH research in Barbados. By examining variation in ACSH by location (parish), the present study identified specific areas where delivery of health care in Barbados might be improved. In addition, the data came from a large national hospital database. Barbados has a uniqueness not seen in studies with larger populations in that the QEH is a large acute care hospital serving the entire population, where most emergent admissions to the hospital for conditions such as those represented in the PDIs will occur. In addition, the dataset include narratives of final diagnosis, which allowed for checks against the ICD-10-CM codes recorded for principal and secondary diagnoses.

Implications for Policy and Research

Considerable variation was found across the eleven parishes of Barbados. It would be useful to address the reasons for these variations, to promote improvement in the delivery of health care to all residents in Barbados. The findings of this study suggest possible access problems to appropriate care for younger residents in some parishes, especially St. Michael, St. George and St. John. These results may indicate the usefulness of a policy intervention to enhance access to primary health care for children living in these parishes.

In addition, the high admission rates for ambulatory care sensitive conditions as a percent of total admissions for the pediatric population in some parishes may also suggest

the need to address preventative and maintenance strategies at the primary care level. Efforts focused on prevention specifically in the case of asthma and gastroenteritis can result in reductions in these hospitalizations and associated allocation of beds and costs. Hospitalizations for ambulatory care sensitive conditions varied from 7.75 per 1000 population in St. Peter to 23.52 per 1000 in St. Michael. Children living in St. Michael appear to have the greatest risk of hospitalization for an ambulatory care sensitive condition, including hospitalization for asthma. Enhancing care coordination programs aimed at chronic diseases such as diabetes and asthma may help to reduce ACSH rates among children. Further, readmissions for some of chronic conditions, due to poor discharge planning or care coordination after discharge, can exacerbate these ACSH rates. Thus, a comprehensive plan to reduce ACSH should include focused efforts to limit readmissions, particularly for those with ambulatory care sensitive conditions, where the possibility of successful intervention is considerable.

The findings of the present study also underscore the importance of promoting population health, and may suggest the need to increase health education, particularly in the area of management of chronic diseases such as asthma. Education about ways to reduce events that may trigger asthma attacks could reduce the ACSH rate among children (Flores, et al., 2003). This study provides relevant foundation for future studies of ACSH in Barbados, and suggests the need for future research in this area. There are significant differences in rates for ACSH across the parishes in Barbados. Although ACSH theory suggest broadly that this result indicates problems in the accessibility or quality of care in the parishes with high ACSH rates, it would now be useful if researchers would examine the more specific factors that contribute to this variation. Of

particular interest would be to investigate the reason for the difference in hospitalization rates observed in the parish of St. Joseph which generally had low ACSH rates though it is a parish which is quite rural with a low physician to population ratio. It would be useful for future studies to assess readmissions for the conditions examined in this study, and the possible risk factors associated with an incident of hospitalization for an ambulatory care sensitive condition.

Table 3.1: Descriptive Demographics for Clinics and Population within each Parish in Barbados and Population and Area Mass for Parishes in Barbados

Parish Code	Parish	Physicians /10000	% Population Under 15 Yrs	% Population Age 15-19 Yrs	Population /Area(mi.^{2})
A	St. Andrew	0	21	7.4	400.9
E	St. Peter	4.4	19.9	6.8	877.3
G	St. George	2.1	20.7	6.9	1120.5
J	St. John	1.1	20.9	6.9	726.8
L	St. Lucy	0	19.8	6.8	713.6
O	St. Joseph	1.4	20.3	7.6	724.4
P	St. Philip	2.8	20.6	6.9	1068.1
S	St. James	6.2	19.5	6.9	2022.5
T	St. Thomas	0	22.1	7.1	1020
X	Christ Church	5.7	19.5	6.6	2405.5
M	St. Michael	21.5	20.5	7.1	6068.3

Source: Barbados Postal Services; Barbados Ministry of Health, Barbados Census 200

Table 3.2: Data elements obtained from Accident and Emergency database at QEH in Barbados

Variable	Definition
Identifier	Pseudo Identifier
Sex	Male or female
Age	Age in numbers from 0 +
Age Type	Type of entry for Age in years or months
Parish	Abbreviations for 11 parishes as in Table 2
Arrival Date	Date patient arrived at hospital
Doctor	Pseudo Identifier for doctor
Year	Year of visit to hospital
Presenting Complaint	Narrative complaint on presentation at ER from patient on arrival
LAB	Whether patient received blood test
XRAY	Whether patient received x-ray or other
Final Diagnosis	Narrative of final diagnosis by Attending
Anatcode2	ICD-10 code for secondary diagnosis
Anatcode3	ICD-10 code for primary diagnosis
Admitted	Whether patient was admitted or not

Source: Accident and Emergency database, QEH Barbados.

Table 3.3: Ambulatory Care Sensitive Conditions and ICD-10 CM codes used in the analyses		
Category	ICD 10CM Codes	
Short term Diabetes Complications	E10.0, E10.1, E10.2, E10.3, E10.4, E10.5, E10.6, E10.7, E10.8, E10.9, E11.0, E11.1, E11.2, E11.3, E11.4, E11.5, E11.6, E11.7, E11.8, E11.9, E12.0, E12.1, E12.2, E12.3, E12.4, E12.5, E12.6, E12.7, E12.8, E12.9, E13.0, E13.1, E13.2, E13.3, E13.4, E13.5, E13.6, E13.7, E13.8, E13.9, E14.0, E14.1, E14.2, E14.3, E14.4, E14.5, E14.6, E14.7	Final Diagnosis Narrative Inclusions: DIABE, 'KETOA
Asthma	J44.1, J44.9, J45.20, J45.22, J45.21, J45, J45.0, J45.1, J45.8, J45.9, J45.990, J45.991, J45.909, J45.998, J45.902, J45.901	Asthma: Exclude: Cystic Fibrosis And Anomalies Of Respiratory System: E849, 'E8411, E840, E8419, E848, Q254, Q313, Q324, Q321, Q311, Q318, Q330, Q333, Q339, Q334, Q331, Q338, Q341, Q348, Q340, Q349, Q394, Q390, Q391, Q392, Q393, Q893, P271, P278, P270 Final Diagnosis Narrative Inclusions “ASTHMA”
Perforated Appendix	K35.0, K35.1, K35.9, K37	Final Diagnosis Narrative Inclusions :ABS'PERF Final Diagnosis Narrative Exclusions :POST' Exclude:Z09.9

(Table 3.3 continued)

Urinary Tract Infections	N10, N15, N15.1, N28.85, N11.9, N16, N15.9, N30.00, N30.01, N30.90, N30.91, N39.0, N28.85	Urinary infection Exclude Immunocompromised state and Kidney/Urinary Tract Disorder: A032, A1782, 'E40, E41, E43, D801, D802, D804, D803, D800, D805, D838, D839, D807, D831, D821, D820, D814, D808,D811, D819, D8189, D810, D812, D849, D8982, D8989, D841, D8989, M359, D899, D71, D720, I120, I120, I129, I120, I1311, I132, I1311, I132, I1311, I132, K912, N185, N186, T8699, T8690, T8691, T8692, T8612, T8611, T8610, T8640, T8641, T8642, T8620, T8621, T8622, T86810, T86811, T86819, T8600, T8602, T86891, T86899, T86890, T86851, T86859, T86850, T86890, T86891, T86899, Z940, Z941, Z942, Z944, Z9481, Z9484, Z9483, Z9482, Z9489, Z992, Z9115, Z4931, Z4901, Z4902 Exclude: Kidney Or Urinary Tract Disorder: N118, N111, N1370, N1371, N13721, N13722, N13729, Q602, Q605, Q619, Q6101, Q613, Q612, Q6119, Q614, Q615, Q615, Q618, Q6239, Q6211, Q6212, Q6231, Q6210, Q6211, Q630, Q631, Q632, Q633, Q638, Q6262, Q6263, Q628, Q625, Q624, Q6261, Q6410, Q6419, Q642, Q6431, Q6432, Q6433, Q6439, Q6479, Q649 Exclude Icd-9-cm diagnosis codes for intermediate risk immunocompromised states: B181, B180, B182, D731, D739, D732, D5702, D57212, D57412, D733, D7389, D734, D735, I8501, I8500, I8511, I8510, K766, K7210, N039, N003, N013, N08, N008, N009, N044, N022, N043, N040, N08, N048, N049, N032, N033, N035, N038, N08, N038, N039, N059, N052, N055, N171, N172, N08, N058, M3210, M349, M341, M340, M3501, M3500, M3390, M3320, M358, M355, M359, Q8901, Q8909, R64, S3600xA, S36029A, S36030A, S36031A, S36032A, S3609x, S3600xA, S31609A, S36021A, S36029A, S36020A, S31609A, S36030A, S31609A, S36031A, S31609A, S36032A, S31609A, S3609xA, S31609A, Z944 * Exclude ICD-9-CM Cirrhosis diagnosis codes - Part I*K7030 "K740 "K743 ',* Exclude ICD-9-CM Hepatic Coma / Hepatorenal Syndrome diagnosis codes - Part II*****;('K7291 "K767 ')

(Table 3.3 continued)

Gastroenteritis Inclusions	A08.2, A08.11, A08.19, A08.31, A08.32, A08.39, A08.39, A0.88, A09, K52.89, K52.9	Gastroenteritis Inclusions for Dehydration :E869, E860, E861 Gastroenteritis Exclusions For Anomalies as secondary Diagnosis Code :K5281, K5281, K3189, K5000, K5010, K5080, K5090, K5180, K5180, K5120, K5130, K5140, K5150, K5100, K5180, K5190, K520, K521, K522, K5281, K5282, K900, K901, K902, K912, K903, K9089, K909, Exclusions for Bacterial Gastroenteritis as secondary Diagnosis Code: A020, A030, A031, A032, A033, A038, A039, A050, A051, A052, A058, A053, A055, A058, A059, A060, A061, A062, A070, A071, A073, A078, A072, A074, A078, A079, A044, A040, A041, A042, A043, A044, A048, A048, A048, A048, A048, A045, A046, A047, A048, A048, A048, A049, B3782 Final Diagnosis Narrative Inclusions: 'Gastro', 'GAST', 'Enteritis',

Source: ICD 9 CM codes obtained from PDI's Technical Specifications mapped to ICD 10 CM codes using CMS Cross walk
AHRQ Pediatric Quality Indicators Technical Specifications Version 4-2009
CMS

Table 3.4a: Characteristics of Pediatric Population Admitted to the Hospital for Ambulatory Care Sensitive Conditions, Barbados, 2003-2008[a]

	All Ages			Girls			Boys		
	ACSH N	Hosp. N	ACSH % of All Hosp.	ACSH N	Hosp. N	ACSH % of All Hosp.	ACSH N	Hosp. N	ACSH % of All Hosp.
Hospitalizations	1346	5975	22.5	504	2644	19.1	842	3331	25.3
Parish									
Saint Andrew	27	123	22.0	13	63	20.6	14	60	23.3
Saint Peter	24	165	14.6	8	81	9.9	16	84	19.1
Saint George	97	458	21.2	45	223	20.2	52	235	22.1
Saint John	56	222	25.2	12	94	12.8	44	128	34.4
Saint Lucy	37	151	24.5	15	61	24.6	22	90	24.4
Saint Joseph	31	130	23.9	8	51	15.7	23	79	29.1
Saint Philip	116	525	22.1	41	205	20.0	75	320	23.4
Saint James	91	415	21.9	30	156	19.2	61	259	23.6
Saint Thomas	57	253	22.5	26	125	20.8	31	128	24.2
Christ Church	208	961	22.5	84	439	19.1	124	522	23.8
Saint Michael	602	2572	23.4	222	1146	19.4	380	1426	26.7
Year									
2003	176	744	23.7	71	336	21.1	105	408	25.7
2004	186	789	23.6	77	370	20.8	109	419	26.0

(Table 3.4a Continued)

2005	116	777	14.9	50	355	14.1	66	422	15.6
2006	272	1187	22.9	96	515	18.6	176	672	26.2
2007	247	1180	20.9	90	512	17.6	157	668	23.5
2008	349	1298	26.9	120	556	21.6	229	742	30.9

[a]Data Source: Queen Elizabeth Hospital, Barbados, 2003-2008, and Barbados Census 2000; ACSH=Ambulatory Cares Sensitive Condition; Hosp.=hospitalizations; n.a.=not applicable; CHF=Congestive Heart Failure; UTI=Urinary Tract Infection; COPD=Chronic Obstructive Pulmonary Disease; PID=Pelvic Inflammatory Disease; ENT=Ear, Nose, and Throat.

Table 3.4b: Characteristics of All Pediatric Population 20 years and under who were admitted to the Hospital tor Ambulatory Care Sensitive Conditions, Barbados, 2003-2008a—Percent is percent of all ACSHs

	All			Men			Women		
	ACSH N	Hosp. N	Diagnosis % of All ACSH	ACSH N	Hosp. N	Diagnosis % of All ACSH	ACSH N	Hosp. N	Diagnosis % of All ACSH
Diagnosis									
Asthma	882	na	65.5	281	na	55.8	601	na	71.4
Gastroenteritis	224	na	16.6	86	na	17.1	138	na	16.4
Appendix	159	na	11.8	88	na	17.5	71	na	8.4
UTI	52	na	3.9	28	na	5.6	24	na	2.9
Diabetes	31	na	2.3	22	na	4.4	9	na	1.1
Gender									
Male	842	na	62.6						
Female	504	na	37.4						

[a]Data Source: Queen Elizabeth Hospital, Barbados, 2003-2008, and Barbados Census 2000; ACSH=Ambulatory Cares Sensitive Condition; Hosp.=hospitalizations; n.a.=not applicable; CHF=Congestive Heart Failure; UTI=Urinary Tract Infection; COPD=Chronic Obstructive Pulmonary Disease; PID=Pelvic Inflammatory Disease; ENT=Ear, Nose, and Throat.

Table 3.5: Rates and Rate Ratios for Pediatric Population under 20 years who were admitted to the Hospital for Ambulatory care Sensitive Conditions across years, Barbados, 2003-2008

	overall					Girls					Boys				
Year	Rate per 1000	RR	LB	UB	P-value	Rate per 1000	RR	LB	UB	P-value	Rate per 1000	RR	LB	UB	P-value
2003	2.35	1.00	1.00	1.00		1.95	1.00				2.7964				
2004	2.48	1.05	0.86	1.29	0.6188	2.11	1.08	0.78	1.49	0.6298	2.8897	1.03	0.79	1.35	0.8104
2005	1.54	0.66	0.52	0.83	0.0004	1.37	0.70	0.49	1.01	0.0548	1.7457	0.62	0.46	0.85	0.0027
2006	3.61	1.54	1.27	1.86	<.0001	2.62	1.34	0.99	1.83	0.0584	4.6482	1.66	1.31	2.12	<.0001
2007	3.27	1.39	1.15	1.69	0.0008	2.45	1.26	0.92	1.72	0.1480	4.1307	1.48	1.15	1.89	0.0020
2008	4.61	1.96	1.63	2.35	<.0001	3.26	1.67	1.25	2.24	0.0006	6.0069	2.15	1.71	2.71	<.0001

[a]Data Source: Queen Elizabeth Hospital, Barbados, 2003-2008, and Barbados Census 2000; RR= Risk Ratio; UB=Upper Boundary of the 95% Confidence Interval; LB=Lower Boundary; p-value is for comparison of the rate for the given year to the rate for 2003.

Table 3.6: Risk of Hospitalizations for Individual Ambulatory Care Sensitive Conditions for All Pediatric Population 20 years and under during 2003-2008

Asthma						Diabetes				
Year	Rate per 1000	RR	LB	UB	P-value	Rate per 1000	RR	LB	UB	P-value
2008	3.59	2.02	1.64	2.49	<.0001	0.07	0.62	0.20	1.89	0.3978
2007	1.59	0.89	0.70	1.14	0.3721	0.12	1.11	0.43	2.89	0.8237
2006	2.15	1.21	0.96	1.52	0.1033	0.03	0.25	0.05	1.17	0.0781
2005	0.90	0.51	0.38	0.68	<.0001	0.07	0.62	0.20	1.90	0.4046
2004	1.69	0.95	0.75	1.21	0.6923	0.03	0.25	0.05	1.17	0.0789
2003	1.78					0.11				

Gastroenteritis						Perforated Appendix				
Year	Rate per 1000		LB	UB	P-value	Rate per 1000	RR	LB	UB	P-value
2008	0.48	1.98	1.12	3.48	0.018	0.33	1.90	0.97	3.71	0.0605
2007	0.94	3.91	2.33	6.55	<.0001	0.52	2.97	1.59	5.57	0.0007
2006	0.78	3.26	1.92	5.52	<.0001	0.48	2.75	1.46	5.19	0.0018
2005	0.20	0.83	0.42	1.64	0.592	0.33	1.91	0.98	3.74	0.0578
2004	0.33	1.38	0.76	2.54	0.292	0.28	1.61	0.81	3.22	0.1768
2003	0.24					0.17				

UTI					
Year	Rate per 1000	RR	LB	UB	P-value
2008	0.15	2.72	0.87	8.53	0.0869
2007	0.11	1.98	0.60	6.58	0.2643

(Table 3.6 Continued)

2006	0.17	3.23	1.05	9.90	0.0404
2005	0.05	0.99	0.25	3.98	0.9942
2004	0.16	2.99	0.96	9.27	0.0577
2003	0.05				

[a]Data Source: Queen Elizabeth Hospital, Barbados, 2003-2008, and Barbados Census 2000; ACSH=Ambulatory Cares Sensitive Condition; UTI= Urinary Tract Infection; RR= Risk Ratio; UB= Upper Boundary; LB=Lower Boundary; p-value is for comparison of the rate for the given year to the rate for 2003

Table 3.7: Risk of Hospitalizations for Individual Ambulatory Care Sensitive Conditions for Pediatric Female Population 20 years and under during 2003-2008

Asthma

Year	Rate per 1000	RR	LB	UB	P-value
2008	2.34	1.67	1.18	2.36	0.0037
2007	0.95	0.68	0.44	1.05	0.0802
2006	1.12	0.80	0.53	1.21	0.2864
2005	0.60	0.43	0.26	0.71	0.0009
2004	1.26	0.90	0.60	1.34	0.6055
2003	1.40				

Diabetes

Year	Rate per 1000	RR	LB	UB	P-value
2008	0.08	0.00	0.00	0.00	<.0001
2007	0.22	0.74	0.17	3.32	0.6971
2006	0.05	1.99	0.60	6.59	0.2629
2005	0.08	0.50	0.09	2.72	0.4199
2004	0.05	0.75	0.17	3.34	0.7026
2003	0.11	0.49907	0.09	2.7248	0.4223

Gastroenteritis

Year	Rate per 1000	RR	LB	UB	P-value
2008	0.41	1.65	0.72	3.77	0.2345
2007	0.60	2.43	1.12	5.27	0.0251
2006	0.71	2.87	1.35	6.13	0.0063
2005	0.19	0.77	0.29	2.08	0.6125
2004	0.19	0.78	0.29	2.08	0.6154
2003	0.25				

Perforated Appendix

Year	Rate per 1000	RR	LB	UB	P-value
2008	0.35	2.58	0.92	7.22	0.0723
2007	0.57	4.17	1.57	11.06	0.0041
2006	0.49	3.58	1.33	9.64	0.0116
2005	0.46	3.39	1.25	9.18	0.0165
2004	0.38	2.79	1.01	7.76	0.0485
2003	0.14				

(Table 3.7 Continued)

	UTI				
Year	Rate per 1000	RR	LB	UB	P-value
2008	0.08	1.49	0.25	8.89	0.6645
2007	0.11	1.99	0.36	10.84	0.4285
2006	0.25	4.48	0.97	20.72	0.0552
2005	0.03	0.50	0.05	5.49	0.5692
2004	0.25	4.49	0.97	20.79	0.0546
2003	0.05				

[a]Data Source: Queen Elizabeth Hospital, Barbados, 2003-2008, and Barbados Census 2000; ACSH=Ambulatory Cares Sensitive Condition; UTI= Urinary Tract Infection; RR= Risk Ratio; UB= Upper Boundary; LB=Lower Boundary; p-value is for comparison of the rate for the given year to the rate for 2003

Table 3.8: Risk of Hospitalizations for Individual Ambulatory Care Sensitive Conditions for Pediatric male Population 19 years and under, 2003-2008,by Year

	Asthma					Diabetes				
Year	Rate per 1000	RR	LB	UB	P-value	Rate per	RR	LB	UB	P-value
2008	4.88	2.23	1.72	2.90	<.0001	0.05	0.49	0.09	2.69	0.4134
2007	2.24	1.02	0.76	1.39	0.8779	0.03	0.25	0.03	2.21	0.2110
2006	3.20	1.46	1.11	1.94	0.0078	0.00	0.00	0.00	0.00	0.9999
2005	1.22	0.56	0.39	0.80	0.0015	0.05	0.50	0.09	2.71	0.4189
2004	2.15	0.98	0.72	1.34	0.9144	0.00	0.00	0.00	0.00	0.9999
2003	2.18	1				0.11	1			
	Gastroenteritis					Perforated Appendix				
Year	Rate per 1000	RR	LB	UB	P-value	Rate per	RR	LB	UB	P-value
2008	0.55	2.30	1.05	5.02	0.0367	0.31	1.48	0.60	3.61	0.3925
2007	1.29	5.38	2.64	10.95	<.0001	0.47	2.22	0.97	5.11	0.0601
2006	0.87	3.64	1.74	7.60	0.0004	0.48	2.23	0.97	5.13	0.0589
2005	0.21	0.88	0.34	2.29	0.7976	0.21	0.99	0.37	2.65	0.9891
2004	0.48	1.99	0.89	4.43	0.0917	0.19	0.87	0.32	2.40	0.7896
2003	0.24	1				0.21	1			

(Table 3.8 Continued)

	UTI				
Year	Rate per 1000	RR	LB	UB	P-value
2008	0.21	3.94	0.84	18.55	0.0829
2007	0.11	1.98	0.36	10.79	0.4317
2006	0.11	1.98	0.36	10.83	0.4291
2005	0.08	1.49	0.25	8.92	0.6624
2004	0.08	1.49	0.25	8.94	0.6606
2003	0.05	1			

[a]Data Source: Queen Elizabeth Hospital, Barbados, 2003-2008, and Barbados Census 2000; ACSH=Ambulatory Cares Sensitive Condition; CHF=Congestive Heart Failure; RR= Risk Ratio; UB= Upper Boundary; LB=Lower Boundary; p-value is for comparison of the rate for the given year to the rate for 2003

Table 3.9: Risk of Hospitalizations for Ambulatory Care Sensitive Conditions for All Pediatric Populations 20 years, Barbados 2003-2008, by year

	2003-2008					2003				
Parish	Rate per 1000	RR	LB	UB	P-value	Rate per 1000	RR	LB	UB	P-value
Saint Andrew	2.78	0.71	0.48	1.04	0.0788	2.48	0.77	0.28	2.10	0.6087
Saint Peter	1.29	0.33	0.22	0.50	<.0001	1.30	0.40	0.15	1.10	0.0761
Saint George	3.02	0.77	0.62	0.95	0.0167	3.19	0.99	0.59	1.67	0.9703
Saint John	3.50	0.89	0.68	1.17	0.4132	2.26	0.70	0.31	1.61	0.4023
Saint Lucy	2.29	0.58	0.42	0.81	0.0015	0.75	0.23	0.06	0.94	0.0409
Saint Joseph	1.81	0.46	0.32	0.66	<.0001	1.05	0.33	0.10	1.03	0.0569
Saint Philip	2.81	0.72	0.59	0.88	0.0011	2.05	0.64	0.36	1.12	0.1172
Saint James	2.32	0.59	0.48	0.74	<.0001	1.69	0.53	0.28	0.99	0.0453
Saint Thomas	2.42	0.62	0.47	0.81	0.0005	2.05	0.63	0.31	1.31	0.2196
Christ Church	2.47	0.63	0.54	0.74	<.0001	1.79	0.56	0.36	0.87	0.0102
Saint Michael	3.92					3.22				

(Table 3.9 Continued)

	2004					2005				
Parish	Rate per 1000	RR	LB	UB	P-value	Rate per 1000	RR	LB	UB	P-value
Saint Andrew	3.09	0.91	0.37	2.23	0.8310	0.62	0.27	0.04	1.96	0.1967
Saint Peter	0.32	0.10	0.01	0.68	0.0193	0.32	0.14	0.02	1.03	0.0534
Saint George	2.06	0.60	0.32	1.13	0.1150	1.49	0.66	0.31	1.38	0.2684
Saint John	2.63	0.77	0.36	1.67	0.5093	3.00	1.32	0.63	2.77	0.4583
Saint Lucy	1.86	0.55	0.22	1.34	0.1876	2.23	0.98	0.42	2.28	0.9662
Saint Joseph	1.05	0.31	0.10	0.97	0.0447	0.35	0.15	0.02	1.11	0.0635
Saint Philip	2.34	0.68	0.40	1.17	0.1639	1.75	0.77	0.41	1.43	0.4107
Saint James	2.00	0.59	0.33	1.05	0.0720	0.31	0.14	0.03	0.55	0.0054
Saint Thomas	1.78	0.52	0.24	1.13	0.0994	1.02	0.45	0.16	1.24	0.1210
Christ Church	2.22	0.65	0.43	0.98	0.0394	1.07	0.47	0.27	0.83	0.0095
Saint Michael	3.41					2.27				

(Table 3.9 Continued)

	2006					2007				
Parish	Rate per 1000	RR	LB	UB	P-value	Rate per 1000	RR	LB	UB	P-value
Saint Andrew	3.70	0.85	0.37	1.92	0.6877	3.07	0.74	0.30	1.82	0.5182
Saint Peter	0.97	0.22	0.07	0.70	0.0100	2.25	0.55	0.25	1.17	0.1209
Saint George	3.36	0.77	0.47	1.26	0.2975	3.16	0.77	0.46	1.28	0.3075
Saint John	5.62	1.28	0.75	2.20	0.3627	3.73	0.90	0.47	1.73	0.7621
Saint Lucy	4.08	0.93	0.50	1.73	0.8244	1.11	0.27	0.09	0.85	0.0248
Saint Joseph	3.14	0.72	0.36	1.41	0.3371	1.39	0.34	0.12	0.91	0.0326
Saint Philip	2.91	0.66	0.41	1.07	0.0927	4.64	1.12	0.76	1.67	0.5621
Saint James	3.67	0.84	0.54	1.31	0.4378	2.14	0.52	0.30	0.90	0.0206
Saint Thomas	3.30	0.76	0.43	1.34	0.3376	2.28	0.55	0.28	1.09	0.0873
Christ Church	2.92	0.67	0.47	0.95	0.0269	2.84	0.69	0.48	0.99	0.0441
Saint Michael	4.37					4.13				

(Table 3.9 Continued)

	2008				
Parish	Rate per 1000	RR	LB	UB	P-value
Saint Andrew	3.68	0.60	0.27	1.36	0.2237
Saint Peter	2.57	0.42	0.21	0.86	0.0171
Saint George	4.82	0.79	0.52	1.20	0.2679
Saint John	3.72	0.61	0.32	1.16	0.1307
Saint Lucy	3.69	0.60	0.32	1.15	0.1229
Saint Joseph	3.81	0.63	0.34	1.15	0.1321
Saint Philip	3.18	0.52	0.33	0.82	0.0043
Saint James	4.11	0.67	0.45	1.01	0.0583
Saint Thomas	4.04	0.66	0.40	1.11	0.1172
Christ Church	3.97	0.65	0.48	0.88	0.0057
Saint Michael	6.10				

[a]Data Source: Queen Elizabeth Hospital, Barbados, 2003-2008, and Barbados Census 2000; RR= Risk Ratio; UB= Upper Boundary of the 95% Confidence Interval; LB=Lower Boundary; p-value is for comparison of the rate for the given parish to the rate for Saint Michael.

Table 3.10: Risk of Hospitalizations for Individual Ambulatory Care Sensitive Conditions for Female Pediatric Populations 20 years and under during 2003-2008

	2003-2008					2003				
Parish	Rate per 1000	RR	LB	UB	P-value	Rate per 1000	RR	LB	UB	P-value
Saint Andrew	2.74	0.93	0.53	1.63	0.8104	2.54	0.84	0.20	3.48	0.8091
Saint Peter	0.89	0.30	0.15	0.61	0.0009	0.65	0.22	0.03	1.61	0.1371
Saint George	2.83	0.96	0.70	1.33	0.8262	2.68	0.63	0.25	1.59	0.3237
Saint John	1.55	0.53	0.29	0.94	0.0301	1.50	0.26	0.04	1.88	0.1810
Saint Lucy	1.88	0.64	0.38	1.08	0.0933	1.53	0.50	0.12	2.06	0.3347
Saint Joseph	1.35	0.46	0.23	0.93	0.0309	0.00	0.68	0.16	2.81	0.5936
Saint Philip	2.05	0.70	0.50	0.97	0.0337	1.75	0.40	0.14	1.12	0.0813
Saint James	1.54	0.52	0.36	0.77	0.0009	0.64	0.81	0.38	1.74	0.5949
Saint Thomas	2.23	0.76	0.50	1.14	0.1801	2.62	0.34	0.08	1.41	0.1363
Christ Church	2.02	0.69	0.54	0.88	0.0035	1.90	0.57	0.30	1.10	0.0927
Saint Michael	2.94					2.48				

	2004					2005				
	Rate per 1000	RR	LB	UB	P-value	Rate per 1000	RR	LB	UB	P-value
Saint Andrew	2.54	0.84	0.20	3.48	0.8091	1.27	0.76	0.10	5.64	0.7879
Saint Peter	0.67	0.22	0.03	1.61	0.1371	0.00	0.00	0.00	0.00	0.9999
Saint George	1.89	0.63	0.25	1.59	0.3237	2.26	1.36	0.55	3.36	0.5087
Saint John	0.78	0.26	0.04	1.88	0.1810	3.11	1.87	0.64	5.44	0.2525
Saint Lucy	1.50	0.50	0.12	2.06	0.3347	1.50	0.90	0.21	3.83	0.8852
Saint Joseph	2.05	0.68	0.16	2.81	0.5936	0.00	0.00	0.00	0.00	0.9999
Saint Philip	1.21	0.40	0.14	1.12	0.0813	2.11	1.27	0.54	2.98	0.5881
Saint James	2.46	0.81	0.38	1.74	0.5949	0.00	0.00	0.00	0.00	0.9999

(Table 3.10 Continued)

Saint Thomas	1.03	0.34	0.08	1.41	0.1363	1.02	0.61	0.14	2.62	0.5099
Christ Church	1.73	0.57	0.30	1.10	0.0927	1.01	0.60	0.26	1.42	0.2495
Saint Michael	3.02					1.67				

	2006					2007				
	Rate per 1000	RR	LB	UB	P-value	Rate per 1000	RR	LB	UB	P-value
Saint Andrew	5.06	1.59	0.57	4.46	0.3736	2.52	0.94	0.23	3.90	0.9298
Saint Peter	0.00	0.00	0.00	0.00	0.9998	1.33	0.50	0.12	2.06	0.3347
Saint George	3.77	1.19	0.59	2.38	0.6259	2.63	0.98	0.43	2.21	0.9581
Saint John	2.33	0.74	0.23	2.38	0.6071	0.78	0.29	0.04	2.11	0.2202
Saint Lucy	2.99	0.94	0.34	2.64	0.9119	0.75	0.28	0.04	2.03	0.2065
Saint Joseph	3.07	0.97	0.30	3.13	0.9561	1.02	0.38	0.05	2.77	0.3395
Saint Philip	0.90	0.28	0.09	0.92	0.0360	3.91	1.45	0.77	2.75	0.2520
Saint James	1.53	0.48	0.19	1.22	0.1248	1.53	0.57	0.22	1.45	0.2376
Saint Thomas	3.58	1.13	0.51	2.52	0.7683	3.06	1.14	0.48	2.71	0.7707
Christ Church	2.45	0.77	0.44	1.36	0.3698	2.58	0.96	0.54	1.70	0.8909
Saint Michael	3.17					2.69				

(Table 3.10 Continued)

	2008				
	Rate per 1000	RR	LB	UB	P-value
Saint Andrew	2.52	0.55	0.13	2.25	0.4056
Saint Peter	2.66	0.58	0.21	1.60	0.2937
Saint George	3.75	0.82	0.42	1.60	0.5607
Saint John	0.77	0.17	0.02	1.22	0.0779
Saint Lucy	2.98	0.65	0.24	1.79	0.4060
Saint Joseph	2.04	0.44	0.11	1.82	0.2601
Saint Philip	2.40	0.52	0.25	1.10	0.0867
Saint James	3.05	0.67	0.34	1.30	0.2351
Saint Thomas	2.04	0.44	0.16	1.22	0.1169
Christ Church	2.44	0.53	0.31	0.91	0.0221
Saint Michael	4.58				

[a]Data Source: Queen Elizabeth Hospital, Barbados, 2003-2008, and Barbados Census 2000; RR= Risk Ratio; UB= Upper Boundary of the 95% Confidence Interval; LB=Lower Boundary; p-value is for comparison of the rate for the given parish to the rate for Saint Michael.

Table 3.11 : Risk of Hospitalizations for Individual Ambulatory Care Sensitive Conditions for Pediatric Male Across parishes for each year Population 20 years and under during 2003-2008

	2003-2008					2003				
Parish	Rate per 1000	RR	LB	UB	P-value	Rate per 1000	RR	LB	UB	P-value
Saint Andrew	2.81	0.58	0.34	0.98	0.0422	2.42	0.61	0.15	2.51	0.4959
Saint Peter	1.67	0.34	0.21	0.56	<.0001	1.89	0.48	0.15	1.53	0.2134
Saint George	3.2	0.66	0.49	0.88	0.0045	3.72	0.94	0.48	1.85	0.8605
Saint John	5.3	1.09	0.80	1.49	0.5974	2.91	0.74	0.27	2.04	0.5562
Saint Lucy	2.69	0.55	0.36	0.85	0.0068	0.00	0.00	0.00	0.00	0.9996
Saint Joseph	3.57	0.73	0.48	1.12	0.1466	2.82	0.71	0.22	2.28	0.5667
Saint Philip	3.51	0.72	0.56	0.92	0.0095	2.27	0.57	0.27	1.21	0.1428
Saint James	3.11	0.64	0.49	0.84	0.0011	2.78	0.70	0.35	1.43	0.3273
Saint Thomas	2.61	0.54	0.37	0.77	0.0008	1.53	0.39	0.12	1.24	0.1091
Christ Church	2.92	0.60	0.49	0.73	<.0001	1.71	0.43	0.23	0.81	0.0087
Saint Michael	4.88					3.96				

(Table 3.11 Continued)

	2004					2005				
Parish	Rate per 1000	RR	LB	UB	P-value	Rate per 1000	RR	LB	UB	P-value
Saint Andrew	3.62	0.96	0.30	3.07	0.9392	0.00	0.00	0.00	0.00	0.9998
Saint Peter	0.00	0.00	0.00	0.00	0.9996	0.63	0.22	0.03	1.60	0.1345
Saint George	2.22	0.59	0.25	1.37	0.2190	0.74	0.26	0.06	1.08	0.0631
Saint John	4.35	1.15	0.49	2.68	0.7463	2.89	1.02	0.36	2.85	0.9767
Saint Lucy	2.21	0.58	0.18	1.88	0.3667	2.94	1.03	0.37	2.90	0.9520
Saint Joseph	0.93	0.25	0.03	1.79	0.1661	0.93	0.33	0.04	2.38	0.2699
Saint Philip	3.38	0.89	0.48	1.68	0.7287	1.41	0.49	0.19	1.26	0.1382
Saint James	1.54	0.41	0.16	1.02	0.0547	0.61	0.21	0.05	0.89	0.0342
Saint Thomas	2.53	0.67	0.27	1.68	0.3929	1.01	0.35	0.09	1.47	0.1534
Christ Church	2.69	0.71	0.42	1.21	0.2062	1.13	0.40	0.18	0.85	0.0176
Saint Michael	3.78					2.85				

	2006					2007				
Parish	Rate per 1000	RR	LB	UB	P-value	Rate per 1000	RR	LB	UB	P-value
Saint Andrew	2.40	0.43	0.11	1.77	0.2437	3.59	0.65	0.20	2.06	0.4653
Saint Peter	1.87	0.34	0.11	1.07	0.0658	3.11	0.56	0.23	1.40	0.2152
Saint George	2.95	0.53	0.26	1.11	0.0916	3.68	0.67	0.34	1.29	0.2294
Saint John	8.67	1.57	0.85	2.88	0.1506	6.48	1.17	0.59	2.35	0.6498
Saint Lucy	5.14	0.93	0.43	2.02	0.8509	1.46	0.27	0.07	1.08	0.0641
Saint Joseph	5.58	1.01	0.44	2.32	0.9851	2.78	0.50	0.16	1.60	0.2449
Saint Philip	4.78	0.86	0.51	1.46	0.5824	5.32	0.96	0.58	1.60	0.8858
Saint James	5.81	1.05	0.63	1.74	0.8518	2.74	0.50	0.25	0.99	0.0480
Saint Thomas	3.03	0.55	0.24	1.26	0.1555	1.51	0.27	0.09	0.87	0.0278
Christ Church	3.38	0.61	0.38	0.97	0.0365	3.09	0.56	0.35	0.90	0.0173
Saint Michael	5.54					5.52				

(Table 3.11 Continued)

	2008				
Parish	Rate per 1000	RR	LB	UB	P-value
Saint Andrew	4.77	0.63	0.23	1.71	0.3661
Saint Peter	2.48	0.33	0.12	0.89	0.0288
Saint George	5.87	0.78	0.46	1.32	0.3457
Saint John	6.46	0.85	0.43	1.69	0.6501
Saint Lucy	4.38	0.58	0.25	1.32	0.1932
Saint Joseph	8.32	1.10	0.56	2.18	0.7850
Saint Philip	3.91	0.52	0.30	0.90	0.0206
Saint James	5.17	0.68	0.41	1.14	0.1462
Saint Thomas	6.02	0.80	0.44	1.45	0.4539
Christ Church	5.46	0.72	0.50	1.05	0.0848
Saint Michael	7.56				

[a]Data Source: Queen Elizabeth Hospital, Barbados, 2003-2008, and Barbados Census 2000; RR= Risk Ratio; UB= Upper Boundary of the 95% Confidence Interval; LB=Lower Boundary; p-value is for comparison of the rate for the given parish to the rate for Saint Michael

Table 3.12: Risk of Hospitalizations for Individual Ambulatory Care Sensitive Conditions for All Pediatric Population 20 years and under during 2003-2008

Asthma						Perforated Appendix				
Parish	Rate per 1000	RR	LB	UB	P-value	Rate per 1000	RR	LB	UB	P-value
Saint Andrew	7.40	0.48	0.27	0.85	0.0118	2.47	0.93	0.34	2.54	0.8847
Saint Peter	5.17	0.33	0.20	0.55	<.0001	1.94	0.73	0.32	1.68	0.4587
Saint George	10.08	0.65	0.49	0.87	0.0031	2.80	1.05	0.60	1.84	0.8547
Saint John	11.61	0.75	0.52	1.08	0.1240	2.25	0.85	0.37	1.95	0.6947
Saint Lucy	9.64	0.62	0.42	0.93	0.0195	1.85	0.70	0.28	1.73	0.4378
Saint Joseph	7.67	0.50	0.32	0.76	0.0014	1.05	0.39	0.12	1.25	0.1141
Saint Philip	10.77	0.70	0.54	0.89	0.0042	1.60	0.60	0.32	1.14	0.1188
Saint James	9.49	0.61	0.47	0.80	0.0003	1.68	0.63	0.34	1.20	0.1608
Saint Thomas	9.66	0.62	0.45	0.87	0.0055	2.03	0.77	0.37	1.59	0.4743
Christ Church	10.76	0.70	0.58	0.84	0.0001	1.57	0.59	0.36	0.95	0.0315
Saint Michael	15.47					2.66				
	Diabetes					Gastroenteritis				
Parish	Rate per 1000	RR	LB	UB	P-value	Rate per 1000	RR	LB	UB	P-value
Saint Andrew	0.00	0.00	0.00	0.00	0.9999	6.17	1.58	0.82	3.02	0.1691
Saint Peter	0.00	0.00	0.00	0.00	0.9999	0.65	0.17	0.04	0.67	0.0117
Saint George	1.49	2.55	1.08	6.01	0.0327	2.80	0.72	0.42	1.23	0.2285
Saint John	0.00	0.00	0.00	0.00	0.9999	5.99	1.53	0.91	2.60	0.1119
Saint Lucy	0.74	1.27	0.29	5.53	0.7543	1.48	0.38	0.14	1.03	0.0575
Saint Joseph	0.00	0.00	0.00	0.00	0.9999	2.09	0.54	0.23	1.22	0.1372
Saint Philip	0.29	0.50	0.11	2.17	0.3523	3.64	0.93	0.60	1.44	0.7488
Saint James	0.31	0.52	0.12	2.29	0.3886	1.68	0.43	0.23	0.80	0.0081

(Table 3.12 Continued)

Saint Thomas	0.00	0.00	0.00	0.00	0.9999		2.54	0.65	0.34	1.25	0.1948
Christ Church	0.14	0.24	0.06	1.06	0.0603		1.78	0.46	0.29	0.71	0.0004
Saint Michael	0.59						3.91				

	UTI				
Parish	Rate per 1000	RR	LB	UB	P-value
Saint Andrew	0.62	0.63	0.09	4.66	0.6518
Saint Peter	0.00	0.00	0.00	0.00	0.9999
Saint George	0.93	0.96	0.37	2.50	0.9256
Saint John	1.12	1.15	0.35	3.81	0.8184
Saint Lucy	0.00	0.00	0.00	0.00	0.9999
Saint Joseph	0.00	0.00	0.00	0.00	0.9999
Saint Philip	0.58	0.60	0.21	1.71	0.3362
Saint James	0.77	0.78	0.30	2.05	0.6191
Saint Thomas	0.25	0.26	0.04	1.92	0.1868
Christ Church	0.57	0.58	0.26	1.29	0.1849
Saint Michael	0.98				

[a]Data Source: Queen Elizabeth Hospital, Barbados, 2003-2008, and Barbados Census 2000; ACSH=Ambulatory Cares Sensitive Condition; CHF=Congestive Heart Failure; RR= Risk Ratio; UB= Upper Boundary; LB=Lower Boundary; p-value is for comparison of the rate for the given parish to the rate for Saint Michael.

Table 3.13: Risk of Hospitalizations for Individual Ambulatory Care Sensitive Conditions for Pediatric Female Population 20 years and under during 2003-2008

	Asthma					Diabetes				
Parish	Rate per 1000	RR	LB	UB	P-value	Rate per 1000	RR	LB	UB	P-value
Saint Andrew	7.59	0.73	0.32	1.66	0.4517	0.00	0.00	0.00	0.00	0.9999
Saint Peter	2.66	0.26	0.09	0.69	0.0072	0.00	0.00	0.00	0.00	0.9999
Saint George	6.42	0.62	0.37	1.02	0.0616	3.02	3.81	1.50	9.65	0.0048
Saint John	3.09	0.30	0.11	0.80	0.0168	0.00	0.00	0.00	0.00	0.9999
Saint Lucy	6.76	0.65	0.33	1.28	0.2109	0.00	2E-11	0.00	0.00	0.9999
Saint Joseph	3.04	0.29	0.09	0.92	0.0352	0.00	0.00	0.00	0.00	0.9999
Saint Philip	7.19	0.69	0.45	1.07	0.0966	0.30	0.38	0.05	2.95	0.3529
Saint James	5.55	0.53	0.33	0.87	0.0124	0.31	0.39	0.05	3.03	0.3668
Saint Thomas	7.70	0.74	0.43	1.26	0.2704	0.00	0.00	0.00	0.00	0.9999
Christ Church	7.21	0.69	0.50	0.96	0.0278	0.29	0.36	0.08	1.66	0.1914
Saint Michael	10.40					0.79				

	Gastroenteritis					Perforated Appendix				
Parish	Rate per 1000	RR	LB	UB	P-value	Rateper 1000	RR	LB	UB	P-value
Saint Andrew	6.33	2.28	0.89	5.81	0.0850	2.53	0.91	0.22	3.79	0.8983
Saint Peter	0.00	0.00	0.00	0.00	0.9998	2.66	0.96	0.34	2.69	0.9331
Saint George	3.02	1.09	0.50	2.35	0.8299	3.40	1.22	0.59	2.55	0.5889
Saint John	3.86	1.39	0.54	3.55	0.4912	0.77	0.28	0.04	2.03	0.2068

(Table 3.13 Continued)

Saint Lucy	1.50	0.54	0.13	2.25	0.3973	3.00	1.08	0.38	3.04	0.8828
Saint Joseph	2.03	0.73	0.18	3.03	0.6642	3.04	1.09	0.34	3.56	0.8812
Saint Philip	1.80	0.65	0.27	1.54	0.3244	1.80	0.65	0.27	1.54	0.3244
Saint James	0.62	0.22	0.05	0.92	0.0383	1.85	0.67	0.28	1.58	0.3564
Saint Thomas	3.08	1.11	0.47	2.64	0.8154	2.57	0.92	0.36	2.36	0.8685
Christ Church	2.16	0.78	0.43	1.43	0.4183	1.88	0.68	0.36	1.28	0.2264
Saint Michael	2.78					2.78				

	UTI									
Parish	Rate per 1000	RR	LB	UB	P-value	Rate per 1000	RR	LB	UB	P-value
Saint Andrew	0.00	0.00	0.00	0.00	0.9999					
Saint Peter	0.00	0.00	0.00	0.00	0.9999					
Saint George	1.13	1.19	0.34	4.22	0.7877					
Saint John	1.54	1.62	0.36	7.24	0.5269					
Saint Lucy	0.00	0.00	0.00	0.00	0.9999					
Saint Joseph	0.00	0.00	0.00	0.00	0.9999					
Saint Philip	1.20	1.26	0.41	3.90	0.6909					
Saint James	0.92	0.97	0.27	3.44	0.9627					
Saint Thomas	0.00	0.00	0.00	0.00	0.9999					
Christ Church	0.58	0.61	0.20	1.88	0.3855					
Saint Michael	0.95									

[a]Data Source: Queen Elizabeth Hospital, Barbados, 2003-2008, and Barbados Census 2000; ACSH=Ambulatory Cares Sensitive Condition; CHF=Congestive Heart Failure; RR= Risk Ratio; UB= Upper Boundary; LB=Lower Boundary; p-value is for comparison of the rate for the given parish to the rate for Saint Michael.

Table 3.14: Risk of Hospitalizations for Individual Ambulatory Care Sensitive Conditions for Pediatric Male Population 20 years and under during 2003-2008

	Asthma					Diabetes				
Parish	Rate per 1000	RR	LB	UB	P-value	Rate per 1000	RR	LB	UB	P-value
Saint Andrew	7.21	0.35	0.16	0.79	0.0118	0.00	0.00	0.00	0.00	0.9999
Saint Peter	7.50	0.37	0.21	0.66	0.0007	0.00	0.00	0.00	0.00	0.9999
Saint George	13.67	0.67	0.48	0.95	0.0225	0.00	0.00	0.00	0.00	0.9999
Saint John	19.52	0.96	0.64	1.42	0.8283	0.00	0.00	0.00	0.00	0.9999
Saint Lucy	12.49	0.61	0.38	1.00	0.0500	1.47	3.818	0.74	19.68	0.1093
Saint Joseph	17.69	0.87	0.54	1.38	0.5489	0.00	0.00	0.00	0.00	0.9999
Saint Philip	14.05	0.69	0.51	0.93	0.0157	0.28	0.73	0.09	6.25	0.7742
Saint James	13.47	0.66	0.48	0.91	0.0108	0.31	0.80	0.09	6.81	0.8344
Saint Thomas	11.62	0.57	0.37	0.87	0.0096	0.00	0.00	0.00	0.00	0.9999
Christ Church	14.25	0.70	0.56	0.88	0.0022	0.00	0.00	0.00	0.00	0.9999
Saint Michael	20.40					0.38				

(Table 3.14 Continued)

	Gastroenteris					Perforated Appendix				
Parish	Rate per 1000	RR	LB	UB	P-value	Rate per 1000	RR	LB	UB	P-value
Saint Andrew	6.01	1.20	0.48	2.98	0.6929	2.40	0.95	0.23	3.94	0.9397
Saint Peter	1.25	0.25	0.06	1.02	0.0534	1.25	0.49	0.12	2.05	0.3302
Saint George	2.59	0.52	0.24	1.13	0.0971	2.22	0.87	0.37	2.08	0.7588
Saint John	7.95	1.59	0.84	3.01	0.1550	3.62	1.42	0.56	3.65	0.4620
Saint Lucy	1.47	0.29	0.07	1.20	0.0879	0.73	0.29	0.04	2.11	0.2217
Saint Joseph	3.72	0.74	0.27	2.04	0.5667	0.00	0.00	0.00	0.00	0.9998
Saint Philip	5.34	1.07	0.64	1.78	0.8026	1.41	0.55	0.22	1.42	0.2174
Saint James	2.75	0.55	0.27	1.11	0.0934	1.53	0.60	0.24	1.54	0.2911
Saint Thomas	2.02	0.40	0.15	1.11	0.0783	1.52	0.60	0.18	1.94	0.3916
Christ Church	1.41	0.28	0.14	0.55	0.0002	1.27	0.50	0.24	1.04	0.0652
Saint Michael	5.00					2.54				

(Table 3.14 Continued)

Parish	UTI Rate per 1000	RR	LB	UB	P-value
Saint Andrew	1.20	1.20	0.16	9.18	0.8598
Saint Peter	0.00	0.00	0.00	0.00	0.9999
Saint George	0.74	0.74	0.17	3.27	0.6897
Saint John	0.72	0.72	0.09	5.52	0.7542
Saint Lucy	0.00	0.00	0.00	0.00	0.9999
Saint Joseph	0.00	0.00	0.00	0.00	0.9999
Saint Philip	0.00	0.00	0.00	0.00	0.9999
Saint James	0.61	0.61	0.14	2.71	0.5177
Saint Thomas	0.51	0.50	0.07	3.86	0.5100
Christ Church	0.56	0.56	0.18	1.73	0.3164
Saint Michael	1.00				

[a]Data Source: Queen Elizabeth Hospital, Barbados, 2003-2008, and Barbados Census 2000; ACSH=Ambulatory Cares Sensitive Condition; CHF=Congestive Heart Failure; RR= Risk Ratio; UB= Upper Boundary; LB=Lower Boundary; p-value is for comparison of the rate for the given parish to the rate for Saint Michael

Table 3.15: Ambulatory care sensitive Conditions across years for Australia, Canada, Singapore, Taiwan, and United States

Taiwan, ACSH Rates [a]		Australia/Victoria ACSH rates per 1,000[c]		Singapore, ACSH rates per 1000[b]		
	Age Group		Age Group		Age Group	
ACSH No.(%)	≤ 18 (n=8581		0-19		>15	15-24
				1991-98	38.1	10.8
2001	362 (4.2)	2001-02				
2002	340(4.0)	2003-04	16.96			
2003	248(2.9)	2004-05	17.47			
2004	199(2.3)	2005-06	17.15			
2005	210(2.4)	2006-07	16.83			
2006	121(1.4)	2007-08	18.09			
		2008-09	17.25			

[a] Source:(Cheng, et al., 2010)

[b] Source: Hospital Morbidity Database and Discharge Abstract Database; Canadian Institute of Health Information

[c] Source:(Victorian Health Information Surveillance System (VHISS), 2011)

[d]Source:(Niti & Ng, 2003)

Table 3.16: Individual hospitalization Standardized Rates for Population 0-19 years
Australian\Victoria Standardized Rate per 1,000 ,2003-2009

	2003-2004		2004-2005		2005-2006		2006-2007		2007-2008		2008-2009	
	Males	Female	Males	Female	Males	Female	Males	Female	Males	Female	Males	Female
Asthma	4.44	3.08	4.66	3.14	4.75	3.09	5.06	3.32	5.11	3.11	4.77	3.21
Cellulitis	0.69	0.50	0.82	0.60	0.79	0.55	0.75	0.57	0.84	0.60	0.73	0.52
COPD	0.08	0.07	0.10	0.03	0.06	0.05	0.09	0.05	0.08	0.03	0.07	0.06
CCF	0.03	0.03	0.01	0.03	0.02	0.02	0.02	0.01	0.02	0.03	0.03	0.01
Convulsions and epilepsy	1.90	1.67	1.79	1.64	1.65	1.59	1.68	1.51	1.78	1.73	1.70	1.57
Dehydration and gastroenteritis	0.42	0.60	0.45	0.57	0.52	0.71	0.51	0.76	0.57	0.85	0.30	0.34
Dental conditions	4.66	4.55	4.90	4.82	4.81	4.64	4.34	4.18	4.48	4.71	4.59	4.81
Diabetes complications	0.50	0.62	0.53	0.77	0.60	0.87	0.56	0.88	0.63	0.88	0.67	0.87
Ear, nose and throat infections	3.52	3.17	3.63	3.12	3.32	2.97	3.31	2.89	3.82	3.47	3.48	3.10
Gangrene	0.04	0.01	0.03	0.02	0.03	0.04	0.05	0.04	0.05	0.02	0.05	0.03
Hypertension	0.04	0.02	0.04	0.02	0.05	0.01	0.03	0.02	0.05	0.03	0.05	0.04
Influenza and pneumonia	0.40	0.35	0.25	0.20	0.24	0.25	0.17	0.19	0.27	0.23	0.35	0.31
Iron deficiency anemia	0.07	0.11	0.06	0.14	0.05	0.14	0.04	0.16	0.09	0.18	0.08	0.16
Nutritional deficiencies	0.01	0	0	0	0.01	0.01	0	0	0	0.01	0.01	0

(Table 3.16 Continued)

Other vaccine-preventable Conditions	0.05	0.07	0.06	0.06	0.03	0.02	0.03	0.03	0.05	0.05	0.13	0.12
PID	0	0.13	0	0.10	0	0.13	0	0.12	0	0.13	0	0.13
Perforated/bleeding ulcer	0	0.01	0.02		0.02	0.01	0.02	0.01	0.01	0	0.02	0.01
Pyelonephritis	0.61	1.50	0.71	1.65	0.64	1.67	0.62	1.66	0.60	1.69	0.62	1.61

The age standardised rate for an area is the number of hospital admissions, usually expressed per 1,000, that would occur in that area if it had the same age structure as the standard population and the local age-specific rates of the area applied. Directly standardised admission rate is calculated by dividing the number of admissions by the actual local population in a particular age group multiplied by the proportion of the standard population for that particular age group and summing across the relevant age groups. The rate is usually expressed per 1,000 population.

Source:(Victorian Health Information Surveillance System VHISS), 2011)

Table 3.17: Individual ACSH Rates for Population 0-17 years, United States per 100,000, for the years 1997-2000, 2004 and 2006

	Number of Hospitalizations per 100,000			Number of Hospitalizations per 100,000	
	1997	2000	2004	2006 [b]	Percent change (1997-2004)*
Short-term diabetes complications (age 6 years to 17 years)	27.6	26.3	31.5	32	NS
Pediatric asthma (age 2 years to 17 years)	206.9	163.2	155.5	144	24.9
Pediatric gastroenteritis (age 4 months to 17 years)	201.1	172.8	178.7		NS
Urinary tract infection (age 4 months to 17 years)	47.3	50.3	48.9		NS
Pediatric gastroenteritis (age 3 months to 17 years)				183	
Urinary tract infection (age 3 months to 17 years)				45	

* Significant at $p \leq 0.05$; "NS" indicates non-significant changes.
[a]Source: AHRQ, Center for Delivery, Organization, and Markets. Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 1997, 2000, and 2004.
[b]Source: AHRQ, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2006 and AHRQ Quality Indicators, version 3.1

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APPENDIX A: DESCRIPTION OF PARISHES IN BARBADOS

Parish	Location	Summary
St. Andrew	Northern tip of the island on the eastern coastline to the Atlantic Ocean	Still quite unspoilt. It consist of a network of rolling hills and is home to the highest peak on the island in the Scotland district (named due to the perception of the British of its resemblance of the fields and rolling hills in Scotland) Mount Hillaby- which stands at an elevation of 336m. Bellepaine is the largest community in this parish. This is also home to islands newest landfill the "Greenland Landfill" is also located there amidst much controversy of potential soil erosion and leakage into the underground water basin. Turners Hall Woods is one of the many natural reserves also located in this parish
St. Peter	North of the island and extends from the east coast to the west	Also one of the largest tourist destination spots on the island. Several parts of this parish are still un-spoilt and covered with rolling hills and sugar cane fields. Speightstown was the first major port to be established in Barbados. The only marina Port St. Charles on the island is also located in this town.
St. George	Landlocked by six other parishes	Home to one of the only remaining signal stations at Gun Hill. The largest community is Glebe Land.
St. John	Eastern side	This parish is one of the most rural parishes on the island. Conset Bay was formed on the southeastern corner of this parish due to the northern turn of the coastline.

St. Lucy	Most northern parish	This parish is a peninsula surrounded by the Atlantic Ocean on three sides and St. Peter to the south. Also previous home to the US Navy base at Harrison's Point. It is the longest distance from the capital of Bridgetown and it also has one of the smallest populations on the island.
St. Michael	South western side	The capital of Barbados Bridgetown is located in here. The capital is the central location of public transport, with the Psychiatric Hospital and the Queen Elizabeth Hospital located here. Three of the islands most prestigious schools Harrison's College and Combermere School and St. Michael's School along with several other schools are located here. The International seaport is also located in this parish.
St. Joseph	Eastern side	Home to two botanical gardens Flower Forest and Andromeda Gardens. A section of the Scotland District also in this parish. Chimborazo, one of the highest elevations on the island is also located in this parish. The "Soup Bowl" home to international surfing events is also located at Bathsheba in this parish.
St. Philip	Southeastern corner	This is the largest parish and is relatively flat with virtually no elevation from sea level. Largest crop cultivation occurs in this parish. There are many villages with no major towns. However, Six Cross Roads where six roads converge from six different points on the island is the central location of many business activities and is located here. The main onshore oil drilling also occurs here.

St. James	West of the island Situated on the Caribbean sea Coast	Home to properties owned by many of the world's famous and wealth people. Some of the most beautiful beaches on the island hence also home t o many beach front mansions. This was first British settlement on the island claimed in the name of King James in 1625. Holetown formerly known as Jamestown is located in this parish. Many tourist and expatriates stay in this parish when visiting the island. Home to one of the three remaining sugar factories on the island. This is also one of largest parishes.
St. Thomas	Centre of the island with St George to the south	Recent years have seen a slow migration of residents to this part of the island from more densely populated areas
Christ Church	Southern tip	The Grantley Adams International Airport is situated in this parish. The town of Oistins a major fishing centre is also situated here as well as St Lawrence Gap one of the most frequented tourist areas on the island.

Footnote: The Northeast trade winds blows across this small island located within the Caribbean Sea, Atlantic and Pacific Ocean

APPENDIX B: DEVELOPED AND DEVELOPING COUNTRIES WITH AVAILABLE RATES FOR AMBULATORY CARE SENSITIVE CONDITIONS

Country	Developed or Developing Country	Published Studies	Available Aggregate Data Source	Years used in Data Analysis	Population
Australia	Developed	~10	Yes	2001-2005	All
Canada	Developed	~10	Yes	1999-2007	All
France (Paris)	Developed	1	No	Not comprehensive ACSH rate data	All
New Zealand	Developed	5	No	1989-1998 2000-2004 1998-1999,2002-2003	Pediatrics (gender & age) All- not separate by age or gender
Portugal	Developing	1	No	2000-2005	All
Singapore	Developing	2	No	1991-1998	
Spain	Developed	5	No	1992-1993,2001-2003, 2004, 1998	Pediatric, Older adults, All
Taiwan	Developing	2	No	1997-2003	
UK	Developed	3	Yes	2002-2006	All
USA	Developed	>50	Yes	2002-2006	All

APPENDIX C :Theoretical framework for health care use (Andersen, 1995)
: