Chapter 2. Overview of Public Health in the Caribbean
Executive summary

Overview of public health in the Caribbean

This report examines the state of Public Health in Caribbean, a diverse group of countries and territories of which are, small in population and geographical size, and highly vulnerable to man-made and environmental shocks. Focus is placed on chronic and acute issues between the years 2014-2016 and the actions taken to address health threats identified.

An overview of public health in the Caribbean is provided in Chapter 2. This involves looking at communicable and non-communicable diseases (NCDs), injuries, risk factors and social vulnerabilities. Progress in meeting the recommendations and targets of some major health frameworks is presented. Chapters 3 and 4 focuses on two key areas of public health significance for the 2014-2016 period. These are vector-borne diseases (VBDs) and childhood obesity (CO). VBDs presented immediate threats in the 2014-2016 period, in which epidemics of chikungunya and Zika: both VBDs that had not been encountered in the Caribbean before had occurred. CO Obesity is an increasing threat, affecting the next generation, and thus the economic and social development of the region.

Health related factors affecting the Caribbean population include (but are not limited to): ageing, import dependency, sedentary lifestyles, climate, and natural disasters. Between censuses conducted around 1990 and those around 2010, the proportion of the Caribbean population aged 14 years and under declined by 9%, while the population aged 65 years and over increased by 2%. Increased prevalence of non-communicable diseases (NCDs) and increased life expectancy are probable confounding factors to the adjustments in the overall age profile. Seventy percent of foods consumed are imported from outside the region, which may infer increased probability of susceptibility to food borne disease and NCDs associated with the consumption of processed food. The transition towards a service based economy, led by sectors such as finance, and away from agriculture and manufacturing, and the advent of social media and hand-held digital devices, tend to decrease physical activity levels in some populations. The effects of global warming are the inferred cause of the proliferation of infectious diseases and mosquito vectors, and increased the frequency of storms and hurricanes in the Caribbean region. During the 2014-2016 period, Tropical Storm Erika and Hurricane Matthew were among the natural disasters experienced by Caribbean people. Erika displaced or made homeless 1,300 people in Dominica, and revealed a need for additional mental health services in addition to traditional disaster relief. Matthew caused the death of 575 people in the Caribbean, of whom 546 were in Haiti, and led to major economic disruption in many Caribbean countries and territories.

2 These population data refer to CARPHA Member States (CMS), as listed in Table 2 of Chapter 1. There are 26 CMS, including CARICOM Member States, CARICOM Associate Members and Dutch Caribbean States.
Disease conditions

NCDs accounted 73% of deaths in the 2000 to 2016 period. Communicable, Maternal, Perinatal and Nutritional Conditions accounted for 13.2%, Injuries for 9.7%, and Symptoms, Signs, and Ill-defined Conditions for 4.1%. A striking finding is the increase in injuries as a cause of death. These accounted for 5% of deaths in 2000 and 10% in 2015.

The three leading causes of death from 2000 to 2016 are cerebrovascular disease, diabetes, and ischemic heart disease, which, collectively, accounted for 29.6% of all deaths over the period. HIV started the 21st century as the fourth leading cause of death, but its rank has declined, and hypertensive diseases are now the fourth leading cause.

Communicable, maternal, perinatal, and nutritional conditions account for two-thirds (66%) of deaths in babies under 1 year old, and more than one-fifth of deaths in the ages between 1 to 4 years old. Similarly, these are the inferred causes of more than 20% of deaths among 30 to 39 years old. NCDs account for more than 40% of all deaths in all age groups except among babies under 1, and adolescents and young adults from the ages of 15 to 34. Among adolescents aged 10+ years through to adults aged up to 34 years, injuries account for more than 40% of deaths, due to the high toll of accidents and violence among young people. Assault is the leading cause of death among males aged less than 65 years, indicating a need for alliances between health, security, and law enforcement agencies to reduce injury related deaths, which may be linked to lifestyles associated with the drug trade, excessive alcohol consumption and gang activity.

The age of death from HIV has risen over time, from the age of 30 years in 1996, to 50 years in 2016, likely due to the increased availability of antiretroviral therapy (ART). Notably, since 2006, CARPHA Member states (CMS) reported fewer AIDS cases, which could be due to increased ART use reducing the probability in number of AIDS related deaths in younger age groups. In 2010, adult ART treatment coverage in 23 Caribbean countries ranged from 57-70% with a sharp 29% increase from 2006. However, there is increasing vulnerability of women and girls to HIV infection, with a ratio of merely 5% increase in males versus female HIV cases being reported by CMS since 2003.

Vaccination has made an important contribution to the reduction in prevalence of some other communicable diseases. In 2015, on average, Caribbean countries had achieved at least 95% vaccination coverage against polio; diphtheria, tetanus, and pertussis; and measles, mumps and rubella. The average coverage for the anti-tuberculosis vaccine, BCG, was 91%.

Viruses for which no effective vaccine exists continue to affect public health. Since 2009, when it was declared a Public Health Emergency of International Concern (PHEIC), H1N1 virus (also known as “swine flu”) has caused considerable illness in CMS, accounting for 17% of respiratory virus illness cases in 2014, 31% in 2015 and 20% in 2016. The three respiratory viruses with the most cases reported were (in descending order of numbers): RSV, H1N1 and H3 in 2014; H1N1, rhinovirus and RSV in 2015, and RSV, H1N1 and rhinovirus in 2016. Peak numbers of respiratory virus cases are in the first and last quarter of each year, reflecting greater travel and visitor arrivals at these times of year.
During the period 2014-2016, there were increased numbers of cases and outbreaks of acute gastroenteritis and food-borne disease pathogens reported by CMS. Since 2005, salmonella accounted for the largest number of reported cases of laboratory-confirmed food-borne disease, followed (in descending order of numbers) by ciguatera, campylobacter, shigella, norovirus and vibrio. In the 2014-2016 period there was a notable sharp increase in the number of cases of salmonella and ciguatera cases in 2014, campylobacter cases in 2015 and norovirus cases in 2015.

Anti-microbial drug resistant pathogens, have been reported in the Caribbean by hospitals and in community settings. Cases of drug resistance by the following pathogens have been identified: pneumococci, *Haemophilus influenzae*, multi-drug resistant *Mycobacterium tuberculosis*, Enterobacteriaceae and carbapenemase-producing bacteria.

**Determinants of health**

An ecological framework is used throughout this report to describe the determinants of health, at three main levels: individual/behavioural; social/environmental, and structural.

Individual/behavioural determinants have been identified in numerous Caribbean studies, including Stepwise Approach to Surveillance (STEPS) surveys of NCD risk factors, conducted in CMS since 2006. The STEPS surveys showed:

- A wide range in levels of smoking between countries, with a common feature being far higher levels among men than women.
- Rates of harmful use of alcohol ranging from 15% to 48% among men and 3% to 35% among women.
- Low levels of physical activity, ranging from 35% to 63% among women, and 15% to 45% among men.
- Average consumption of fruit and vegetables reported to be far below the recommended amount of five servings per day for both men and women in all countries.
- More than half of women are overweight in all countries, and more than 30% of women are obese in all countries. Levels of overweight and obesity were lower but substantial among men.
- Raised blood pressure affect between 18% and 50% of men and between 16% and 35% of women.

Social and environmental determinants impacting on health are many, and some are specific to health conditions of concern. General determinants include low levels of social inclusion and access to facilities such as health care, education, housing, and sanitation based on poverty and discrimination. For example, these are associated with greater exposure to pathogens, environmental toxins, extreme weather, and consumption of harmful products. Improving environments in which people make choices, for example school meals facilities and the foods available in them, can improve health. Social and environmental determinants relating to VBD and CO are presented in detail in chapters 3 and 4.
Socioeconomic and environmental factors at the local level are influenced by political, economic, and environmental conditions and decisions at global and national levels. Among important structural factors affecting the health of Caribbean people are import dependency, a narrow range of exports (notably tourism), macroeconomic and trade policies, high levels of travel and migratory flows, and climate change.

Public health action

The Caribbean has a long tradition of institution-building for public health across the region. For instance, a regional institution for medical research was established as early as 1955 and continues as part of CARPHA today. CARPHA began operation in 2013, and merges five regional institutions previously working on public health in the region: the Caribbean Environmental Health Institute, the Caribbean Epidemiology Centre, the Caribbean Food and Nutrition Institute, the Caribbean Health Research Council, and the Caribbean Regional Drug Testing Laboratory.

The Caribbean has benefited from the development of inter-governmental agreements, declarations and initiatives which respond to regional needs and supplement those of hemispheric and global agencies. Regional frameworks include, among others, the Caribbean Cooperation in Health (CCH) frameworks (since 1984) and the Port of Spain Declaration on Non-Communicable Diseases (2007).

An evaluation of the third in the series of CCH agreements, CCH III (2010-2015), was published in 2016. The CCH III had contributed to advances in regional cooperation, such as: maintaining success in high-levels of vaccination coverage while decreasing communicable disease transmission; continued progress towards implementing commitments towards the prevention and control of NCDs; building capacity of Human Resources for Health and laboratory services and improving the safety of hospitals. Remaining challenges include, among others, difficulties in monitoring and evaluation given human resource scarcity and complexity of indicators, and lack of a communication strategy across sectors to increase stakeholder knowledge and bring them on board with CCH.

Evaluations completed by CARICOM Member and Associate States from 2012 to 2016 revealed variable success in implementing provisions of the Port of Spain Declaration on Non-Communicable Diseases (2007). by 2016, most had a national NCD policy, strategy or action plan that integrated NCDs and risk factors as well as a budget or allocated funding; Caribbean Wellness Day multi-sectoral, multi-focal celebrations; and had conducted risk factor surveys. Notably, nutrition-related action was much less frequently implemented, such as: policies to reduce salt, limit saturated fats and eliminate trans fats and increase fruits and vegetables; Ministry of Health presence during negotiations on food security; implementation of WHO recommendations on the marketing of foods and beverages to children, and front-of packaging labelling for easy identification of unhealthy foods.

A qualitative evaluation of implementation of the Port of Spain Declaration began in 2014 and is ongoing, led by the University of the West Indies in collaboration with regional and international health agencies. Unpublished findings thus far suggest that: implementation of recommendations was more likely with elements where the action needed, and timeframe are clear including activities such as hosting Caribbean Wellness Day. Facilitating structures and resources should be put in place,
facilitated by people at the highest levels of government, and coordinated intervention from relevant CARICOM agencies is needed on nutrition-related action.

During the 2014 - 2016 period some major communicable disease emergencies in the Caribbean, with threats from Ebola, chikungunya and Zika. Actions taken to address these emergencies strengthened institutional capacity for regional health security. No cases of Ebola were detected in the Caribbean over the 2014 - 2016 period, but the epidemic that started in West Africa in December 2013 required massive mobilisation to mitigate the threat because of its severity. Following the WHO’s declaration of Ebola as a PHEIC on August 8, 2014, CARPHA launched public education activities and established an Incident Management Team and hosted virtual meetings at least twice a month with Chief Medical Officers, Epidemiologists, and Laboratory Directors. Rapid assessments were carried out in CMS, using the International Health Regulations Core Competencies framework to assess preparedness with respect to aspects such as coordination, isolation facilities, transport of people and samples and skills in use of personal protective equipment. Training and equipment were provided, and a Regional Coordinating Mechanism on Ebola was established on November 4th, 2014. This was later renamed the Regional Coordinating Mechanism on Health Security, building on the experiences of addressing the Ebola threat to develop further the health security mechanisms of the Caribbean.

Conclusion

In the 2014- 2016, period, the PHEIC around Ebola was accompanied by new disease burdens in addition to the rising costs from chikungunya and Zika. These led to unprecedented measures to strengthen regional health security cooperation and infrastructure in infectious disease management. During the same period, the hurricane seasons demonstrated our ongoing and increasing dangers associated with climate change. Longer-term and systemic health challenges accompanied during environmental crises including a rise in respiratory and food-borne diseases, especially those not covered by vaccination, demonstrate the continued vulnerability of the public to environmental conditions and travel of goods and people. Health related impacts of HIV, accidents, and violence are examples that incur some of the costs in social divisions, stress and conflict. NCDs link global issues such as the distribution of food production and access, and individual behaviour such as dietary choices.

Agencies collaborated over the 2014- 2016 period to respond to the abovementioned crises. CARPHA strengthened alliances from the five regional health agencies from which it was formed, as well as other agencies concerned with public health ensuring that multi-sectoral approaches are used to address health including structural, social, environmental, behavioural and individual factors.
Introduction

As indicated by the ecological model above, health in a country or region is subject to a wide variety of internal and external forces. Some key internal characteristics and external policy factors have been presented. Before looking at features of health in the Caribbean, it is helpful to frame them with a consideration of models that seek to explain health transitions and the pattern of health conditions likely to occur under developmental conditions. We now examine such models and go on to look at patterns and trends in mortality, non-communicable diseases (NCDs) and communicable diseases. A final section of this chapter looks at evaluation of public health actions taken in response to the patterns and trends identified.

2.1 Transitions: epidemiologic, demographic and nutritional

Epidemiologic transition describes changes in mortality and morbidity patterns within and between countries. The main aspects are a decline in mortality, an increase in life expectancy, and a shift in the leading causes of morbidity and mortality from infectious and parasitic diseases to non-communicable, chronic, degenerative diseases. This transition is believed to result from improved economic conditions, medical care, an ageing population, public health interventions (e.g. vaccination programmes) and advances in nutrition and sanitation and health.

Demographic transition occurs when there is a shift in patterns of population ages usually resulting from periods of high fertility and high mortality to low fertility and low mortality. Nutritional transition can be described as the shift from malnutrition to that of an overabundance of food leading to obesity. As such epidemiologic transition is linked to demographic and nutritional transitions (Adogu, Ubajaka, Emelumadu, & Alutu, 2015; McKee, Karanikolos, Sim, & Pomerleau, 2011).

In 2016, the majority of the CARICOM Member States are classified by the UNDP as High Human Development countries with the exception of Guyana (Medium Human Development) and Haiti (Low Human Development) (UNDP, 2016). Thus, the range of population pyramids found with the Caribbean mirror those of both the developed and the developing worlds. For example, Barbados is classified as a high development country and Haiti as a low development country. The following figure demonstrates the population pyramids for “developed” and “developing’ countries.
The following figure shows projected population pyramids for 2017 of Barbados and Haiti respectively. Haiti’s pyramid shape suggested that it is at an “early stage” and that of Barbados that it is at a “later stage” in such a transition. That these are both countries in the Caribbean region demonstrates the enormous variability in demographic conditions and associated challenges in the region. The relative youth of Haiti’s population exposes it to risks of infectious disease, sexually transmitted disease, accidents, and violence. High prevalence of NCDs is associated with Barbados’ relatively old population.

Abdel R Omran is thought to be the founder of epidemiological transition theory in his often-cited paper in 1971, where he stated that, “Conceptually the theory of epidemiologic transition focuses on the complex change in patterns of health and disease and on the interactions between these patterns.
Omran's paper has been subsequently adapted, adopted, and critiqued but is still important as it gave a framework to the concept of transitioning populations thereby stimulating further enquiry (Caldwell, 2001; McKeown, 2009; Sastre, Rojas, Cyrus, De La Rosa, & Khoury, 2014).

Omran's theory of epidemiologic transition consisted of five propositions. Firstly, the theory states that mortality is a fundamental factor in population dynamics. A period of declining mortality is usually followed by one of declining fertility. The combination of lower birth and death rates as well as higher life expectancies results in a change in the population age distribution. Section 1.2. gives a demographic overview of CARPHA Member States and the demographic transition to an increased elderly population (over 65 years old) coupled with a shrinking younger population (under 14 years old). Secondly, during the transition, a long-term shift occurs in mortality and disease patterns whereby pandemics of infection are gradually displaced by degenerative and man-made diseases as the chief form of morbidity and primary cause of death. Thirdly, during the epidemiologic transition, the most profound changes in health and disease patterns are among children and women. This is characterised by declining infant and maternal mortality and a resultant drop in fertility. Fourthly, the shifts in health and disease patterns that characterise the epidemiological transition are closely associated with the demographic and socioeconomic transitions that are associated with modernisation. This is characterised by lowered fertility and longer intervals between births, improved socioeconomic status leading to better nutrition and sanitation resulting in decreased morbidity and mortality (McKeown, 2009; Omran, 2001).

These epidemiological changes have an enormous impact on public health planning, health care provision, and health care workforce development including political, social, and financial policies. For example, in countries such as Barbados which is a high development country, (as with most of the Caribbean), Figure 8 demonstrates a growing aging population, and a falling working population (15-65 years old) and younger population (0-14 years old). From an economic perspective, the growing population of the elderly will consume a disproportionate amount of health care costs, particularly for continuous treatment and care of NCDs and other debilitating conditions. Such a population has reduced potential for economic income. At the same time there appears to be a decline in numbers of young people to move into the workforce.
Limitations to Omran’s theory include the fact that it assumes a single trajectory of development. It ignores the history of colonial relationships between countries, whereby diversification of the economy may be stalled, and poverty worsened. It neglects global interdependencies and economic cycles of expansion and contraction. All of these affect living standards, availability of foodstuffs, health care and consumption patterns, and therefore health (Allen, 1999). The model provides a limited account of the roles of poverty and education in affecting disease risk. It has been observed that many “developing” countries now struggle with a “double burden” of high numbers of infectious diseases and NCDs. In sub-Saharan Africa, for example, prevalence rates for type 2 diabetes and cardiovascular diseases have seen a 10-fold increase in the past 20 years, while countries continue to suffer high death rates from communicable diseases (Adogu et al., 2015).

A further issue that has subsequently arisen is that the difference between infectious diseases and chronic diseases is not clear. For example, some infectious diseases have the characteristics of chronic diseases, especially with the emergence of life-prolonging treatment, such as HIV.
Additionally, some infectious agents and related inflammatory processes play a role in chronic disease outcomes e.g. Human Papilloma Virus is associated with development of cervical cancer. (Caldwell, 2001; McKeown, 2009). Thus, acute infections of short duration are accompanied by infections with long-term consequences, adding to health care costs.

For historical and geographical reasons, the Caribbean is highly open to global influences. Globalisation has not favoured all members of the population, and levels of unemployment and poverty are high (Rawwida Baksh and Associates, 2016). Poverty and geographical/climatic factors are associated with epidemics of CDs. At the same time, the long-term expansion in Caribbean economies, increase in the availability of imported processed food, urban living with reduced green spaces and unhealthy eating have increased NCDs, leading to the “double burden” of CDs and NCDs (Adogu et al., 2015). The Caribbean region has also been undergoing a nutritional transition and is one that faces a dual burden on under- and over-nutrition. The prevalence of low birth weight remains between 4% and 11%, and between 28% and 35% for overweight/obesity among children 4-20 years old in the Caribbean (CARPHA, n.d.-b).

2.2 Mortality

Mortality patterns presented in this section suggest that epidemiological transition has taken place, as they are dominated by NCDs. At the same time, they present the “double burden” of developing areas of the world, with communicable diseases also among top ten causes of death. High prevalence of injuries brings a third burden to these vulnerable societies. There are notable differences by sex, suggesting the need to pay attention to gender in the design of health promotion strategies.

CMS report annual cause of death data to CARPHA. These data are typically presented by age, gender and underlying cause of death (UC). The UC refers to the train of morbid events leading directly to death or the circumstances of the incident (the external cause) that produced the (fatal) injury. The UC is the primary target for disease prevention and control.

The analyses that follow in this section should be prefaced by the observation that several CMS have not kept their reporting to CARPHA up-to-date. Since 2010, the percentage of countries submitting their reports has been no larger than 80%. Data for the 2014-16 period represents no more than 60% of countries, and the data for those years should therefore be treated with caution especially for 2016 since so far only 4 countries (16.7%) have reported their figures on mortality for that year. Given the lower reporting for recent years, it is important to present longer term trends so that the less representative recent data can be placed in the context of more representative figures. In the analyses that follow, trends are shown from 2000 until 2016, and more recent data appears to reflect the pattern of earlier years, and still permits some trends to be detected.

Over the seventeen-year period 2000 to 2017, 21 CMS reported 579,215 deaths. Of these, 318,306 (55%) occurred among males and 260,909 occurred among females (45%). In all age groups except

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3 The 21 CMS are: Anguilla, Antigua and Barbuda, Aruba, Bahamas, Barbados, Belize, Bermuda, Cayman Islands, Curacao, Dominica, Grenada, Guyana, Jamaica, Monserrat, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Suriname, Trinidad And Tobago, Turks And Caicos Islands and UK Virgin Islands.
1-4 years and 65+, there were more male than female deaths. Similar percentages of males and females died in the 1-4 age group, while the disparity between the sexes was far wider in the age group representing senior citizens. Sixty-five percent of female deaths were in the 65+ age group, while only 53% of male deaths occurred in this age group. Put another way, there were 19% fewer male than female deaths in the age group representing senior citizens (Figure 9 and Table 4).

**Figure 9: Age and sex distribution of total reported deaths for the English- and Dutch-Speaking Caribbean, 2000-2016**

Source: CARPHA
Among males, then, deaths occur on average at an earlier age than among females. In childhood, the difference between the sexes is small. However, among adults until the usual retirement age of around 65 there are wide gender disparities. These are at their widest among youth aged 15-24, where there are 92% more male than female deaths. The disparity tails off as people get older, with a 49% gender gap in the 25-44 age group and a 24% gender gap in the 45-64 age group. Evidently, Caribbean males are at risk from dying young, and they are at greatest risk relative to females in their late adolescence and early adult years. While the gender gap is smaller in later adulthood, the numbers are larger, indicating the need to pay attention to gender-related behavioural and other possible risk factors throughout adulthood.

### 2.2.1 Top Causes of Regional Mortality

Since the beginning of the 21st Century, Non-Communicable Diseases (NCDs) have been the leading causes of death. They accounted for three-quarters (73%) of deaths in the 2000 to 2016 period. This percentage fluctuated between 69% and 77% with no clear trend. Communicable, Maternal, Perinatal and Nutritional Conditions accounted for 13.2%, Injuries for 9.7%, and Symptoms, Signs and Ill-defined Conditions for 4.1%.

A striking finding is the increase in injuries as a cause of death. These accounted for 5% of deaths in 2000 and 10% in 2015. There was a jump from 7% to 12% in 2004-2005 and since 2005, the average contribution of injuries to total deaths has been 11%. This will be explored further when looking at causes of death by age group and sex.
In the analyses of leading causes of death, those classified as 'Symptoms, signs and ill-defined conditions' or 'Other' have not been included. Underlying causes of deaths are grouped using the 'Standard list for leading causes of death' (Becker, Silvi, Ma Fat, L’Hours, & Laurenti, 2006).

Figure 11 shows trends in the leading causes of death from 2000 to 2016, along with information on the percentage of countries reporting mortality data. The three leading causes of death are NCDs, with diabetes increasing in importance over the period and becoming the leading cause of death in 2010 and 2011. Collectively, cerebrovascular disease, diabetes and ischemic heart disease account for 29.6% of all deaths for the period. Hypertension – a risk factor for other diseases as well as a cause of death in itself - was the fourth leading cause of death.

HIV started the 21st century as the fourth leading cause of death in CMS, but over the years its rank has declined along with its contribution to the death toll. By 2007 its contribution was roughly equal to that of prostate cancer, influenza and pneumonia, heart failure and complications and ill-defined heart disease, and perinatal conditions. Reasons for the decline in HIV mortality will be examined in section 2.3.7. The following charts present causes of death by age group and sex, enabling a more precise analysis of population groups and conditions where attention should be focused.
Figure 11: Leading causes of death as percentage of all deaths, and percentage of CARPHA Member States reporting cause of death data, 2000-2016
We now turn our attention to causes of death at different points in the life course.

Among babies less than 1 year of age, conditions originating in the perinatal period are the predominant cause of death, accounting for 13,891 deaths reported to CARPHA over the seventeen-year period. Malformations, deformations, and abnormalities account for 3,042 reported deaths. Infections (influenza, pneumonia, intestinal, septicaemia and meningitis) are small as regards cause of death but are striking given the availability of treatment for acute infections, such as antibiotics. That some babies are killed by accident or by assault is shocking. There are small but notable differences by sex in each UC category.

**Figure 12: Top 10 underlying causes of death by sex among infants less than 1 year old (2000-2016)**

In the infant 1-4 age group, numbers of deaths are smaller than among babies (see Figure 12 above on age and sex distribution of total reported deaths). In this age group, malformations, deformations and abnormalities are the number one cause of death, accounting for 685 reported deaths: fewer than among babies under 1 year of age. As in the under 1 age group, more girls than boys died from this cause. Conditions originating in the perinatal period continued to account for substantial numbers of deaths, causing 385 reported deaths among 1 to 4-year olds. HIV was the third leading cause in this age group, accounting for 312 reported deaths over the period, compared with 245 in total for babies under one year of age. Trends would be needed to ascertain whether HIV has declined as an infant cause of death over the period since the introduction of programmes of prevention of mother-to-child transmission. We continue to see infections as causes of death, and accidental drowning and transport accidents as important public health concerns among young children. We also see cancer (neoplasm) emerge as a leading cause of death in children.
Among older children aged 5 to 14, accidents emerge as leading causes of death, and kill more boys than girls. Land transport accidents accounted for 643 reported deaths and accidental drowning for 305 reported deaths. The latter suggest a need for swim training covering Caribbean children and adolescents. Cancer of lymphoid, haematopoietic and related tissue emerge as the third leading cause of death, with 275 cases. Adding to the importance of injury as a cause of death among children, there were 243 deaths from assault, 171 from intentional self-harm and 141 from events of undetermined intent.
Figure 64: Top 10 underlying causes of death by sex among children 5 to 14 years old (2000-2016)

As noted above, there are many more male than female deaths in the youth age group 15-24. Youth are also the group most susceptible to death from accidents and violence. Among youth, there were 4,840 deaths reported from assault. Nine in ten assault deaths were among young men (89.2%). Male youth also accounted for three-quarters of land transport accidents (78.7%), and events of undetermined intent (79.7%), and nine in ten cases of accidental drowning and submersion (90.2%) and non-intentional firearm discharge (90.6%). While intentional self-harm (suicide) accounted for a greater proportion of young women than of young men, in terms of numbers there were more male than female deaths from self-harm (66.7% of self-harm deaths were among males).

HIV/AIDS was the leading cause of death among young women, and 55.4% of youth deaths from HIV disease were among them.

The data demonstrate the importance of addressing violence and accidents with special focus on male youth. For youth as a whole and especially for young women, there is a need to focus on behavioural and social environmental risk factors for HIV. Cancers, cerebrovascular and hypertensive disease also emerge among the top causes of death in this age group.
Among adults 25-44 years old, the leading causes of death were HIV and assault. HIV was the leading cause of death for women, and assault the leading cause for men. There were far more deaths among men overall in this age group. The number of reported HIV cases among men actually outnumbered those among women: 7,158 and 4,814 respectively, or 59.8% male. Again, accidents and violence caused far more deaths among men than women. Of 9,223 deaths reported from assault, 89.3% were among men. Land transport deaths were 83.9% male and intentional self-harm deaths were 82.6% male. In this young adult age group, we see five NCDs among the leading causes of death: ischemic heart diseases, diabetes, cerebrovascular diseases, hypertensive diseases and cirrhosis and other diseases of the liver.
Among adults aged 45-64, NCDs account for 8 out of 10 of the leading causes of death. Diabetes was the leading cause for women, while ischemic heart disease was the leading cause for men. Liver, breast and lung cancer are among the top 10. In this age group, HIV cases are mostly among men (68.9%).
In the 2000-2016 period, among elders (65+), where most of deaths occur, NCDs accounted for 6 of 10 leading causes of death. Women account for the majority of the top 2: 55.4% of cerebrovascular deaths and 59.7% of diabetes deaths. Prostate cancer is a leading cause of death among men. Infections, notably influenza and pneumonia, take significant numbers of lives of older people.
We see that NCDs and injuries are prominent among adults as causes of death. Over the 16-year period studied, HIV led to more deaths than any other communicable disease (CD). Other CDs were especially important as causes of death among infants, children and elders.

### 2.2.2 The burden of NCDs, injuries and HIV: premature mortality

While knowing the number of deaths due to a particular disease or condition is important, so too is the age at which those deaths occur. Here we look at age of death in three ways. First, an overall picture of deaths in people under the age of 65, which can be regarded as “premature mortality”.

Secondly, the number of potential years of life lost (PYLL) through premature mortality to get a better sense of the impact a given disease or condition has on the health of a country’s population. PYLL per 100,000 population are calculated using the latest mortality data from each country and the latest population data (from censuses and mid-year population estimates) and are measured relative to average life expectancy of 72.5 years. Underlying causes of deaths are grouped using the Global Burden of Diseases (WHO, 2004).

Thirdly, specific trends in age at death among people with HIV, which may indicate success in slowing or halting HIV disease progression,
The following figure summarises recent information on leading causes of deaths among people under the age of 65, which may be regarded as premature. NCDs are prominent causes of early deaths, indicating a need to focus on underlying risk factors at early ages (PAHO & CARICOM, 2006). Violence and injuries account for substantial proportions, especially among males. There is a need to focus on underlying causes, such as crime and mental health, as critical public health concerns (Moat & Yearwood, 2015). Since the chart is based on the most recent year of data available, it shows that HIV remains important, ranking third for women and second for men as a cause of early death.

Figure 11: Premature mortality: leading causes of death in people under the age of 65, based on the most recent year of data available

Most recent year of data available: 2007 – Curacao; 2010 – British Virgin Islands; 2011– Jamaica, Trinidad and Tobago; 2013 – Barbados Cayman Islands, Guyana; 2014 – Bahamas, St. Lucia, Suriname; 2015 – Aruba, Belize, Bermuda, Dominica, St. Kitts and Nevis, St. Vincent and the Grenadines, Turks and Caicos Islands; 2016 – Anguilla, Antigua and Barbuda, Grenada, Montserrat

PYLL data are presented by sex, since, as shown above, gender seems to be a critical factor in determining patterns of mortality.

For adolescent girls, PYLL are lower than the other age groups, but it is striking to note that the leading cause of premature mortality among them is injuries. This may reflect violence against women and girls and the rising toll of road traffic and other accidents.
The 25-44 age group accounts for the highest rates of PYLL from communicable, maternal, perinatal and nutritional conditions, possibly reflecting HIV since this is the age group with highest HIV mortality in the Caribbean.

Among women 25-64, NCDs are the major cause of premature deaths, with this peaking in the older adult age group. Overall, the data suggest the need to direct health promotion on NCDs towards girls and women at a young age to prevent premature death.

Looking at data for males, the high prevalence of injuries is immediately apparent, especially among youth and adults under the age of 45. Among male youth, the PYLL rate is 7316, as compared with a rate of 1251 among female youth.

PYLL from communicable, perinatal, and nutritional conditions are also higher among men than women, but only from age 25 onwards. In the 25-44 age group, men's PYLL exceeded women's by around 30% (male/ female ratio of 1.31) while in the 45-64 age group it was twice as high among men (male/female ratio of 1.99).

Men also experienced greater PYLL from NCDs, which far outstripped the other causes in the 45-64 age group. The male to female ratio was 1.35 in the oldest 45-64 age group and 1.49 in the youngest 15-24 age group, while the PYLL was roughly the same in the middle age group 25-44 (male/female ratio 0.98).
One of the striking findings so far has been the importance to mortality of injuries in the Caribbean, and especially injuries to men. The following diagrams illustrate this further by examining data on PYLL from road traffic accidents and assaults. In each age group, PYLL from land transport accidents and assaults are several-fold higher among men than women. Assaults cause more deaths than traffic and road accidents for both sexes, but the differences are far larger for men.
Figure 122: PYLL by sex per 100,000 population for Land Transport Accidents, CARPHA Member States

Figure 133: PYLL per 100,000 population by sex for Assaults, CARPHA Member States
NOTES ON SOURCES OF DATA: Same as for PYLL charts above. Assaults refer to deaths classifiable to ICD-10 codes X85-Y09. Land transport accidents refer to deaths classifiable to ICD10 codes V01-V89.

Murders, assaults, and road traffic accidents appear almost daily in the newspapers of many Caribbean countries. The data we have presented show them to be a major public health concern as well as a social scourge. Alliances between health, security and law enforcement agencies are needed, especially to reduce injury mortality among men, which may be linked to a number of social ills such as the illegal drug trade, excessive alcohol consumption, and gang vendettas (UNDP, 2012).

It should be noted, however, that the data present a partial picture of the toll of accidents and violence as they do not include morbidity or indicate the incidence of violent acts. This shortcoming in showing the scale of violence against women and girls, which is less often fatal but is important in the pain and restriction in opportunities it causes. Violence against women and girls is most often perpetrated by someone they know, such as a partner, family member, family “friend” or neighbour. It may be physical, sexual or emotional. Only a minority of cases are reported to the police, and since a minority are fatal, they hardly appear in mortality data (Garcia-Moreno, Jansen, Ellsberg, Heise, & Watts, 2006). It should also be noted that in the Caribbean, some countries have higher rates of female deaths from assault, including homicide, than others.

UN Women is working with several Caribbean countries to improve the quality and quantity of data on violence against women and girls. In the absence of uniform indicators, it is remarkable that studies in several Caribbean countries have found that around one in three women is subjected to domestic or intimate partner violence at some time in their lives (Allen, 2011, 2012; Jones, Da Breo, Trotman Jemmott, Joseph, & Moller, 2017).

To assist in guiding countries on public health strategies to address violence, CARPHA has engaged policy-makers and experts in dialogue and produced an evidence brief (Ciurea, Moat, & Yearwood, 2015; Moat & Yearwood, 2015).

HIV remains a leading cause of death. The following chart shows the distribution of HIV deaths between age groups reported to CARPHA since 1995. The modal age group for HIV deaths was 35-39, and the chart demonstrates that HIV has killed many at the peak of their productive and reproductive lives. It has therefore brought substantial costs in terms of lost economic production and the loss of parents and other young caregivers (La Foucade, Ewan, Theodore, & Beharry, 2004; Theodore & La Foucade, 2001).
There is evidence, however, that the situation is improving. The following chart shows that over time, the average age at death from HIV has increased. Since 1996, when the age at HIV death hit a low of 30, it has risen, to reach age 50 on average by 2016. While 50 is still too early to die, the figures show success in extending the lives of people with HIV in the Caribbean. This will be explored further in section 2.3.7.
2.3 Non-Communicable Diseases

The ecological framework presented in section 1.4 suggests that determinants of health are to be found at the individual/behavioural, social/environmental and structural levels. In this section, we present evidence on each of these levels as they relate to NCDs. Further detail of some factors at each level will be provided in Chapter 4, which concentrates on childhood obesity.

2.3.1 NCD risk factors

Studies of risk factors for NCDs have focussed mainly on individual behaviours. Those looking at the general population are presented here, while Chapter 4 looks at the behaviours of children that are associated with obesity.

To help meet the enormous challenge of NCDs outlined above, the WHO and CARPHA have collaborated with CMS to conduct a number of risk factor surveys using the Stepwise Approach to Surveillance (STEPS) methodology. These were conducted with adults between 2006 and 2016. They were designed to assess the prevalence among men and women of risk factors that have been shown to be associated with NCDs, such as smoking, alcohol consumption, physical activity, consumption of fruit and vegetables, overweight and obesity, waist circumference and raised blood pressure. As such they provide pointers as to areas appropriate for health promotion interventions in each country.

Table 5: Risk factor surveys completed in CARPHA Member States using the WHO STEPS methodology with technical support provided by CARPHA (2006-2016)

<table>
<thead>
<tr>
<th>Country</th>
<th>Survey Year</th>
<th>Target Age Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aruba</td>
<td>2006</td>
<td>25-64</td>
</tr>
<tr>
<td>Barbados</td>
<td>2007</td>
<td>25+</td>
</tr>
<tr>
<td>Dominica*</td>
<td>2008</td>
<td>15-64</td>
</tr>
<tr>
<td>St. Kitts</td>
<td>2008</td>
<td>25-64</td>
</tr>
<tr>
<td>British Virgin Islands</td>
<td>2009</td>
<td>25-64</td>
</tr>
<tr>
<td>Grenada</td>
<td>2011</td>
<td>25-64</td>
</tr>
<tr>
<td>Trinidad &amp; Tobago</td>
<td>2011</td>
<td>15-64</td>
</tr>
<tr>
<td>Bahamas</td>
<td>2012</td>
<td>25-64</td>
</tr>
<tr>
<td>Cayman Islands</td>
<td>2012</td>
<td>25-64</td>
</tr>
<tr>
<td>St. Lucia*</td>
<td>2012</td>
<td>25-64</td>
</tr>
<tr>
<td>St. Vincent &amp; the Grenadines</td>
<td>2014</td>
<td>18-69</td>
</tr>
<tr>
<td>Bermuda</td>
<td>2014</td>
<td>18+</td>
</tr>
<tr>
<td>Anguilla</td>
<td>2016</td>
<td>18-69</td>
</tr>
<tr>
<td>Guyana</td>
<td>2016</td>
<td>18-69</td>
</tr>
</tbody>
</table>

*Response rates too low for survey results to be considered nationally representative
The surveys showed a wide range in levels of smoking between countries, with a common feature being far higher levels among men than women. This applies to both current smoking and daily smoking.

**Figure 166: Prevalence of current smokers and current daily smokers**

Drinking alcohol is likewise more common among men than women. Greater percentages of Caribbean populations drink than smoke.
Harmful use of alcohol is also much higher among men than women, except in St. Kitts and Nevis. In Anguilla, Bermuda, Guyana and St. Vincent and the Grenadines, a more stringent definition of harmful use was used, resulting in lower estimates for those CMS.

The alcohol and smoking data show that men are more involved in the consumption of harmful substances than women. This may also extend to illegal drug consumption, though this is intrinsically hard to measure and was not included in the STEPS surveys. The consumption of harmful substances may be associated with the high prevalence of accidents and violence among men.
Figure 28: Harmful use of alcohol

NOTE: Definitions of harmful use of alcohol differed by country. For Aruba, Bahamas, Barbados, British Virgin Islands, Cayman Islands, Dominica, Grenada, St. Kitts and Nevis, St. Lucia and Trinidad & Tobago, the definitions were: Females having ≥ 4 drinks on any day in last week, and Males having ≥ 5 drinks on any day in last week. For Anguilla, Bermuda, Guyana and St. Vincent & the Grenadines, the definitions were: Females or Males (having ≥ 6 drinks on any occasion in the past 30 days).

Levels of physical activity vary widely between countries, with those of men almost always exceeding those of women. In nine countries, more than half of men were highly physically active. On the other hand, in three countries, more than half of women reported low levels of physical activity.
In all countries, average consumption of either fruit or vegetables is far below the recommended amount of five servings per day. In this case, the gender differences are negligible, indicating that poor levels of consumption of fruit and vegetables apply regardless of gender.
In the Caribbean, there has been a growing rise in obesity and diet-related NCDs over the last five decades. Over 60% Caribbean adults are overweight and over 30% are obese. In some CMS overweight and obesity prevalence rates exceed over 80% and over 50% respectively. More women than men are overweight or obese in almost all countries.
Average waist circumferences are at or above the 35-inch mark for most countries. Two countries had male waist circumferences higher than those of females, with one of these having average male waist circumference size of over 40 inches. In other countries, often, female waist sizes are slightly higher than those of males.
An important risk factor for cardiovascular disease, raised blood pressure, is more prevalent among men than women, though by quite a small margin in most countries. In half of countries surveyed, more than 30% of men had high blood pressure.
The following figure combines information from the risk factors to present a composite measure of risk of NCD. Note that the surveys with a younger age range tended to show lower levels of risk. In Aruba and Grenada, overall risk was higher for men than for women, but the opposite was true in most other countries.
The risk factor data present an important counterpoint to mortality data, which tend to show more early deaths among men than women. The risk factors are somewhat more prevalent among women, though they tend to die less early than men. The risk factor data suggest that women are more likely to endure long-term illness from NCDs than men. However, men are more likely to use harmful substances, and this may be associated with the high prevalence of accidents and assaults among them, along with other consequences such as lung cancer and cirrhosis of the liver.
2.3.2 Environmental influences on NCDs

Features of the social environment affecting susceptibility to NCDs are many, including: cultural attitudes to body weight and shape; the influence of the media (including, increasingly, social media); parental, religious, educational and peer influence on exercise and eating habits; the local availability and price of fresh foods low in sugar and fat; the existence of “food deserts” where food choice is limited to processed food of low nutritional value, and the local accessibility of green spaces and exercise facilities. These will be explored in detail in Chapter 4 on childhood obesity. Here we present some of the physical environmental influences on NCDs.

There are several direct and indirect impacts of environmental factors on NCD. The human cardiovascular and respiratory systems are sensitive to temperature change, poor air and water quality, and chemical exposure. Thus, climate change and pollution affect susceptibility to NCD. The combination of dietary and exercise practices and external environmental factors can lead to metabolic stresses culminating in NCDs.

Environmental health and sustainable development approaches include the testing of foods and physical environments for toxins and other harmful substances, and legislative and practical action to remove and reduce these. They also include ensuring a safe environment to support wellness and well-being such as green spaces, parks, safe walking and biking paths, to encourage physical activity and mental wellbeing and thus prevent NCDs, and reducing the onset of some non-communicable diseases (Clauzel & Forbes-Robertson, 2017).

2.3.3 Regional Initiatives to address NCDs

Section 1.3, on health frameworks and institutions, provided information on ground-breaking Caribbean initiatives on NCDs, such as the Port of Spain Declaration and the establishment of the Healthy Caribbean Coalition. Some other important initiatives are highlighted below.

International Agency for Research on Cancer (IARC) Caribbean Hub

Cancer is one of the leading causes of mortality in the Caribbean (see section 2.2.1). The most common cause of cancer deaths among males was prostate (33.3%) and lung (14.1%), and among females, breast (21.8%) and cervical (11.0%) (Razzaghi et al., 2016). Mortality and morbidity rates from these cancers can be reduced and prevented through early detection, diagnosis, management and treatment. To do this successfully, as well as develop policies and evaluated strategies, timely and reliable epidemiological data are necessary.

In 2011, the Global Initiative on Cancer Registry Development (GICR) was launched in collaboration with the International Agency for Research on Cancer (IARC). Its aim is to improve population based cancer registries worldwide with the establishment of six regional reference centres including one in the Caribbean. The IARC Caribbean Hub is to be located at CARPHA. Key activities of the Caribbean Hub include building and sustaining the capacity for cancer registration throughout the Caribbean through technical training and support, promoting networking among cancer registries and encouraging research within the region (Global Initiative on Cancer Registry, n.d.).
Caribbean Wellness Day

One of the mandates of the 2007 Port of Spain Declaration was the establishments of Caribbean Wellness Day (CWD). CWD is held every year on the second Saturday in September. The aim is to increase awareness of NCDs in the Caribbean through multi-sectoral activities in support of wellness. The first CWD was held in 2008 and for the first four years, until 2011, the goal was to raise awareness of health issues in general via the event. In 2012, the focus shifted to preventing and controlling NCDs throughout the life course. In 2016 the theme was, “Healthy Children in Healthy Environments”, in light especially of the growing epidemic of childhood obesity in the region (Caribbean Public Health Agency, 2017a).

In 2016, progress in meeting the goal of the 2007 Port of Spain Declaration, including Caribbean Wellness Day, was evaluated (see section XX). It was found that CWD was observed in 19 CARICOM Member States, with more than half celebrating it every year and successful involvement of private sector and civil society. Regionally produced CWD material such as the slogan, logo, posters and fact sheets were often adapted by national civil society organisations and private sector participants.

CWD was found to be viewed more as a national than a regional initiative with typical activities such as health fairs, exhibitions, healthy eating demonstrations, sponsored walks, mass public exercise sessions and health screening. Several countries have extended events beyond a single day. For example, the Bahamas, Belize and Guyana celebrate Caribbean Wellness Week, and other countries such as Trinidad and Tobago have events throughout the whole month of September (Samuels & Unwin, 2016a). CWD has experienced global impact; the World Economic Forum and PAHO have...
embarked on promotion of “Wellness Week” inspired by the success of Caribbean Wellness (Samuels & Unwin, 2016b).

2.4 Communicable Diseases

The Caribbean has experienced an epidemiological transition, including a shift in the leading causes of morbidity and mortality from infectious and parasitic diseases to NCD. Nevertheless, infectious diseases persist, and we saw earlier that CD are among top causes of death for children and the elderly, indicating that they affect the most physically vulnerable the most severely. Given that substantial proportions of Caribbean people continue to live in poverty and suffer malnutrition, there remain many opportunities for severe consequences from infection. HIV remains a leading cause of death in some age groups.

Epidemics can spread rapidly according to climactic, travel and urbanisation patterns. Underlying all other circumstances is the sanitary conditions for disease transmission through contaminated water and food, poor air quality, poor waste disposal and opportunities for micro-organisms and vectors to proliferate. The impact of climate change appears to favour the resurgence of CDs. Increased rainfall in hot conditions will encourage the reproduction of pathogenic micro-organisms, mosquitoes and other insect pests. Periods of intense rainfall will also increase risks associated with flooding. On the other hand, increased heat in the dry season will reduce water availability and impact sanitation.

Some diseases may be treated with antibiotics, but there is evidence of increasing antibiotic resistance. Viruses are more difficult to treat, and in the case of HIV, have had massive public health and social consequences.

In this section, we examine respiratory and food-borne diseases, HIV, anti-microbial and anti-retroviral resistance, and Ebola, with a focus on what happened in the 2014-’16 period. We also examine the Caribbean public health response to CDs, including immunisation and health security measures. Notably, there was not a single case of Ebola in the Caribbean, but the public health mobilisation was massive, and strengthened the mechanisms for responding to public health emergencies. Responses to vector-borne diseases, notably chikungunya and Zika, which created a huge burden of illness on Caribbean societies from 2014-16, are the subject of the next chapter in this report.

2.4.1 Respiratory diseases

Respiratory diseases are very common among acute infections in the Caribbean. Chronic respiratory illnesses cause significant morbidity and mortality, with cancer of the lung, bronchus and trachea being among leading (top 10) causes of death among 45-64-year olds and chronic lower respiratory disease among leading causes for elders aged 65+. Influenza and pneumonia are among leading causes of death in the under 1, 1 to 4, 5 to 14 and 65+ age groups, indicating that children and elders are especially vulnerable. Tuberculosis has also staged a resurgence as a cause of illness in the region, often as a co-infection with HIV, and generally associated with outcomes of poverty, such as overcrowding, poor sanitation and low health expenditure per capita (Bergonzoli, Castellanos, Rodriguez, & Garcia, 2016; Geoghagen, Farr, Hambleton, Pierre, & Christie, 2004; Munayco, Mujica, Leon, del Granado, & Espinal, 2015; Rouzier, 2011b).
CARPHA conducts respiratory viral illness surveillance for the Caribbean. The following three charts show the pattern of respiratory viruses submitted and identified by CARPHA and the percentage confirmed positive over the years 2014, 2015 and 2016.

The beginning of 2014 saw an outbreak of H1N1 influenza, which dissipated by March 8th. There was a lull in the number of respiratory virus cases between around April 17th and September 13th. After this there were more cases until the end of the year, with rhinovirus, influenza A (non-subtyped), influenza A (H3) and RSV making substantial contributions to the total. The diseases with the most cases in the year were RSV (33%), H1N1 (17%), H3 (14%), influenza A (not subtyped, 9%) and rhinovirus (8%).

In 2015, until week 14 ending 4 April, there were a wide variety of respiratory viruses diagnosed, with 10 of the weeks seeing four or more viruses, and a peak in the week ending 7 March. Between 5 April and 27 June (week 26) there was a relative lull in number of infections detected. Rhinovirus was detected throughout the year, and there was a rise in the number of cases the week ending 4 July (week 27) and the week ending 24 October (week 43). There was an outbreak of H1N1 virus from around 3 October until the end of the year, with a peak in the week ending 31st October. The end of the year also saw relatively large numbers of cases of RSV. H1N1 saw the most cases in 2015 (31% of total), followed by rhinovirus (22%) and RSV (12%).

At the beginning of 2016 there were reports of many infections of various types, only tapering off around the end of May. Prominent among the viruses were H1N1, rhinovirus, influenza B and RSV. In the latter part of the year there was an uneven rise in cases, with the highest levels of infection in the week ending 5th November. Rhinovirus and H3 virus were common causes of infection. There were cases throughout the year, RSV (22%), H1N1 (20%) and rhinovirus (17%).
Figure 20: Distribution of influenza virus and other respiratory viruses by epidemiological week, 2014
Figure 21: Distribution of Influenza virus and other respiratory viruses by epidemiological week, 2015
Figure 228: Distribution of influenza virus and other respiratory viruses by epidemiological week, 2016
The following three figures look at influenza subtype distributions over the three years. We see that in 2014, H1N1 was the most widespread at the beginning of the year, while type A (H3) and A (not subtyped) made up the bulk of influenza cases later in the year.

There were two outbreaks of influenza of various strains in 2015. The smaller outbreak lasted until the week ending 28 March and included four subtypes. The larger outbreak started from around 4 September and was dominated by H1N1, which reached a peak in the week ending 31st October.

The relatively large number of H1N1 cases persisted into 2016, only easing off around the middle of May, and with a further peak between April 3 and 16. There were also relatively large numbers of influenza B cases in the first half of the year, and an outbreak of not-subtyped flu between 21 February and 7 May. Towards the end of the year, H1N1 emerged again and there was an outbreak of H3 virus.
Figure 239: Distribution of Influenza (types and subtypes) by epidemiological week, 2014

- A(H1N1)pdm09
- A not subtyped
- A not subtypable
- A(H1)
- A(H3)
- Influenza B

Number of positive cases

Percentage positivity

Epidemiological Week

% samples influenza positive
Figure 24: Distribution of Influenza (types and subtypes) by Epidemiological Week, 2015

- A(H1N1)pdm09
- A Not subtyped
- A Not subtypable
- A(H1)
- A(H3)
- Positivo Influenza B

- % positivos a influenza entre total de muestras
Figure 41: Distribution of Influenza (types and subtypes) by epidemiological week, 2016

- A(H1N1)pdm09
- A Not subtyped
- A(H1)
- A(H3)
- % positivos a influenza entre total de muestras
- % positivos a influenza B
2.4.2 Food-borne diseases

Increased food production, globalisation, travel, trade and the emergence of new or antibiotic-resistant pathogens are increasingly challenging food safety and security. These factors have brought increasing numbers of large outbreaks. The WHO adopted Resolution WHA 53.15 in 2002, establishing food safety and the surveillance, prevention and control of food-borne illness as priority in 2002 and again in 2010.

Globally, *Salmonella*, *Norovirus*, *Clostridium botulinum*, *Shigella*, *pathogenic Escherichia coli (E-coli)*, *Campylobacter*, *Vibrio cholera* and parasites are the most important human food-borne illnesses, among more than 250 food-borne diseases (FBDs) that have been described.

Since 1990, increasing numbers of reported cases and outbreaks of acute gastroenteritis and FBD pathogens have been reported to CAREC, then CARPHA. A Foodborne Disease Programme was established at CAREC in 2003. The purpose was to strengthen national and regional capacity to develop and sustain integrated surveillance, prevention and control systems. This integrated the epidemiological, laboratory, environmental and veterinary aspects of FBD surveillance into a coordinated programmatic approach.

CARPHA continues this integrated farm to table multi-sectoral approach to FBD surveillance. Challenges include variation in national surveillance systems for FBD in CMS, and in laboratory capacity. There are almost no CMS with a fully integrated FBD surveillance system that integrates human, food and animal surveillance data. Reporting frequency and completeness vary by country. Stool specimens are also not commonly collected from patients with acute gastroenteritis, significantly affecting the determination of the aetiology and prevalent FBD that cause human illness. This is perhaps the single most limiting factor for FBD surveillance in the Caribbean.

In 2014, with support from the Inter-American Development Bank, CARPHA set up an integrated surveillance system for the tourism sector, including the monitoring of FBD as one of the major areas of surveillance capacity-building.

*Food-borne disease trends 2005-2016*

The following chart show a fluctuating picture of laboratory-confirmed food-borne diseases reported to CARPHA since 2005.

- Salmonella accounted for the largest number of cases, with average 564 cases per year, peaking at 798 in 2010, and falling to a low of 297 cases in 2016. There were 639 salmonella cases and 405 in 2015.
- Ciguatera cases averaged 328 cases per year, ranging from 205 cases in 2009 to 444 in 2013, with 427 cases in 2014, 323 cases in 2014, and 285 in 2016.
- Cases of typhi fell dramatically from 805 in 2005 to 6 in 2008, and thereafter did not exceed 7 in any year.
- Shigella and campylobacter accounted for similar number of cases per year, with the average for shigella being 92 and that for campylobacter being 102. Shigella showed a downward trend while campylobacter showed an upward trend. Figures for shigella were 79, 52 and 30
for 2014, 2015 and 2016 respectively. There was a spike in campylobacter cases in 2015. Figures for campylobacter were 96, 377 and 68 in 2014, 2015 and 2016 respectively.

• Around a yearly average of 41 cases, there was a rise in the number of norovirus cases until 2012 when 178 cases were confirmed. Figures for norovirus were 19, 61 and 39 in 2014, 2015 and 2016 respectively.

• There was an average of 5 laboratory-confirmed cases of E-coli every year, ranging from 0 to 20. Figures for E-coli were 1, 0 and 8 in 2014, 2015 and 2016 respectively.

• Numbers of vibrio cases were very small, with a total of 3 cases over the period, in 2005, 2009 and 2015.

• Hepatitis A cases have only been reported since 2013, when 142 cases were reported. There were 71 cases in 2014, 72 in 2015 and 10 in 2016.

Figure 42: Reported Laboratory-confirmed Cases of Foodborne Diseases Pathogens, CARPHA Member States, 2005-2016
Laboratory confirmed salmonella cases by country for the years since 2013 are presented below. The highest numbers were in Guyana, Bermuda, Barbados and Belize, though cases were only reported in Belize for two of the years. which saw an increase from 71 to 81 cases over the period. Numbers of cases in Jamaica were small given the larger population of this country. Numbers of cases of salmonella did not exceed 29 in any other CMS in any year since 2013.

**Figure 4325: Reported salmonella cases by CARPHA Member State, 2013-2016**

<table>
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<tr>
<th></th>
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<th></th>
</tr>
</thead>
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<tr>
<td>Anguilla</td>
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<tr>
<td>Antigua and Barbuda</td>
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<td>Guyana</td>
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<td>St. Maarten</td>
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<td>St. Vincent and Grenadines</td>
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<td>8</td>
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<tr>
<td>Turks and Caicos Is.</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>9</td>
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</table>
2.4.3 Immunisation and Vaccine-Preventable Diseases

The Governments of the Caribbean Community (CARICOM), CARPHA and its predecessor CAREC and PAHO have been committed to supporting the WHO’s Expanded Programme on Immunization since its beginning in 1974. The objectives of the EPI programme in the Caribbean are:

- To achieve equity in the provision of vaccine services by achieving and maintaining >95% coverage for all antigens
- To maintain polio eradication status
- To maintain measles, rubella and congenital rubella syndrome elimination status
- To maintain and strengthen surveillance for Vaccine Preventable Diseases
- To advocate for the introduction of new and underutilized vaccines using an evidence-based approach.

CARPHA promotes and supports regional vaccination planning. Monitoring activities such as laboratory surveillance and implementation evaluation are key factors in which CARPHA is engaged.

Stock-outs caused by shipping problems have occasionally caused a drop off in coverage. Some municipalities within countries have lower rates of coverage. CARPHA continues to support countries in strategies to increase equitable access to vaccination.

Table 6: Vaccination coverage by antigen and by Caribbean country, 2015

<table>
<thead>
<tr>
<th></th>
<th>BCG</th>
<th>Polio</th>
<th>DTP3-cv</th>
<th>MMR1</th>
<th>Municipalities with DTP3 coverage ≥ 95%</th>
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<td>100</td>
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Key: n/a = not applicable; BCG = Anti-tuberculosis vaccine (Bacille Calmette-Guerin); Polio 3 = Oral polio vaccine or inactivated polio vaccine, third dose; DTP3-cv = Diphtheria-tetanus-pertussis containing vaccine, third dose; MMR1 = Measles, Mumps and Rubella, first dose.

Source: (Pan American Health Organization / World Health Organization, 2016)
The table above provides data for 2015, the latest available year. It shows that, on average, Caribbean countries have achieved at least 95% vaccination coverage against polio, diphtheria, tetanus and pertussis and measles, mumps and rubella. The average coverage for BCG was less than 95% and was pulled down by a rate of 38% in one country.

Of the nineteen countries listed, nine had not achieved 95% coverage for polio, seven had not achieved it for DTP and four had not achieved it for MMR. On the other hand, some countries achieved universal coverage: five for polio, six for DTP and five for MMR.

Within countries, 95% or greater coverage of DTP across municipalities was achieved by four countries. The range of rates of 95% coverage across municipalities varied widely by country, from as low as 10% through to 100%. Geographic coverage of vaccination is clearly a challenge in some countries.

2.4.4 HIV and AIDS: the story as told by CARPHA Member State data

Aggregate data on new cases of HIV, AIDS and AIDS deaths have been reported to one of CARPHA’s predecessor agencies, CAREC, dating back to 1982. Though the data received over this time-period vary in their completeness and, to some extent, their absolute accuracy, they paint a general picture of the development of the HIV pandemic, in the Caribbean region, over the last three decades.

It should be noted that Haiti is a relatively new CARPHA Member State and has not reported HIV data to CARPHA. Haiti is the largest CMS with relatively high HIV prevalence (Figueroa, 2008) and the absence of its data from this country reduces the overall numbers of HIV and AIDS cases reported by CMS considerably.

**General Trends**

*Figure 44: Reported HIV Cases and AIDS Cases, 1982 - 2015. All CARPHA Member States.*
Regionally, reported HIV Cases gradually increased from single digits, in the early 1980s to the early 2000s, peaking in 2007 with 4383 cases reported throughout the region followed by a gradual decline, which transitioned to an apparent precipitous “drop off” from 2011. (Figure 44). This data, however, must be interpreted cautiously. The completeness of reporting for the region achieved a plateau of 80-90% of CMS reporting annually, from the late 1980s through to 2008. After this, reports from CMS became more sporadic, with 60-70% of CMS reporting up to 2012, dipping further, to approximately 30-40%, over the last 3 years of available data. The rapidity of the decline in total new HIV cases in the database since 2008 is therefore largely an artefact of reporting. It is important to look at data from individual countries to find out whether incidence has declined; this is done later in this section.

Data on AIDS diagnoses in the region follows a similar pattern both in terms of numbers of cases and completeness of reporting. Initially more AIDS cases than HIV cases were diagnosed in the first 3 years of the pandemic, with HIV diagnoses eventually outpacing their more severe counterpart from 1985 to 1992. AIDS cases again outstripped HIV cases reported between 1993 and 2005, before finally falling behind from 2006 onward. A large gap emerged between the number of HIV cases and the number of AIDS cases reported from 2006, which could in part be explained by the success of widespread antiretroviral therapy (ART) use in reducing the number of AIDS cases. In 2010 adult ART treatment coverage in 23 Caribbean countries ranged from 57%-70% with a 29% increase from 2006 (Jack, Gebre, Del Riego, & Francis, 2012). In total, >69,000 cases of HIV and >62,000 cases of AIDS were reported to CAREC/CARPHA over the period 1982 to 2015.

Gender differences were noted in both HIV and AIDS reports, with men outnumbering women in almost all years of the epidemic. The “gender gap” narrowed considerably from 2003. Prior to that year, there were 20% or more male than female HIV cases every year. In 2003, there were 5% more male than female cases, and from 2006 until 2011, there were no more than 2% more. Small reporting numbers thereafter make it difficult to be confident in the male/female ratio. The evidence suggests a transition from concentration of HIV cases among men who have sex with men in the early days of the epidemic to a more generalized epidemic with substantial heterosexual transmission in more recent years (Allen, 2015; Bokazhanova & Rutherford, 2006; Cleghorn et al., 2000; De Groulard et al., 2000).
The proportion of AIDS cases that were already deceased at the time of diagnosis (Dx) declined only modestly over the past 3 decades from a high of 43% in 1984 to a low of 26%, in 2013 with significant fluctuations in the intervening years. This, to some extent, is reflective of the ongoing challenge of reaching infected persons at earlier stages to improve both their quality and duration of life. The fairly steady proportion of persons dead at AIDS diagnosis is evident in the following figure, as the “Number dead at diagnosis” graph remains largely congruent with the graph for total cases, throughout the time-period.

Figure 45: Total new male and female HIV cases reported by CARPHA Member Countries, 1982-2014

Figure 46: Total Reported AIDS Cases and total numbers of people dead at the time of AIDS reporting, 1982 - 2015. All CARPHA Member States
The seven most populous countries in the region contribute the vast majority (> 86%) of the total number of HIV cases, overshadowing reports from other smaller, though more numerous, territories. To appreciate the subtler differences in pattern that may exist between various CARPHA Member States (CMS), the region’s countries were sub-divided into three main groups:

i) the seven largest countries - Jamaica, Trinidad and Tobago, Guyana, Suriname, Belize, The Bahamas and Barbados;

ii) the CMS belonging to the Organisation of Eastern Caribbean States (OECS) – Antigua and Barbuda, Dominica, Grenada, St. Kitts and Nevis, St. Lucia and St. Vincent and the Grenadines;

iii) the United Kingdom’s Overseas Territories – Anguilla, Bermuda, the British Virgin Islands, the Cayman Islands, Montserrat, and Turks and Caicos Islands alongside the Dutch Islands, represented by two reporting loci – Aruba and Curacao and the remaining Netherlands Antilles which report the aggregated data from Bonaire, Saba, St. Eustatius

At the sub-regional level, gaps in the data, especially for the smaller CMS, become more evident. Jamaica only reported HIV and AIDS data for one year and this explains the absence of data from this country in the analyses that follow.

In several of the larger countries and OECS countries, a fall in the incidence of HIV shown in the following charts is apparent in the graphs below from around the 2006-2008 period. This suggests that the fall in numbers of HIV cases observed earlier in this section is not merely the result of lower reporting in later years. There is evidence that HIV prevention and control efforts are successfully reducing HIV incidence in the Region.
Figure 47: New HIV Cases per year in larger CARPHA Member States, 1982-2014
Figure 26: New HIV Cases per year in the Organisation of Eastern Caribbean States, 1982-2014
Figure 49: New HIV Cases per year in UK Overseas Territories, Aruba, Curacao & the Netherlands Antilles, 1982-2014
Reporting on HIV and AIDS

The collection of risk factor data for both HIV and AIDS diagnoses has been a perennial challenge for most CMS. Completeness of risk factor data collection varies by country and year.

**Figure 50: Completeness of Risk Factor reporting, and Number of Years HIV data reported. All CMS**

On average ~20% of HIV and ~36% of AIDS risk factor data were reported across the region for all member states, throughout the course of the pandemic. Some countries, notably some of the UK Overseas Territories (UKOTs) and some of the OECS islands maintained higher proportions completeness for risk factor reporting, but, in general no more than 6 countries achieved >50% completeness of risk factor reporting for either HIV or AIDS. These highlights systemic challenges in data collection for potentially sensitive, though epidemiologically important, data from patients and presents an opportunity for intervention in strengthening systems for strategic information across the region.

Variability in data completeness and in consistency of reporting both indicate that alternative approaches to collecting HIV and AIDS data may be of benefit. The significant decline in completeness of reporting in the last 5 years of data make it difficult to assess the status of HIV in the regions from the data currently available to CARPHA. Adjustments in data collection strategy have, however been proposed and supported by development partners working with the region in the field of strengthening country responses to HIV. The approach and inherent challenges therein are now outlined.
Changes in Reporting Strategy

International development partners (IDPs), including UNAIDS, PAHO, CDC and others, have, engaged in activities to improve the reach of prevention activities and the provision of care. Alongside this aid, has been the drive toward the collection of data more reflective of the treatment and care outcomes of Persons Living with HIV (PLHIV) in the region. While approaches have varied between IDPs, there has been regional and global consensus on the need to gather data on key aspects of healthcare systems’ responses to HIV. Among these, the elements commonly described as the Cascade of Care and Treatment (Gardner, McLees, Steiner, Del Rio, & Burman, 2011) have been emphasised as the sine qua non of current HIV reporting. The Cascade focuses on estimating numbers of PLHIV, using a mathematical model, and ascertaining what proportion PLHIV know their HIV Status; are initiated on Anti-Retroviral Treatment (ART); and achieve viral suppression. The target is to have 90% of PLHIV know their status, 90% of those diagnosed initiated on ART, and 90% of those on ART virally suppressed by the year 2020 (UNAIDS, 2017). An example of the treatment cascade is given below.

![Figure 271: Ideal HIV Treatment and Care Cascade](image)

There is additional interest in producing similar cascades for vulnerable subgroups in the population, e.g. Men who have Sex with Men (MSM) or Commercial Sex Workers (CSW), which would require the collection of near-universal risk-behaviour data, in order to generate reliable information for these Key Populations. Challenges exist, however in the collection of the data to supply the treatment and care (T&C) cascade information. Strategic Information systems in-country are not currently designed to produce outputs that match these requirements, leading to gaps in the resultant country "Cascades". Table 7 below highlights this challenge by reflecting the issues identified in a recent year of data provided from 14 CMS, in accordance with the newer, Cascade-related, reporting system. Several issues relating to missing data and queried data sources were identified, relating to the capacities of CMS health information systems, to collect and collate this data from disparate parts of the treatment and care system, in-country.
Ten of the 14 (10/14) reporting States had mathematical errors in the disaggregate data; 3 had no estimates of PLHIV; 3 had PLHIV estimates that equated to the number of people diagnosed, and therefore warranted further investigation; 3 had testing data that warranted a review of the data source; while 2 had no testing data at all; one country had viral suppression data that surpassed the number of people on treatment; and two other countries could not produce viral suppression data; finally, 6 countries were missing sub-group data for the pillars of the cascade.

This challenge has been the focus of CARPHA’s Strategic Information (SI) and Monitoring & Evaluation (M&E) teams over the past 3 years, with a view to building sustainable systems, in-country, for the collection and processing of all the data needed to drive the production of the treatment and care cascades and inform decision-making on the areas of focus needed to strengthen national and regional response to HIV.
2.4.5 Anti-microbial and anti-retroviral Resistance

Antimicrobial Resistance (AMR) has been highlighted by WHO as a growing global concern. In the Caribbean, infections due to resistant pathogens have been reported by hospitals and in community settings. There have been reports of penicillin-resistant pneumococci, chloramphenicol-resistant *Haemophilus influenzae* and multi-drug resistant *Mycobacterium tuberculosis*. Extended-spectrum beta-lactamase producing Enterobacteriaceae have been observed in tertiary care facilities in Jamaica and Trinidad and Tobago, and carbapenemase-producing bacteria, which can pose serious challenges for national health services, have already been identified in Barbados. In response to this potential emerging threat, CARPHA hosted a workshop for CMS in December 2014 to identify issues around AMR and explore key steps to tackle AMR in the region. Senior technical advisors and policy officials from 19 CMS attended together with representatives from CARPHA, CMS, Public Health England and PAHO/WHO (CARPHA, 2014c).

2.4.6 Challenges and Risks of Imported Diseases: the 2014-’16 Ebola Crisis

The 2014-’16 period saw some major communicable disease emergencies in the Caribbean, with threats from Ebola, chikungunya and Zika. The situation and response with respect to Zika and chikungunya will be analysed in looking at vector-borne diseases in Chapter 3 of this report. In this section, we tell the story of the Caribbean response to the potential threat of Ebola; a disease for which no cases were detected in the Region over the 2014-’16 period, but which nevertheless required massive mobilisation to mitigate the threat because of its severity. We also look at general issues concerning the necessity to establish systems to curtail the risks of imported diseases.

Ebola virus disease (EVD) is one of numerous viral haemorrhagic fevers. It is a severe, often fatal disease in humans and nonhuman primates, such as monkeys, gorillas, and chimpanzees. When infection occurs, symptoms usually begin abruptly anywhere from two to twenty-one days thereafter. These include sudden fever, headache, joint and muscle pain and weakness. Additional symptoms include rash, diarrhoea, vomiting and abdominal (stomach) pain. The infected person may bleed internally, as well as from the ears, eyes and mouth (CARPHA, 2014f). About half of people infected die from the disease; the average case fatality rate is 50% and varied from 25% to 90% in previous outbreaks (WHO, 2017b).

The first Ebola virus species was discovered in 1976, in what is now the Democratic Republic of the Congo, near the Ebola River. Since then, outbreaks have appeared sporadically. The largest outbreak to date started in Guinea in West Africa in December 2013 and was concentrated in that country, Liberia and Sierra Leone (CARPHA, 2014f), with a few cases that were successfully contained in Nigeria, Senegal, Mali, the United States, the United Kingdom and Spain (Berry, 2014).

The WHO declared the Ebola epidemic a Public Health Emergency of International Concern (PHEIC) on August 8, 2014, following evidence that the epidemic was not confined to a limited geographical area after the return of two US health care workers to the United States for treatment on August 4 and 5. In August 2014, an Incident Management Team was set up by CARPHA in response to questions from Member Countries, especially regarding testing facilities. CARPHA hosted virtual
meetings at least twice a month with Chief Medical Officers, Epidemiologists and Laboratory Directors. On September 11, 2014, CARPHA hosted a Regional Press Conference on Ebola, to inform the public of key facts about the disease and answer questions about the potential for spread to the Caribbean and measures being put in place. This was one of many public education and engagement activities by CARPHA for the duration of the PHEIC, which also for example saw the maintenance of a webpage with information about the epidemic and advice to Caribbean people to avoid travel to the most affected countries.

Also in September, CARPHA provided advice on Ebola to the CARICOM Council on Human and Social Development, where Health Ministers deliberated on the threat to the Region. In October, the CARPHA Executive Director met with Health Ministers of the OECS to provide them with evidence to inform their response efforts (CARPHA, 2014b).

In collaboration with PAHO, rapid assessments were conducted in nine Member States of Ebola preparedness. These utilised a WHO checklist to assess preparedness with respect to aspects such as coordination and control, capacity for isolation, transport of people and samples, availability of and skills in using PPE (CARPHA, 2014e).

A grant from the Inter-American Development Bank helped CARPHA strengthen the response to Ebola, especially in assessing capacity and providing training and certification on safety in handling and processing samples and how to use Personal Protective Equipment (PPE). CARPHA conducted a survey of Member States preparedness for Ebola using the preparedness tool of the International Health Regulations Core Capacities as the framework for analysis. The IHR core capacities are presented and discussed below, in section 2.5.1. The survey was conducted at a meeting of Laboratory Epidemiologists and therefore reflects their perceptions of preparedness, at that time (September 2014), based on experience of being on the ground in developing response capacity.

A Technical Meeting of Specialists and Directors on the Response to the Ebola Virus was hosted on October 30th and 31st in Cuba for countries in the Americas and regional agencies such as CARICOM. This was also attended by multilateral agencies such as WHO and PAHO. Strategies and resource mobilisation for the Ebola response were discussed. The meeting was followed by training of key health personnel from countries and regional agencies which focused on a model of how to set up an Ebola Treatment Centre.

The hosting by Cuba followed the tradition of its government in providing support for public health systems around the world. The WHO sent an appeal to health experts around the world to join a roster of people to assist the most affected countries. Cuba was among the first governments to send health personnel to address the Ebola crisis. In early October 2014, it sent 103 nurses and 62 doctors to Sierra Leone, the largest contribution of health staff by any country (Kirk, 2015). CARPHA provided a list to WHO of its own technical officers who stood ready to assist as part of the Global Outbreak Alert and Response Network.

The Regional Coordinating Mechanism on Ebola (RCM-E) was established on November 2nd, 2014 at a meeting of CARICOM Heads of Government. Bearing in mind the possibility of the devastating economic and social outcomes that could occur, the Heads of Government decided that the regional response was to be a community effort and a 10-point plan was devised to address Ebola. The RCME
consisted of CARPHA, as Chair, CARICOM and OECS Secretariats, CARICOM Implementation Agency for Crime and Security (IMPACS), Caribbean Disaster Emergency Management Agency (CDEMA), PAHO/WHO and CMS by responsibility and national capacity (Bahamas (Tourism), Barbados (Economy), St Kitts and Nevis (Health), Trinidad and Tobago (Security), Haiti, Jamaica, Suriname) and Cuba (by invitation). An action plan entitled ‘Stop Ebola There and Here’ was adopted with CARPHA as Chair, coordinating its implementation and providing technical and administrative support to the RCME (CARPHA, 2014g; Hospedales & Olowokure, 2016; PAHO, 2017). The RCME eventually expanded its focus to become the Regional Coordinating Mechanism on Health Security (RCMHS), using the Ebola experience to initiate a strengthened approach to Regional health security. This will be described further in section 2.5.1.

By December 22nd, 2014, the Ebola epidemic stood at 19,340 cases and 7,518 deaths in eight countries (Berry, 2014). Throughout 2015, the Incident Management Team at CARPHA worked on the regional response and regular virtual meetings continued with CMOs, Laboratory Directors and Epidemiologists. In July 2015, a regional simulation of the Ebola response was coordinated by CARPHA and CARICOM Implementation Agency for Crime and Security (IMPACS), liaising with countries. This examined issues such as the availability and adequacy of PPE and Advance Passenger Information Systems to advise when persons were travelling from most affected countries.

The full range of tests for Ebola can only safely be conducted in a Level 4 Bio-Safety Laboratory, of which there are none in the Caribbean. Level 4 Bio-Safety Laboratories exist at the United States Centers for Disease Control (CDC) and the Public Health Agency of Canada. CARPHA in collaboration with PAHO liaised with CDC and PHAC to facilitate access by CMS to these facilities in the event of a suspected Ebola case (CARPHA, 2014a). Some countries made bilateral arrangements with these agencies for testing. Discussions in meetings with country stakeholders examined systems of sample collection and processing to use in the event of a suspected case of Ebola, and whether CARPHA should pool samples from Member States to send for testing in the specialised laboratories in Canada or the US. CARPHA has a Level 3 Bio-Safety Laboratory (BSL3) at CARPHA, launched in May 2014 with support from the Government of Canada. This level of safety enables the testing of de-natured samples.

CARPHA played an important role in advising countries on their response. In response to public concern, most countries put a travel ban of some description in place. CARPHA maintained the position that travel bans were not supported by scientific public health evidence, as a means for reducing international spread of communicable disease but upheld its obligation to respect the sovereignty of Member States in their decision-making. CARPHA advised on the best ways to frame the chosen public health actions to maximise public health impact while minimising disruption and discrimination against people from countries in Africa that were unaffected by Ebola or where the epidemic had been contained and controlled.

CARPHA also provided guidance on screening travellers on the basis of their exposure risk, as opposed to their nationality, placing emphasis on minimising travel between the Caribbean and the most affected countries. CARPHA advised that these countries had instituted exit screening procedures to detect people who had been in contact with someone with Ebola and/ or with Ebola symptoms and prevent them from travelling abroad (CARPHA, 2014a). Advice was also provided on
the length of time that should be covered by the travel ban. Since the WHO had stated that people could be declared cured of Ebola if they had no symptoms in the past 21 days, a 21 day period since travelling to affected countries was recommended to be the appropriate period for a travel ban, rather than longer periods (CARPHA, 2014d).

CARPHA developed an algorithm, the Ebola Risk Assessment Flow Chart, on procedures to follow in the event of a suspected Ebola case. This was used and continues to be used as the basis for training on Ebola.
Figure 52: Ebola Risk Assessment Flow Chart, CARPHA 2015

Disclaimer: All due care has been taken to ensure that the content of this algorithm is current and accurate. This algorithm has been provided as a guide for EVD testing and infection control measures. It is not intended to supersedeprofessional clinical judgment.
In March 2016, the WHO declared the Public Health Emergency of International Concern officially over. Despite never having had a case, the Ebola epidemic left a legacy in the strengthening of public health institutions in the Region. Among the continuing mechanisms and programmes are:

- Strengthened capacity within national health systems to respond to health emergencies, including health care workers trained and sensitised on Ebola and appropriate responses. The Ebola response algorithm is an important tool.
- Ongoing CARPHA visits to countries to train teams in bio-safety, the use of Personal Protective Equipment and other aspects of preparedness. Some training follows on from previous training, while some new cohorts have also been trained. This is necessary in the light of turnover of staff since the 2014-16 period of the PHEIC, and to develop capacity for a broad range of infectious disease emergencies.
- The RCMHS, mandated by Caribbean governments to oversee strategy for health security.

The Ebola crisis was an extreme example of a Caribbean-wide response to a serious infectious disease threat. Such responses are necessary for other internationally circulating diseases as well, especially in view of the high volume of travel to and from the region.

We now consider evaluations of public health action in the Caribbean, including of the application of International Health Regulations designed to reduce the threat to health security posed by infectious diseases such as Ebola or by other means such as natural or man-made disasters.

### 2.5 Evaluations of Public Health Action

#### 2.5.1 International Health Regulations and Regional Health Security

In today's world interconnected through travel, trade and communication, outbreaks can have a significant impact on the economic and social development of a country and its surrounding neighbours (CDC, 2017). Disease outbreaks can weaken the workforce and scare visitors away. The latter is especially important in the Caribbean region which is heavily dependent on tourism. Globalisation brings other increasing threats as well, such as those from chemical and radiation emergencies.

The International Health Regulations (IHR) were first written in 1969 and underwent a major revision in 2005. The IHR are a legal framework, "to prevent, protect against, control and provide a public health response to the international spread of disease in ways that are commensurate with and restricted to public health risks, and which avoid unnecessary interference with international traffic and trade" (WHO, 2005, p. 1). The revised IHR 2005 entered into force on 15 June 2007 and were agreed upon by all WHO Member States, including the 24 CARPHA Member States (CMS). WHO Member States then had two years, until June 2009, to assess their national public health core capacities and develop a national IHR action plan to achieve them.
The capacities are those required, “...to detect, assess, notify and report events ... and respond promptly and effectively to public health emergencies of national and international concern...” as stipulated in Articles 5 and 13, and Annex 1, of the IHR 2005 (WHO, 2005, pp. 11, 15). These capacities can be grouped under the following headings as follows (Hardiman, 2012; WHO, 2005, 2017c):

A. Surveillance and response
   a. National legislation, policy and financing
   b. Coordination and communications
   c. Surveillance
   d. Response
   e. Preparedness
   f. Risk communication
   g. Human resources capacity
   h. Laboratory diagnostic and confirmation capacity

B. Development of capacities at Points of Entry (POE)
C. Potential health hazards
   a. Zoonotic events
   b. Food safety
   c. Chemical events
   d. Radiological and nuclear events

Most countries having not met the 2009 deadline to assess their national public health core capacities and develop a national IHR action plan, they were then given an additional three years, until June 2012. However, by this date fewer than 20% of all WHO Member States had implemented an IHR action plan and achieved the required core capacities. All 24 CMS requested and obtained two two-year extensions of the IHR deadline; the first until June 2014 and the second to June 2016 (CDC, 2017; Hospedales & Olowokure, 2016; WHO, 2015b).

While previous versions of the IHR required that countries report incidents of diseases such as cholera, plague and yellow fever, the revised IHR 2005 are more “flexible and future-oriented, requiring countries to consider the possible impact of all hazards, whether they occur naturally, accidently, or internationally” (Gostin, 2004, p. 606). The IHR 2005 are important in that they ensure that countries can detect and report all events that maybe considered to be a potential PHEIC. Since the revised IHR 2005 came into force, WHO has declared four PHEICs: H1N1 influenza (2009), Polio (2014), Ebola (2014) and Zika (2016).

A monitoring framework has been used to monitor twenty indicators that assess the implementation of a country’s eight core capacities, development of capacities at points of entries, and development of capacities for the IHR-relevant hazards. This information is collected annually (Hardiman, 2012; WHO, 2017c). However, it should also be noted that in 2015, the Review Committee of the IHR agreed that, “…the work to develop strengthen and maintain the core capacities under the IHR should be viewed as a continuing process for all countries...implementation of the IHR should now advance beyond simple ‘implementation checklists’ to a more action-oriented approach to periodic evaluation of functional capacities” (WHO, 2015b, pp. 4, 7). As such the IHR should be viewed as a tool to support the continuous inter-sectoral public health preparedness process.
The current draft of the IHR Monitoring and Evaluation Framework is based on four components: an annual report to the World Health Assembly based on a self-assessment, an After-Action Review, Simulation Exercises, and Joint External Evaluation (JEE). The annual report is mandatory while the other three are optional. In the Caribbean, JEE’s have been conducted in Belize and Haiti (WHO, 2016).

To date, in compliance with the IHR, CMS have all appointed National Focal Points (NFP), which are usually an organisation/agency rather than a person. The role of the NFP is largely that of communications within their country and internationally on all aspects of the IHR. This is conducted by notifying WHO of any relevant health related events, and responding to WHO with any requests for information (Hardiman, 2012). The 14 CARICOM Member States continue to be generally compliant with the submission of annual reports; annual confirmations or updates of contact details for their NFPs; routine connectivity tests between the WHO IHR contact point and the CARICOM Member States NFPs; and authorisation of ports to issue the Ship Sanitation Certificate (SSC) (WHO, 2016).

Tables 8 and 9 shows there has been an overall improvement in all of the core competencies throughout the 14 Caribbean countries from 2014 to 2016. Even though core capacities of human resources, chemical events, radiation emergencies demonstrated the most development, they still remained the most challenging areas for the CARICOM Member States. (WHO, 2013, 2015c, 2017d).
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**KEY %**

- **Implementation**
  - 80-100%
  - 50-79%
  - 0-49%

Source: World Health Assembly, World Health Organisation
Table 9: Implementation of International Health Regulations (2005) Core Competencies in Caribbean countries as of 2016

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**KEY %**

- **Implementation**
  - 80-100%
  - 50-79%
  - 0-49%

Source: Pan American Health Organization/World Health Organisation

When there is the occurrence of a potential PHEIC, the Director-General of WHO will seek the advice of an IHR Emergency Committee with members selected from the IHR Roster of Experts (WHO, 2017f). Each WHO Member State can nominate a national with the relevant expertise for consideration to the Roster of Experts. To date there are very few experts from CARICOM Member States on the IHR Roster of Experts. The advantage of having CARICOM nationals on the Roster of Experts allows the region to have direct input into, and the channel through which the Caribbean perspective can be presented, any recommendations and policies being formulated with regards to the relevant PHEIC.
With respect to radiation-related emergencies, an increasing number of countries are becoming members of the International Atomic Energy Agency (IAEA), which is beneficial for not only strengthening core capacity related to radiation in health, but also in other sectors. Eleven CARICOM Member Countries were members of IAEA as of 2016. Further training has been developed through the Caribbean Field Epidemiology and Laboratory Training Programme (CR-FELTP) and three PAHO Skills On-line Epidemiology courses which were developed to strengthen in-country human resource capacity for preparedness and response.

In 2014, the Global Health Security Agenda (GHSA) was launched. It is a multilateral and multi-sectoral approach bringing together approximately 50 countries, NGOs and international stakeholders to, “strengthen both global and national capacity to prevent, detect and respond to infectious disease threats”. The GHSA seeks to accelerate the implementation of the IHR 2005 and similar global health frameworks (Global Health Security Agenda, 2017).

In November 2015, CARICOM agreed to work with the United States as a GHSA Phase II partner (CARPHA, 2016). It was decided that the Regional Coordinating Mechanism (RCM) on Ebola should be now called the Regional Coordinating Mechanism on Health Security (RCMHS) to encompass health security issues of not only Ebola, Chikungunya, Zika and Yellow Fever but any public health threat including a response to public health hazards of chemical and radio nuclear emergencies as in the IHR 2005 (CARPHA, n.d.-a). In September 2016, COHSOD agreed to support a joint planning meeting for a 5-year Roadmap for the Caribbean Region Global Health Security Agenda. CARPHA, CARICOM, US government representatives, and PAHO led a collaborative and facilitative approach to engaging stakeholders in the GHSA internal self-assessment and roadmap. The Roadmap for the Caribbean GHSA was developed between September and December 2016 and in the context of the CCH IV. This included a five-day workshop facilitated by United States Agency for International Development (USAID) with over seventy participants including Chief Medical Officers (CMOs) and Chief Veterinary Officers (CVOs) from thirteen Caribbean nations, representatives from regional institutions, private sector, development partners, civil society and universities. The draft Caribbean Regional Global Health Security Agenda 5-year Roadmap (2017-2021) “...serves to document and guide regional health security activities in the Caribbean, identify milestones for future work and detect areas where additional support is needed to achieve [19 themes] of the GHSA targets” (CARPHA, 2016, p. 4).

2.5.2 Evaluation of the Port of Spain Declaration

The Port of Spain Declaration on Non-Communicable Diseases 2007: “Uniting to Stop the Epidemic of NCDs” was the outcome of a regional meeting of CARICOM Heads of Government (see Section 1.3.1). The implementation of the Port of Spain Declaration was monitored using a grid developed in 2008 and later revised in 2010. It was completed twice by CARICOM countries, the first time between 2012 to 2014 and then in 2016.
The grid showed that some elements of the Declaration were implemented successfully, while others proved to be challenging. Overall elements of commitment, education, surveillance and treatment were relatively well implemented while those of nutrition were less well addressed. For example, by 2016 across the 20 CARICOM Member States and Associate States, most had a national NCD policy, strategy or action plan that integrated NCDs and risk factors as well as a budget or allocated funding; Caribbean Wellness Day multi-sectoral, multi-focal celebrations; had conducted a STEPS survey, Global Youth Tobacco Survey and Global School Health Survey. Nutrition-related action, such as implementation of policies to reduce salt, limit saturated fats and virtually eliminate trans fats and increase fruits and vegetables, were noticeably absent in most countries. Also absent was Ministry of Health presence during negotiations on food security; implementation of WHO recommendations on the marketing of foods and beverages to children and the implementation of front-of packaging labelling for easy identification of unhealthy foods.

This led to the development of a more thorough evaluation, the overall goal of which was, “to evaluate, seven years on, the implementation of the CARICOM NCD Summit Political Declaration in order to learn lessons that will support and accelerate its further implementation and will inform the attainment of the UNHLM NCD commitments.” (Samuels & Unwin, 2016b, p. 7). This goal was broken down into eight objectives. The first six objectives were used to guide research conducted in order to add regional knowledge on the status of implementation of the Declaration and its regional and international impact. There were two additional objectives that were used to communicate the knowledge gained and to build capacity to improve the implementation of NCD policy responses in CARICOM Member States.

The evaluation was supported by the Canadian International Development Research Centre (IDRC) and coordinated by the Department of Public Health, Faculty of Medical Science and the Chronic Disease Research Centre (CDRC), both of UWI, Cave Hill. Research was conducted by a multidisciplinary project team from the following regional and international agencies:

- Department of Public Health, (UWI), Cave Hill
- Chronic Disease Research Centre, (UWI)
- Department of Community Health and Psychiatry (UWI), Mona
- HEU, Centre for Health Economics, (UWI), St. Augustine
- Institute of International Relations, (UWI), St. Augustine
- G8 Research Group, University of Toronto
- Caribbean Public Health Agency
- Pan American Health Organization
- The Healthy Caribbean Coalition

The evaluation was guided by a Project Advisory Committee (PAC) which consisted of regional and international experts in public health, policy analysis, economics, social science and implementation science. The PAC included advisors from Caribbean Ministries of Health, international advisors from...
the Washington University, St Louis, PAHO, Emory University, University of Washington, and Oxford University. The evaluation began in 2014 and runs until 2017.

The following summarises some of the key findings for each of the six research objectives:

A. National and regional trends in NCD mortality
   - There are large variations in life expectancy and in NCD-related mortality between CARICOM members. Except for Haiti, NCDs cause 65% to over 80% of all deaths with cardiovascular disease and diabetes causing the majority of premature NCD deaths followed by cancers.
   - There are high burdens of risk factors, including obesity, hypertension and diabetes. Risk factor patterns differ by gender: higher obesity and diabetes in women, higher smoking and excess alcohol consumption in men.

B. National policy responses to NCDs and lessons learned
   - No country has met all of the indicators, but all have met at least one on the monitoring grid.
   - Indicators with the lowest levels of implementation concern nutrition.
   - Indicators with the highest levels of implementation are those where the action needed is clear and there is support from regional or international organisations. For example, Caribbean Wellness Day and WHO STEPS risk factor surveys and the WHO’s Framework Convention on Tobacco Control (FCTC).
   - Achieving true multi-sectoral action, between government, civil society and the private sector, and within government between different ministries, requires appropriate facilitating structures to be in place and to be properly resourced. Leadership and support is required from the highest level of government.

C. International institutions’ support for the Declaration
   - Of the 27 commitments made by CARICOM members at the 2007 Port of Spain Summit, 8 identified specific international institutions (both within and outside the Caribbean), which were expected to provide assistance.
   - The poor performance by CARICOM members on commitments related to the macro-determinants of nutrition, demonstrates the need for greater coordinated intervention from relevant CARICOM agencies. There is concern that support for action by CARICOM members on nutrition is weaker now that the CFNI has been subsumed into CARPHA.

D. International impact of the 2007 Port of Spain Declaration
   - The 2007 Heads of Government Port of Spain Summit had significant influence on shaping global governance of NCDs and paved the way for the 2011 UNHLM on NCDs.
   - There have been several activities arising out of the Declaration that are being adopted internationally. For example, in 2014 WHO recommended the formation of National Commissions to the global community.

E. Surveillance and monitoring
   - There are too many overlapping demands for reporting being made from several agencies. Collaboration is needed to reduce the demands on individual countries while still meeting agencies’ requirements.
• Some key surveillance activities need better support and capacity building to ensure that the countries make full use of the data collected. This applies in particular to STEPS NCD surveys, where many have been done but few analysed beyond providing limited summary data.

F. Financing NCD prevention and control in CARICOM: potential role of tobacco and alcohol taxes.

• There is significant potential for revenue generation from increased taxes on tobacco and alcohol. Other forms of taxation, such as taxes on sugar-sweetened beverages should also be considered.

• The evidence suggests that targeted taxation can lead to reduced consumption of unhealthy products and significantly contribute to the cost of interventions to respond to NCDs. (Healthy Caribbean Coalition, 2017d; Samuels & Unwin, 2016a, 2016b).

Major conclusions and observations from this evaluation indicated that NCDs are still given relatively low political priority, both within countries and regionally, and this has acted as a barrier to policy development and implementation. Specific national and regional mechanisms are necessary to promote an effective response, e.g. NCD Commissions and a joint NCD Secretariat, led by CARICOM/PAHO, to provide leadership. A drop in political buy-in is evident by the fact that at the 2011 UNHLM on NCDs, at least nine CARICOM Heads of Government were in attendance as compared to no CARICOM Heads of Government at the 2nd UNHLM in 2014 (Healthy Caribbean Coalition, 2017b). Additionally, specific funding is required to support national and regional NCD responses. National health budgets are rapidly consumed as governments focus on secondary and tertiary treatment(Healthy Caribbean Coalition, 2017d).

An implementation workshop was held 24-25 February 2016 in Port Spain, Trinidad and Tobago to determine the way forward for the prevention and control of NCDs in the region. Participants included, but were not limited to regional Ministers, journalists and experts in health, economics, agriculture and social security. Findings were presented, and the participants were asked to validate them and draft an action plan for presentation at the 2017 CARICOM Heads of Government meeting. The major issues addressed at the implementation workshop were as follows:

✓ Diet, food and food security: relevant policy on agriculture and trade;
✓ Reducing alcohol-related harm;
✓ Tobacco control;
✓ Promoting health in different settings: workplaces (including the health sector), schools, faith-based institutions etc;
✓ Investing in NCD prevention and control;
✓ Media and social communications, health promotion and advocacy; and
✓ Physical activity and the built environment.

At the Caribbean Heads of Government meeting 4-6 July 2016, in Guyana, the issue of NCDs was discussed and pledges were given to address, “the banning of smoking in public places; trade related measures; banning advertisements of potentially harmful foods which specifically target children; and elevating taxes on foods high in sugar, salt and trans-fats” (Samuels & Unwin, 2016a, p. 78)
2.5.3 Evaluation of the Caribbean Cooperation in Health III

The Caribbean Cooperation in Health III (CCH III) is the third in a series of CCH documents which provide framework for functional cooperation in health. It has five areas of cooperation and eight priority areas; the priority areas were retained from CCH II (see section 1.3.1). The purpose of the evaluation of the CCH III was to provide a comprehensive evidence-based report for the development of the CCH IV.

The evaluation was conducted using a three-pronged approach: communication with the steering committee; review of extant documents, on-line media data, and literature from peer-reviewed journals; and interviews and consultations from stakeholders. Stakeholder input was gained from telephone interviews and consultations. There were two preliminary consultations: 2015 CARPHA and PAHO/WHO Environmental Health Conference in St Lucia and a 2015 PAHO/WHO and CARICOM Sub-Regional Workshop on the Development of Competencies for Nurse Educators in Belize. A final regional consultation occurred in Trinidad and Tobago which allowed attendees (stakeholders, governments, civil society, academic, donors, the private and public sectors) an opportunity to provide feedback on the initial CCH III evaluation findings and final document.
Challenges to conducting the CCH III evaluation included: limited resources over a short five-month time frame; indicators having not been measured (only 27 out of the 192 indicators were collected by countries); CCH III lacked a regional monitoring, evaluation and accountability framework and therefore it was challenging to collect evidence; and the fact that many of the key informants were not aware of the CCH III (Ferguson & Owens-Ferguson, 2016a, 2016b).

Data was obtained from over 40 key organisational documents, over 70 peer reviewed publications and an on-line media analysis that resulted in viewing 97 webpages from on-line news outlets and social media platforms. Additionally, results of 27 of the 192 CCH III indicators were analysed. Analysis of this data produced the following summary of advancements in regional cooperation (Ferguson & Owens-Ferguson, 2016a, 2016b):

- Establishment of CARPHA
- Maintaining success in high-levels of vaccination coverage while decreasing the transmission of communicable diseases
- Continued progress towards implementing commitments towards the prevention and control of NCDs
- Building capacity of Human Resources for Health (HRH)
- Increasing capacity of laboratory services for the region
- Caribbean Wellness Day
- Implementation of core capacities of the IHR 2005
- Creating safe and environmentally-friendly hospitals

At the two consultations in St Lucia and Belize the attendees were asked to identify their priority areas with respect to their areas of expertise. The following figure demonstrates these findings (Ferguson & Owens-Ferguson, 2016a, 2016b).
Twenty-one key stakeholders were also interviewed. These included leaders from public health agencies and government officials (including the architects of CCH and CARPHA), representatives from Ministries of Health of select CARICOM Member States, academia and civil society. The stakeholders identified key strengths and challenges of CCH III and key recommendations for CCH IV. These are summarised in the following figures (Ferguson & Owens-Ferguson, 2016a, 2016b).
Figure 55: Strengths and Challenges of CCH III identified by stakeholders

**Strengths**

• CCH III is a needed framework to ensure regional cooperation.
• Regional cooperation has and is occurring as a result of the CCH III.
• Examples of regional cooperation cited the most by stakeholders included: the 2007 Port-of-Spain Declaration, CARPHA, immunizations, PANCAP, laboratory services and PAHO/WHO’s Human Resources for Health and Health Systems Strengthening strategic plans.

**Challenges**

• Burden on Ministries of Health to gather and report on all the indicators to different agencies.
• Countries have limited capacity to deploy their own surveillance systems to capture risk factor indicators.
• Acknowledged that countries are very diverse in terms of population size, health system needs and political geography.
• Indicators were not flexible and difficult to fit country needs and national strategic plans.
• Some were not aware of the CCH III framework.
• Some noted there was no communication and dissemination strategy.
Figure 56: Recommendations for CCH IV identified by stakeholders

Recommendations

- Create a CARICOM/CARPHA-mandated basic indicator set that is better aligned to the UN SDGs and all other required country-level indicators.
- The eight CCH III priority areas are still relevant. However, consider including Food and Nutrition under NCDs, and have HRH and HSS as a cross-cutting issue rather than separate priority areas.
- Include the following areas in CCHIV: climate change, aging, childhood obesity, alcohol abuse, tourism and health, emergency and disaster preparedness, men's health, violence and injury prevention, food insecurity, health financing, and enhanced regional laboratory services.

Based on the evaluation results, the following were presented as recommendations for CCH IV (Ferguson & Owens-Ferguson, 2016a, 2016b):

a. The need for multi-sectoral approach.
b. A better governance and accountability system.
c. An increased awareness of CCH framework.
d. Develop an achievable timeline, perhaps over two or three five-year periods.
e. Create and select indicators aligned with PAHO/WHO’s basic indicators and SDGs.
f. Create a centralised surveillance system for data collection that is easy to access and use.
g. Re-organise the priority areas as suggested by the key stakeholders.
h. Encourage all sectors to utilise the CC HIV framework to mobilise human, financial and material resources.
i. Develop more national and international partnerships across private, public and civil society sectors to ensure CCH IV’s overall cooperative goals are met.

Conclusion

2014–16 was a remarkable period in the history of public health in the Caribbean. Chikungunya and Zika brought new disease burdens and costs, which will be further explored in Chapter 3. Along with the public health emergency around Ebola, they highlighted gaps in regional health security, and led to unprecedented measures to strengthen regional health security cooperation and infrastructure. The period also saw major storms and Hurricane Matthew, damaging public health and other facilities along with mental and physical health in several countries. The damage provides troubling signs of the ongoing and increasing dangers associated with climate change.

The immediate crises of these CDs and weather events were accompanied by longer-term and systemic health challenges. Respiratory and food-borne diseases demonstrate the continued vulnerability of the public to environmental conditions associated with travel of goods and people and variations in weather conditions. The importance of vaccine development and coverage and environmental action are highlighted. HIV, accidents and violence expose some of the costs of social
divisions, stress and conflict. NCDs are outcomes of chains of events linking global issues such as the distribution of types of food production, social and environmental issues such as access to fresh food, and individual behaviour such as dietary choices.

A number of national, regional and international agencies have partnered over the 2014-’16 period to respond and build capacity to increase the resilience of Caribbean people to the threats facing them. CARPHA, having been formed in 2013, was faced with responding to public health emergencies along with systemic health challenges at an early stage in its existence. It drew on the strengths of the five regional health agencies from which it was formed, and forged and strengthened alliances with national, regional and international agencies. Increasingly, it and other agencies concerned with public health in the region espoused multi-sectoral approaches which were based on acknowledgement that health results from the interplay of structural, social, environmental, behavioural and individual factors.
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