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University consortium to address public health priorities and research capacity building in the Caribbean

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The State University of New York (SUNY) – University of the West Indies (UWI) Health Research Consortium (HRC) was implemented in 2015 by the SUNY Global Health Institute (GHI) and the SUNY-UWI Center for Leadership and Sustainable Development. The goal was to advance public health in the Caribbean through collaborative research and education among faculty and students at SUNY and UWI. The Consortium is now a dynamic matrix addressing health priorities that were initially agreed upon with the Jamaica Ministry of Health and Wellness. The HRC has built a foundational matrix that is planning for cutting edge laboratory instrumentation, biomedical informatics system, seamless electronic medical records network, national laboratory data management system, and novel biotechnology (e.g., robotic surgery cluster). The SUNY-UWI partnership fills existing gaps through collaborative programs with the SUNY GHI that facilitate UWI faculty interactions with SUNY faculty and core resources and incubators that encourage collaborations while UWI infrastructure expands. The Health Research Consortium utilizes existing academic models at UWI and SUNY to promote collaboration, capacity building, and program implementation. Consortium teams develop sound business development models that foster sustained economic growth and form the pipeline for workforce development

and career opportunities. The Caribbean diaspora and UWI alumni are engaged in working together on this effort. In addition, mentoring in K-12 and beyond is needed to create a vision for the next generations.

KEYWORDS

public health, Caribbean, Caribbean (Jamaica), health priorities, capacity building, global health

Introduction

The Caribbean nation-states and the greater Latin America region have a complex history, from the era of African enslavement and colonialism to the geopolitical and environmental challenges of modern times (Hickling, 2010; Gahman et al., 2021; Barthélemy et al., 2023). This history has led to the current health inequity and public health challenges (i.e., educational disparities that contribute to higher risk for cardiovascular disease risk factors; Ferguson et al., 2017) that require sustainable development and capacity building of regional health system infrastructure and clinical, biomedical and translational research (Cassells et al., 2022). Like other Caribbean countries and developing nations worldwide, Jamaica's principal health concerns include non-communicable diseases, injuries, and infectious diseases (GBD 2019 Viewpoint Collaborators, 2020). Noncommunicable diseases (NCDs), which include heart disease, diabetes, and cancer, are a significant public health concern and cause 79% of mortality in Jamaica (World Bank, 2019). Approximately 34% of NCD deaths have their onset before 70 years of age (World Health Organization, 2018). Furthermore, the aging population of Jamaica is growing and at higher risk of NCDs thereby increasing the burden on the healthcare system (Pan American Health Organization, 2017). Injuries stemming from motor vehicle accidents, falls and violence are also a major, and oft underrecognized public health crisis in Jamaica, throughout the rest of the Caribbean, and globally (Crandon et al., 2008, 2009; Fletcher et al., 2019). Infectious diseases, especially vector-borne diseases, remain a major concern in the Caribbean region due to their susceptibility to climate change (Mora et al., 2022). In addition, recent awareness of the impact of climate change and the need for regional health informatics systems are important factors to consider in developing sustainable public health programs.

The State University of New York-University of West Indies (SUNY-UWI) Health Research Consortium was established through a joint memorandum of understanding between SUNY, UWI and the Ministry of Health and Wellness, Jamaica in 2015 to advance a regional effort to achieve health equity by conducting collaborative investigations to create new public health guidelines and build biotechnology infrastructure. The mission of the consortium is focused on identifying priority areas in the Caribbean that require immediate action (Figure 1) and to form faculty teams including individuals and research cores to address current challenges, rather than waiting for capacity building efforts. To address the regional challenges across multiple key health challenges, the consortium has developed a matrix that builds infrastructure in areas like health informatics, laboratory biotechnology, and research administrative support, while implementing programs that foster multidisciplinary teams, such as a pelvic oncology center, an infectious diseases research center, a diabetes and nutrition initiative, a community health strategy for managing autism spectrum disorders, and a neurosciences program that spans neurology, neurosurgery, and mental health. Similar global health consortiums include the Consortium of Universities for Global Health (with over 175 institutions around the world), as well as the McMaster and Maastricht University Global Health Consortium (with seven institutions spanning 5 continents); the SUNY-UWI Consortium shares their mission of increasing awareness, funding, and capacity building for global health issues.

Infectious disease

The Caribbean is confronted by multiple waves of epidemic arboviruses including dengue, Zika and chikungunya. These insults overlay high rates of infectious diseases, including HIV/AIDS and hepatitis. Recently, SARS-CoV-2 and Mpox have emerged as serious threats to public health.

In Jamaica, there are approximately 30,000 adults and children currently living with HIV and 14,000 who are on antiviral therapy/have suppressed viral loads (UNAIDS, 2021). HIV stigma affects multiple groups including men who have sex with men (MSM) and the homeless. HIV prevalence among adult incarcerated men in Jamaica was 3.3%, compared to a prevalence in the range of 20% for MSM, one of the highest in the world (Andrinopoulos et al., 2010; Figueroa et al., 2015). Sex work, multiple partnerships, incarceration, non-injecting drug use, and female rape were common factors among HIV in homeless people in urban centers (Skyers et al., 2018). Liver disease due to hepatitis is also a major health challenge in the region. Hepatitis A has a seroprevalence of approximately 59.9%, similar to other developing countries (Brown et al., 2000). Herpes simplex virus type 2 has a declining seroprevalence of 20.6% but remains as the cause of nearly half of GUD cases and almost all genital herpes cases (Harfouche et al., 2021). Arboviruses such as dengue and chikungunya reach over 80% seroprevalence in Caribbean populations, and zika has a seroprevalence of 15% in pregnancy, meaning arboviruses continue to be a significant burden in this region (Christie et al., 2023). The effects of multiple circulating viruses in an endemic area with high rates of chronic non- communicable diseases is not well understood.

The COVID-19 pandemic and Mpox outbreak also raised global health concerns. Jamaica had more than 150,000 confirmed COVID-19 cases and 3,500 deaths as of May 2023 (PAHO, 2022). Among COVID-19 deaths, 96.9% were unvaccinated cases that demonstrates the importance of vaccination in Jamaica (COVID-19

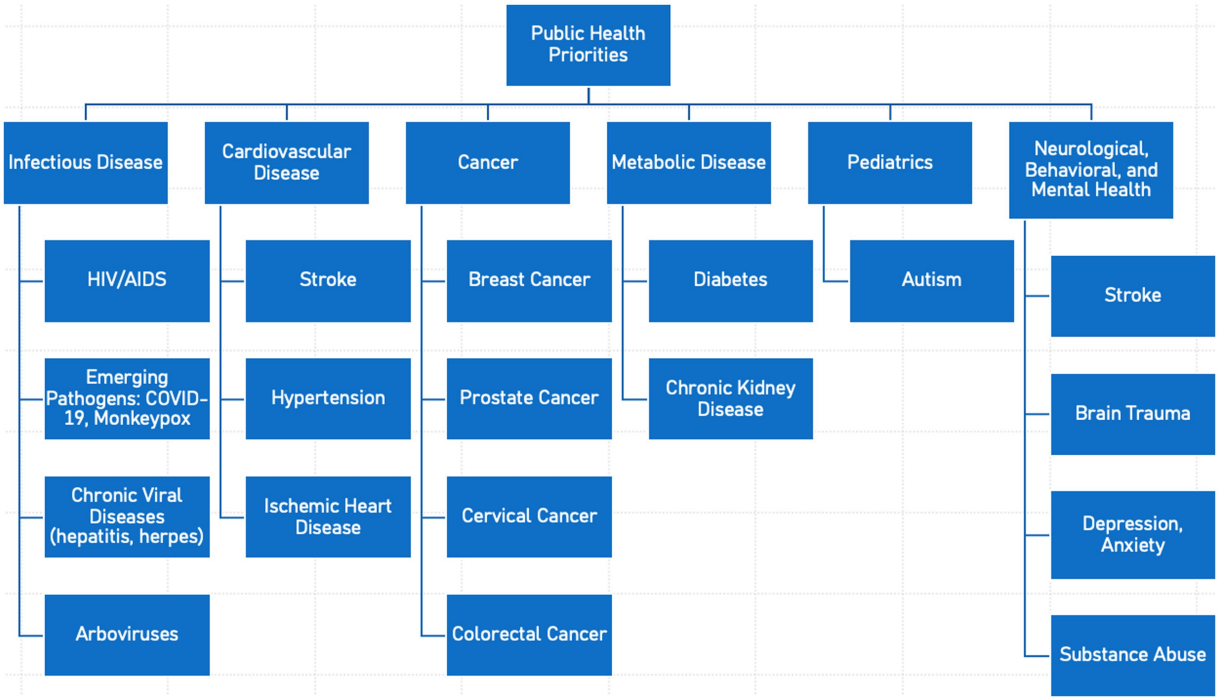

FIGURE 1
Summary of public health priorities.

Clinical Management Summary, 2023). Yet only 27% of the population is fully vaccinated (Our World In Data, 2023), due to vaccine hesitancy or lack of access. The first reported serosurvey for SARS-CoV-2 post-Omicron indicates that although there was high SARS-CoV-2 population immunity, wider vaccination coverage would have delivered significant benefit as much of the population lacked spike RBD IgG (Anzinger et al., 2022). After genomic surveillance of SARS-CoV-2 was implemented in the Caribbean, findings showed the need for expanded digital infrastructure within both local academic institutions and national public health laboratories to better collect and integrate genomic sequencing data across the country and bolster genomic surveillance capacity (Sahadeo et al., 2023).

The Mpox outbreak in 2022 did not reach the severity of COVID-19. Jamaica had 21 pox cases and no deaths (Centers for Disease Control and Prevention, 2022), but the Ministry of Health created protocols for case reporting and investigation, contact tracing, and quarantine (Ministry of Health Jamaica, 2022a). The lessons learned from COVID-19 were applied to better organize the Mpox response. Systematic priority setting is crucial for allocating resources to groups in case future outbreaks occur.

The Consortium has responded to the viral threats through human resource capacity building and expansion of consortium partners for effective response. To address this public health priority, the University at Buffalo (UB)/SUNY, Upstate Medical University (Upstate/SUNY) and the UWI Mona Campus (Kingston, Jamaica), in collaboration with the Jamaica Ministry of Health and Wellness (MOHW), successfully competed for a D43 Global Infectious Diseases (GID) Research Training Program grant with a focus on virology research training and capacity building. The D43 program has received strong support from the UWI and SUNY leadership and has been renewed successfully. This initiative involves colleagues from UWI (Mona and St Augustine campuses) UB, SUNY Downstate and Upstate Medical University. The work is further supported by an Immunology Core located at Rush University with omics support from Case Western Reserve University. The goals of the first 5-year award included 10 pre-doctoral and 10 post-doctoral trainees with a focus in virology. The renewal goals include expanding the current core of early-stage global infectious diseases investigators, utilizing a cutting-edge curriculum with mentored core laboratory experiences that emphasize research design, methods and analytic techniques to address virology research questions that confront Jamaica, providing research training with a multifaceted, integrated mentoring program based on an Individual Development Plan for each trainee that fosters innovative research and enhances the trainees' ability to conceptualize and investigate research problems with increasing independence, and the continued development of independent research leaders in virology who will be competitive for extramurally funded research, mentor the next generation of pre-doctoral and post-doctoral trainees and build on the foundation created during the initial GID award period. GID trainees have focused on the application of novel new biotechnologies (e.g., next generation sequencing, flow cytometry) and bioinformatics.

The consortium has added supporting partners such as the Global Virus Network by the establishment of an Affiliate Center of Excellence at the Mona campus in Jamaica. The efforts of the consortium were also strengthened by the Jamaica becoming a member of the Abbott Pandemic Defense Coalition (Averhoff et al., 2022). This offered resources including equipment, reagents, training,

and next generation sequencing services to support viral surveillance and virus discovery.

Several alumni of the Fogarty training program have been appointed to faculty positions and continue research in emerging viral infections. This includes virus surveillance and discovery in humans and the mosquito vector, drug development, RSV epidemiology and the development of long COVID-19 in children. The virus research activity and the presence of the National Influenza Center influenced the decision of the Ministry of Health and Wellness to establish Jamaica's NGS service for COVID-19 at the UWI.

Cardiometabolic and neurologic diseases

Cardiovascular diseases are the most prevalent (25%) of the NCDs in Jamaica (World Health Organization, 2018). Hypertension and diabetes mellitus are major modifiable risk factors to stroke (Chen et al., 2016). Stroke, ischemic heart disease, and hypertension are some of the top causes of mortality in Jamaica and increase with age (Pacheco-Barrios et al., 2022). Among those over 60 years of age, the most prevalent NCD was hypertension at 61.4%, which increased from 41.4% in 1989. Hypertension prevalence increases with age (Mitchell-Fearon et al., 2014) and may lead to serious cardiovascular disease. A blood pressure screening campaign in Jamaica with 2,550 participants identified 1,055 (41.4%) who had hypertension, and 31.1% of those with hypertension were unaware of the condition (Nwokocha et al., 2019). More emphasis on community awareness and managing risk factors is needed. Jamaica's Health Screening Strengthening Programme has implemented a chronic care model to address NCDs and risk factors (Health Systems Strengthening Programme, 2022).

Type 2 diabetes mellitus and hypertension are the most common causes of chronic kidney disease (CKD) in Jamaica (Ministry of Health, 2020). There is a high prevalence of diabetes in the Caribbean and if untreated may cause multi-organ health complications including stroke, heart disease, renal failure and blindness. Prediabetes is asymptomatic and requires screening programs for detection. Data from the United States Centers for Disease Control and Prevention indicate that prediabetes often leads to type 2 diabetes and related cardiometabolic complications including heart disease, and stroke, affecting 13.7% of Jamaicans (Wilks et al., 1999). Impaired fasting glucose is less common occurring in ~3% (Cunningham-Myrie et al., 2013). Risk factors for prediabetes can be managed with a team approach that must be combined with screening programs for early detection.

Diabetes and hypertension can lead to CKD. A study at the UHWI Diabetes Clinic showed that most patients had CKD and were at high or very high risk of adverse outcomes (total mortality, cardiovascular disease, and renal failure) (Ferguson et al., 2015). Limited economic resources hinder access to crucial dialysis treatment for those affected by CKD. Approximately 50% of persons with kidney failure are working-class, and more than 20% may not be receiving dialysis due to cost (Kramer et al., 2018). More resources must be allocated to screening programs, diabetes, and hypertension prevention, and providing access to CKD treatments.

Neurological diseases comprise a significant public burden in Jamaica and throughout the Caribbean and Latin America. The unmet need for neurological and neurosurgical health care in the Caribbean has been documented for over half a century, but disparities in access to equitable neuro-health care in Jamaica and throughout the Caribbean persist (Spillane, 1969). In addition to nervous system complications of cardiometabolic disease, such as stroke and diabetic neuropathy, burdensome neurological disorders in the region range from common pathologies such as epilepsy, dementia, headache disorders and traumatic brain injury, to less common or more underrecognized conditions such as tropical ataxic neuropathy, neuromyelitis optica and neurotoxicological complications of lead or pesticide poisoning (Rahbar et al., 2015; Hendriks et al., 2021; Ibanez et al., 2021; Li et al., 2021; Pacheco-Barrios et al., 2021; Gracia et al., 2022; Rolle et al., 2022; Zúñiga-Venegas et al., 2022; Pacheco-Barrios et al., 2023). Comprehensive programs for prevention and treatment of these neurological disorders must therefore consider health system vulnerabilities that drive Caribbean neuro-health disparities, such as an inadequate or inadequately resourced neurological and neurosurgical workforce (Perez-Chadid et al., 2023; Santos-Lobato et al., 2023).

The consortium has tested the implementation of an electronic tablet-based system in the development of a diabetes registry at the Kingston Public Hospital. The aim was to develop an efficient and economical registry for the digitization of current and future patients diagnosed with Diabetes Mellitus Type 1 (T1D). The project was led by the University at Buffalo with UWI colleagues from the Kingston Public and University Hospital; of the West Indies (Prescott et al., 2021).

Furthermore, colleagues from the UWI Schools of Dentistry at Mona (Jamaica) and Cave Hill (Barbados) with colleagues from the School of Medicine at UB/SUNY and Rush University have embarked on a program of research training in Periodontitis, Microbiome and Comorbidities in Jamaica. This initiative was recently awarded a 5-year D43 research training grant that will train 5 pre-doctoral and 5 post-doctoral scholars in this area of research.

Cancer

The major cancers affecting the Caribbean include breast and pelvic (prostate, cervical, and colorectal). Breast cancer is the leading cause of cancer-related deaths for Jamaican women with an age-standardized mortality rate of 28 per 100,000 in 2014 (Gibson et al., 2010; Reid et al., 2020). Trends from the past 5 years show that mortality is increasing, in contrast with decreasing mortality rates among US women (Reid et al., 2020). Fear of pain during mammography, subjective indifference, and reliance on physician referrals are barriers to complying with mammographic screening guidelines. Increased efforts are needed to advance screening mammography programs and improve access to treatment (Ncube et al., 2015).

Jamaica has the highest incidence of prostate cancer in the world at 304/100,000 per year, while the Caribbean has the highest rate of prostate cancer mortality globally (Morrison et al., 2014). A 2015 study reported that a substantial proportion of Jamaican men ≥40 years had never been screened for prostate cancer, with uptake in some areas as low as 7% (Anderson et al., 2015). A study at the largest organized screening clinic in Jamaica in 2016 found that compliance with regular maintenance visits and requests for

confirmatory biopsies were poor (Morrison et al., 2016). The stigma associated with digital rectal examinations has contributed to low rates of screening. Early detection for prostate cancer should focus on measurement of prostate-specific antigen (PSA) and prostate exam in men with family history of prostate cancer and begin at 40 years of age or 10 years prior to the earliest age of death form prostate cancer and test ultrasound to improve prostate biopsy efficacy. The use of micro-ultrasound (Laurence Klotz, 2020) could improve staging and prostate biopsy and alleviate the need for 3-paramter MRI, which is not readily available in Jamaica.

Cervical cancer is the second most common cancer worldwide and impacts developing countries disproportionately due to vaccine hesitancy and supply, and social determinants of health such as education. Less than half of women 15–54 years old received screening in Jamaica in the last 3 years, although screening has been proven to decrease mortality (Ncube et al., 2015; Duncan et al., 2021). Pap smear tests and HPV vaccinations are underutilized: a woman who is unaware of where PAP smears are available is 85% less likely to get one and the HPV vaccination rate is only 30% among adolescents (Ncube et al., 2015; Duncan et al., 2021). Research should investigate the value of automated Pap smear interpretation versus visual inspection (Schlecht et al., 2006) and the most cost-effective method to evaluate abnormal pap smears, cervical dysplasia, and cervical lesions using cervix biopsy, colposcopy, and state-of-the-art automated pathology.

Colorectal cancer is the third most common cancer in Jamaica (Gibson et al., 2010; Hanchard et al., 2017) and survival appears worse in Jamaica than in the US despite similar surgical quality (Plummer et al., 2016; Roberts et al., 2020). An early detection program could incorporate fecal blood and DNA screening, CT colography, and/or colonoscopy. To improve outcomes, length-of-stay can be decreased using Enhance Recovery After Surgery (ERAS). Advanced endoscopic procedures, Endoscopic Mucosal Resection and Transanal Minimally Invasive and Endoscopic Microsurgery could replace many major surgeries without decreasing cure rates.

Cervical, prostate, and colorectal cancer early detection and treatment can be routinized using the National Comprehensive Cancer Network (NCCN) 2021 Guidelines® and their 2019 modification for the Caribbean, when appropriate due to resource limitations, which were developed in a two-day in-person meeting during 2018 in Trinidad of the resource-adjusted guideline working groups. Improved treatment also could be guided by biospecimen acquisition to understand variation in cervical carcinogenesis after HPV infection, response to androgen deprivation therapy (ADT) in prostate cancer, and differences in colorectal cancer incidence in Jamaica versus Canada and the United States.

Given the public health burden, excess mortality associated with treatment of more advance cancers due to delayed detection, and the expenses associated with advance cancer treatments, consideration is being given to the establishment of cancer treatment centers of excellence for prostate, colon, and cervical cancers. These sites would facilitate integrated multidisciplinary approaches to care and a more cost-effective deployment of highly specialized diagnostics and therapeutic modalities as well as provide a platform for research and training. The consortium has led an initiative to establish a Pelvic Cancer Center of Excellence at the Mona campus of the UWI working with colleagues from UB/SUNY and Roswell Park Comprehensive Cancer Center.

Pediatrics

Over the last decade, there has been a decline in neonatal, infant and early childhood mortality, with rates in 2021 of 12.4, 10.7, and 10.3/1000 live births, respectively (UNICEF, 2021). In the Caribbean and small island states, the IMR is 14/1000 live births (The World Bank Databank World Development Indicator, n.d.). The most common threats to neonatal health include respiratory and cardiovascular disorders, which are the leading causes of death for children under 5 years from 2011 to 2014 (Pan American Health Organization, 2017).

Being overweight and obese (World Obesity Federation, 2021) and having mental health challenges (United Nations Children's Fund, 2021) are major health issues as children age and have implications for future CNCD. This is compounded by limited access to mental health services and stigma associated mental health diseases. Additionally, STI/HIV infections threaten adolescent health and teenage pregnancy remains common in Jamaica, with limited access to contraception for young people (UNFPA, 2017; Figueroa et al., 2020). The consortium's NIH grant is being actively utilized to scale up a pilot program, Community HIV Adherence and Adolescent Mental Health Program (CHAMP++), to increase access to the mental health workforce through training at treatment sites for HIV-infected adolescents.

During epidemic surges of dengue, severe disease occurs in 1 in 5 hospitalized children, with increased vulnerabilities among those with sickle cell disease and a mortality rate of 5%. Two-thirds of deaths occur within 24–48 h of admission. Dengue, chikungunya and zika arboviral infections contribute to significant morbidity and mortality in Caribbean children (Christie et al., 2023), and due to the lack of approved vaccine treatments in the region, supportive clinical care and early diagnosis is essential. The impact of climate change on arboviral disease epidemiology could have implications on these childhood outcomes (Lue et al., 2022). In the Caribbean, research concerning respiratory diseases among children exposed to volcanic eruptions in OECS territories is relatively unknown. Additional concerns are reduced coverage of vaccine-preventable diseases (VPDs) and vulnerability of the Caribbean to reintroduction of eliminated VPDs.

In addition, autism in Jamaican children is a growing concern with 700 children with autism born each year (Autism Jamaica, 2019); the Jamaica Autism Support Association works to spread awareness, support affected families, and promote inclusivity. However, services are severely limited, and many medications used to treat more severe behavioral disturbances and comorbid disorders are unavailable. The consortium collaboration is still in the exploratory phase, with grand rounds and online consultations planned for 2023.

Mental health and substance abuse

Mental health and substance abuse disorders share four common behavioral risk factors: tobacco use, unhealthy diet, physical inactivity, and harmful use of alcohol (Pan American Health Organization, 2017). Depression and anxiety are the most common mental health disorders in Jamaica with a prevalence of 3.0 and 4.1%, respectively, and are more common in women than men (PAHO, 2019). Premature mortality due to these disorders could be prevented by community-based interventions and increased focus on mental health services. However, substance

abuse remains a concern. The 2016 National Drug Prevalence Household Survey reported that among 4,263 persons aged 12–65, 75% had used alcohol, 30% had used cigarettes and 28% had used marijuana. Alcohol was found to be the most used substance among adolescents with a lifetime prevalence of over 60% in a 2013 UWI study (Pan American Health Organization, 2017).

Important considerations

Genetic diversity

The Caribbean has a long history of interactions among European, African, Asian, and Native American populations. Studies have reported extensive gene flow across the Caribbean that probably result from two pulses of forced African displacement related to the slave trade (Moreno-Estrada et al., 2013). Genomic diversity has a broad positive impact on human survival: within a single population, every standard deviation of heterozygosity an individual has over the mean decreases that person's risk of death by 1.57%, which was consistent between European and African ancestry cohorts, men and women, and major causes of death (cancer and cardiovascular disease) (Bihlmeyer et al., 2014). The SUNY-UWI HRC is establishing partnerships through ongoing genomics research planning with the H3Caribbean project and other members of the Consortium.

Climate change

Increased temperatures that optimize mosquito reproductive cycles and feeding may enable the spread of vector-borne diseases. Droughts and floods also present an obstacle to sustainable development. These environmental issues are compounded by social issues, such as poverty, poorly constructed infrastructure, and communities located in high-risk areas (Pan American Health Organization, 2017). In 2020, Jamaica became the first Caribbean nation to submit a tougher climate action plan to the United Nations (Doyle, 2020). Climate change will only increase, which will stress healthcare infrastructure and capacity building further. To address the important link between climate change and global health the SUNY-UWI HRC is building public-private partnerships with innovative strategies such as decarbonization technologies.

Health informatics

Health informatics, including improved electronic health records, public health surveillance systems, digital imaging, and telehealth technologies, is essential for Jamaica's innovation and progress. Current projects of the Ministry of Health include the E-health Pilot Project, which aims to establish the national electronic Patient Administration System, the ICT infrastructure of the National Health Information Network (NHIN) and supporting initiatives. The E-health Pilot Project is the first step toward universal access to healthcare records at any patient care facility a patient attends while improving the quality of health reports for stakeholders (Ministry of Health Jamaica, 2022b). Their Laboratory Information System (LIS) Project is about 95% completed; the project addresses the efficiency of data management at the National Public Health Laboratory and strengthens the connection with linkage systems. The remainder of the plan outlines six additional strategic goals and corresponding action items and performance indicators to streamline health information systems and improve the quality of care (Ministry of Health, 2013).

The University of the West Indies (UWI), Mona, launched its Hospital Information Management System (HIMS) in 2018. The digitization of patient records aims to streamline healthcare delivery and establish a national repository of medical records (Scott, 2018). However, several setbacks have occurred in the project according to *The Gleaner*. Continued reliance on paper records and uncertainty around the cost-effectiveness of the project have delayed its completion (Johnson, 2021). The UWI Caribbean Institute for Health Research also has a program focused on Health Informatics (Biobank, Routine Data Management, Data Curation) (Caribbean Institute for Health Research, n.d.). Multiple research projects are focused on building a biorepository, improving health data management, and developing a registry for prostate cancer. The SUNY-UWI HRC has brought together key stakeholders in this field and has initiated collaborative projects including cloud-based strategies for disease surveillance.

Discussion

Cardiovascular and metabolic diseases, neurological disease, infectious disease, metabolic disease, injuries, and cancer are the primary areas of public health concern in Jamaica. Neonatal health, mental health, and substance abuse also negatively impact community health and contribute to NCD risk factors. Climate change and health informatics, especially building upon e-Health systems, play important roles in capacity building and ensuring sustainable development. Food security, housing, education, transportation, and cultural considerations are also factors that should not be ignored. As technology continues to develop, e-Health programs must be strengthened to secure patient information, enhance efficiency, reduce costs, increase access to technology, and improve expertise, and thereby improve healthcare outcomes. Recommendations include expanding early detection programs, developing healthcare infrastructure, and capacity building. With a number of successful planning and scientific meetings completed, the SUNY-UWI HRC is now working to establish a UWI Global Health Institute in Montego Bay that will utilize the Western Jamaica Campus as a location for a Caribbean hub that will foster collaborations across the region.

Author contributions

ALi wrote the framework and background information for the paper with the assistance of GM. All authors contributed paragraphs in their specialty of experience.

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Conflict of interest

AE was employed by the company Kingston.

The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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