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Kigali Car Free Day: An Innovative Model in the Fight against Non-Communicable Disease Pandemics

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ABSTRACT

Non-communicable diseases (NCDs) remain the leading cause of mortality worldwide and the burden is worsening especially in resource limited countries. Evidence has shown that physical exercise plays an integral role in preventing NCDs. In 2016, the government of Rwanda established a mass sport program in the capital city of Kigali entitled "Kigali Car Free Day" which offers an opportunity for Kigali residents to participate in physical exercise around the city on roads free of vehicles. The program also provides free screening of NCDs for residents. In this paper, we will describe the "Kigali Car Free Day" program and provide scientific insight on how the Car Free Day program in Rwanda can be potentially improved to benefit more people across the globe.

Key words: NCD; Car Free Day; Rwanda; Screening

PUBLIC HEALTH BURDEN OF NON-COMMUNICABLE DISEASES

Non-communicable diseases (NCDs) remain the leading cause of mortality worldwide [1]. In 2012, NCDs were responsible for 38 million (68%) of the 56 million deaths that occurred. The majority of NCD related deaths, as well as the majority of premature deaths, occur in low and middle income countries [1]. NCDs dominate the global burden of diseases, causing economic pressure on countries struggling against poverty. Estimates show that between 2011 and 2025 NCDs will cost the global economy over 50 trillion US dollars during this 14 year period [2]. Fortunately, it has been proven that NCD prevention is more cost effective [2]. Cardiovascular diseases, diabetes, cancer, and respiratory diseases are the four main NCDs and account for over 80% of NCD related deaths. Of all these conditions, diabetes is the most threatening since it is a risk factor for cardiovascular diseases and cancer on top of traditional complications of its own.

According to the International Diabetes Federation (IDF), 9% of adults, aged 20-79 years, are estimated to have diabetes worldwide [3]. In Africa, the prevalence of diabetes in adults is 4% but the rate of undiagnosed people living with type 2 diabetes mellitus is as high as 69% [3], [4]. Infact diabetes exhibits a progressive disease course without any apparent immediate effect on physiology or threat to death causing difficulties in diagnosis as people tend to consult physicians only when they feel unwell. In Rwanda for instance, according to the first ever national NCD risk survey conducted by the ministry of health in 2012-2013, 98% of respondents reported that they had never had their blood glucose measured [5]. Many NCDs share risks factors that pertain to personal behavior and environmental factors. Risk factors associated with NCDs such as physical inactivity, high blood pressure (BP), tobacco use, obesity, high blood glucose levels, and high cholesterol levels have been identified as the leading global risk factors for morbidity and mortality [1]. The lack of physical activity is a recognized important risk factor for many chronic diseases, such as coronary heart diseases, hypertension, type 2 diabetes mellitus, stroke and obesity. Moreover, physical inactivity was the cause of 9% of premature mortality, more than 5.3 million out of the 57 million deaths worldwide in 2008. In the African region, approximately 28% of people were physically inactive and the mortality from physical inactivity for the region was estimated at 6% [6], [7].

In Rwandan rural settings, non-work-related physical exercise has been traditionally regarded as a luxury reserved for the urban

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population. In some African cultures, obesity is perceived as a good sign for wealth and well-being [8]. Models of routine integrated NCD screening at community and health facilities have been described in Africa and advocated for as an effective strategy for increased NCD cases detection and enrolment into care [9], [10]. Nevertheless, education and screening for NCD risk factors during mass sports and car free day promotion have never been combined on a regular basis in urban settings.

RWANDA: AN ECONOMIC SUCCESS STORY AND REPERCUSSION ON DISEASE ECOLOGY

The world is projected to see an increase in the number of people with diabetes which is out of proportion compared to the projected growth in adult population in general [11]. According to Guariguata et al, the number of adults worldwide with diabetes is expected to increase 55% by 2035 [11]. Today, the African region has the lowest prevalence of diabetes, but it is projected to have the largest proportion of increase in the number of adults with diabetes, rising 156% by 2045 [3]. Factors contributing to this rise include reduction in physical activities, aging populations, a rise in obesity and increasing urbanization [12]. On top of these traditional risk factors for diabetes, a recent study has revealed that African populations have the highest genetic risk for type 2 diabetes [13].

Since the 1994 Genocide against the Tutsi, Rwanda has made tremendous progress in various aspects of its development. Over the last two decades, Rwanda's economy has seen a steady growth [14], [15]. The premature mortality has fallen and the life expectancy has almost doubled over the last two decades leading to an older population [16]. Kigali is one of the fastest growing cities in Africa and rapid urbanization leads to a more sedentary lifestyle in the population [17]. The World Health Organization's global status report on NCDs has revealed that 11% of men and 25% of women have age-standardized adjusted estimates of overweight status in Rwanda [1]. The last NCD Stepwise approach to surveillance (NCD STEPS) survey conducted in Rwanda in 2012 showed that the prevalence of hypertension was estimated at 15% in the general population and 39% in people aged 55-64 years. About 70% of those individuals were unaware of their hypertensive status [18]. In May 2016, the City of Kigali launched a car free day program to reduce the risk of NCDs among Kigali dwellers while promoting a green city with decreased air pollution.

THE KIGALI CAR FREE DAY PROGRAM

Twice a month, on the first and third Sunday, Kigali bans cars and motorbikes in many parts of the city to allow citizens to cycle, walk, and jog freely on the roads. The city mainly closes roads heading towards designated assembly points for people involved in the activity while keeping open the rest of the roads to allow motorists undertaking their usual activities. The car free day activity takes most of the morning hours from 7 to 11 am. The bimonthly activity attracts thousands of Kigali residents who bike or run several miles from home to eventually converge at a large park where they continue physical exercises and stretching as directed by a gymnastic specialist. A special program of physical activities is also conducted in a separate area for children. Advertisement of the event is done by sending automated short text messages to Kigali residents' mobile phones as well as through television and radio announcements.

With the support of the Ministry of Health and the NCD Division of the Rwanda Biomedical Center, several local health organizations erect tents where they provide free screening for NCDs. Volunteers include medical doctors, nurses, laboratory technicians and students in various health professions from local universities under the coordination and constant training of the Rwanda NCD Alliance (RNCDA), a platform made of several local NCD civil society organizations. There are several stands where volunteers provide individual education and counseling on screening results. Education brochures are distributed and key messages broadcast loudly through sound systems to participants, particularly when there are special campaigns or international NCD events such as World Heart, Diabetes, or Cancer Days. Systematically performed procedures include BP measurement, anthropometrics (body mass index and waist circumference), random capillary blood sugar and intraocular pressure for glaucoma screening. Identified individuals with abnormal screening findings get advised to seek further medical attention in health facilities in Kigali through the usual referral pathways.

Two years after it was launched, the Kigali Car Free Day program has gained tremendous popularity and is strongly supported by the government of Rwanda. Currently, the Car Free Day activity is held twice a month in Kigali and its implementation is extending to two other cities across the nation, namely Huye in the South and Musanze in the North.

USEFULNESS AND LIMITATIONS OF NCD SCREENING AT KIGALI CAR FREE DAY

Scientific evidence has largely confirmed the benefits of physical exercise on human health. For instance, there is established evidence that regular physical activity prevents or delays the onset of type 2 diabetes and reduces cardiovascular risks [19], [20]. The Car Free Day program in Rwanda is an exemplary and innovative intervention that might improve the health of beneficiaries and promote the culture of regular physical exercise. In fact, car free day programs have existed for several decades in many parts of the world and have a world celebration day every year on September 22nd. However, the main goal for the car free city model in other parts of the world consisted in environmental benefits [21]. The inclusion of NCD screening in the Rwandan car free day activity is an innovative move and a powerful screening intervention amid NCD pandemics around the world.

As Africa still struggles with insufficient resources to address NCDs, novel and inexpensive approaches for early diagnosis of NCDs are highly needed. A recent study in Malawi is an inspirational example on how existing resources in HIV management can be leveraged for early detection of NCDs. The study explored an NCDs screening model among participants at community events, outpatient gatherings and patients waiting for

HIV screening and resulted in high enrollment in NCD care in one of the districts in Malawi [10]. The screening of NCDs during car free day events is another potentially innovative approach in the early detection of chronic diseases. However, the usefulness of the screening procedures performed during the Car Free Day has yet to be established. Data on anthropometrics and blood samples from thousands of participants are collected every month. From a clinical standpoint, the Car Free Day health care providers should interpret screening results with extreme caution and remain careful while advising participants, as the screening is undertaken on participants in a post-exercise state. Using the standard thresholds for BP and random blood glucose to interpret findings can be misleading because these were designed to be used in clinical settings. Screening results may provide a rough estimate on health status of participants, but cannot reliably guide clinical decisions.

Another critical consideration is the knowledge and skills of personnel engaging in data collection, participant counseling and health literacy teaching activities. Several health-related organizations especially in the field of NCDs, take part and volunteer to help in Car Free Day activities across the country. Providers may not be certified health professionals and it is critically important for organizers to ascertain their skills while performing procedures such as blood pressure and waist circumference measurements to minimize errors. Health literacy lessons may need to be standardized and censored by experts before they get released for broadcast.

FUTURE PERSPECTIVES: HOW CAN THE CAR FREE DAY BE LEVERAGED INTO A MORE PROFITABLE PROGRAM?

The establishment of the Car Free Day program in Rwanda is a commendable effort in the battle against NCDs. Moving forward certain factors need to be considered to make the program more profitable.

Cost effectiveness of deployed human and financial resources

On every Car Free Day occasion, hundreds of participants show up in Kigali. The health care team that offers free NCD screening includes practicing doctors, nurses and other working citizens. Significant amounts of medical equipment are deployed and all willing participants are tested without limitations such as age, risk factors or how recently they were last screened, which poses a significant concern for the cost effectiveness of this intervention. Since the same people may participate in car free day activities regularly, assigning permanent identification numbers can help save resources by decreasing the frequency of screening, allowing follow ups of people with abnormal results and evaluation of education and physical activity's impact. Furthermore, cost effective non-laboratory tools for predicting the risk of diabetes have been developed and validated in several populations across the world [22]. However, such tools need to be population specific and none of the existing tools have included African populations. Developing such tools for Rwanda could be extremely useful for diabetes risk stratification and would help cut down the number of participants needing further blood workups at the Car Free Day.

Interpretation of screening results

It is always helpful to collect data from patients to understand their medical conditions, but how doctors interpret this data is always critical. Taking the example of waist circumference (WC), blood pressure and blood glucose, the most commonly sampled parameters at Car Free Day, we can mention some factors that may limit their usefulness.

Interpreting findings with extreme caution.

Today, there is no validated threshold for WC and risk for insulin resistance in Africans. Due to scarcity of data in Africans, IDF recommends using guidelines from Europeans which are 94 cm in men and 80 cm in women [23]. The American Heart Association's recommendations of 102 cm in men and 88 cm in women are also commonly used by clinicians to predict insulin resistance. A few studies, mostly from South Africa, have tried to provide WC thresholds, but they are far different from the ones provided by IDF especially for women. Those studies have found the WC of risk to be between around 90 cm and 95 cm for men and women respectively [24]–[27]. It is therefore important for the Car Free Day program health care providers to understand the limitations of using the current guidelines and interpret the collected results accordingly.

BP measurement is probably the most commonly performed medical procedure. Although the procedure may look simple, BP level accuracy largely depends on patient preparation, equipment, settings, and knowledge of the care provider [28]. The Car Free Day activity is not the ideal setting for BP measurement. Participants usually come after strenuous physical exercise and may not have had time to rest enough to meet the standard BP measurement guidelines. Furthermore, the health care providing team is diverse and all may not have been trained to take BP at an occasion such as this. Therefore, BP findings may not accurately help in advising participants and may not also reflect the true picture of prevalence among the general population.

Although limited data exists, some literature suggests that exercise has an immediate effect on glucose status [29], [30]. A recent pilot study revealed that short bouts of high intensity activity influence blood glucose level among adults with prediabetes. The post-exercise change in blood glucose level was more marked in participants with higher pre-exercise blood glucose [29]. Therefore, using standard fasting blood glucose thresholds at the Car Free Day activity can lead to under-diagnosis of diabetes and prediabetes among participants. The Car Free Day participants should be unequivocally advised that the screenings during Car Free Day activity do not supplant regular physicals and medical follow-ups in clinical settings.

A unique opportunity for novel research and lifestyle interventions

The Kigali Car Free Day activity gathers approximately one thousand people every month. Most of these participants are residents of Kigali City and are able to attend the activity regularly. This can be an excellent platform for research projects for the benefit of the larger Rwandan and African population.

For instance, the Car Free Day program can be a hub for lifestyle interventions and studies aimed at understanding how exercise affects human physiology. It is also a brilliant example of integration of NCD screening into existing programs for big impact with minimal effort and resources. We therefore perceive the Car Free Day program in Rwanda as an immense opportunity for novel initiatives in the fight against NCDs but the success of those interventions requires constant improvement in all aspects of the program by different stakeholders.

Competing interests
The authors declare no competing interest

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