Urban green spaces in the wake of Covid-19 pandemic: reflections from Nairobi, Kenya

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Abstract This paper seeks to examine how the perception and use of Nairobi's urban green spaces (UGS) have been impacted by the Covid-19 pandemic. The question of how the current pandemic and the resulting government policies will affect urban green spaces has remained elusive. Similarly, the relationship between public health crises and urban green spaces has not been well integrated in the current literature. This paper identifies a nexus between government response to the Covid-19 pandemic and (*Un*) sustainability of UGS. The authors further reflect on the potential role UGS could play to mitigate the negative effects of the pandemic. Findings of the study show that UGS in Nairobi have not been fully exploited to provide citizens with sufficient access to green spaces yet as the pandemic has shown these spaces could significantly improve physical and mental health for the citizens as well as act as logistical areas for humanitarian activities during a

pandemic. The paper therefore concludes with policy recommendations that can give rise to short and long term reforms in the provision and management of UGS.

Keywords Urban green spaces · Covid-19 · Pandemic · Nairobi

Introduction

Urban forestry and green spaces are considered to be a nature-based solution in urban sustainability and fundamental element for achieving the UN Sustainable Development Goal 11 (Borelli et al, 2018). They play multifunction roles to the city dwellers in economic development, improving social cohesion, and public health benefits (FAO, 2018). With increasing urbanisation across the world, city and urban planners have been keen to include open spaces with vegetations as a way of dealing with the pressure of growing population and rapid construction. Urban green spaces can take different forms including green corridors, gardens, parks, natural areas, wetlands, children playing spaces among others. Apart from being intended to improve the quality of living in the urban area, green spaces are also important in providing biodiversity in urban areas, reducing environmental hazards as well as tackle effects of extreme

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climate such as heat waves and flooding. If well managed, green spaces act as the lungs of the city. Environmentally, urban green spaces and forests aid in mediating air pollution from industries and motor vehicles in mega cities, controlling urban climate through cooling effect, tree vegetation acts as wind-breaks and control urban flooding (Tyrväinen et al, 2005). Economically, green spaces increases property values, especially residential areas close to urban green spaces, creation of employment to individuals in parks, garden and other related businesses (Mensah, 2014a). Ultimately, urban green spaces such as parks and garden promote mental and physical health by alleviating stress, mental relaxation, restore social cohesion and minimize exposure to extreme urban heat and air pollution (WHO, 2018).

Developed countries tend to have well established and better managed urban green spaces than most less developed countries which often experience depletion of such spaces (Mensah, 2014a). It is also noted that the concept of urban green space is less valued in underdeveloped countries partly due to poor urban planning strategies as well as theft of public land that could be designated for green spaces (Cilliers, 2009). Ideally, owing to the benefits of Urban green spaces provides, more spaces are expected to be reserved for expansion but this is not the case mega cities in Africa (Mensah, 2014b). Challenges of urban green spaces and impacts on health have been studied however, impacts of Covid-19 on urban green spaces and mental health is not well articulated due to inconclusive existing information.

As the Covid-19 pandemic continue to disrupt different sectors, it has left the world in uncharted territory with scholars and policymakers struggling to understand and mitigate its ultimate impact even as scientists rush to find a cure or vaccine for the virus. Amid these debates has been the concern over the impact of the disease on mental and physical health whether the environment and more specifically urban green spaces will have a role to play given that scholars have verged for urban green spaces usefulness in providing conducive ecosystem that can improve mental health (Ugolini et al., 2020). Moreover, the question on how government policies in curbing the spread of the Covid-19 pandemic will affect UGS have also arose.

In Kenya, green spaces form part of public spaces thus the need for collective participation by the

government (County and National), public and private sectors and the urban community to conscientiously participate in sustainable establishment and management of urban open spaces (Weya, 2015). In a proposed policy recommendation adopted in 2015, the government acknowledge the need to give urban green spaces the attention it deserves proposing to promote protect, improve, maintain and monitor of urban green spaces. Historically, public spaces have been irregularly allocated in the country to individuals and institutions with influence. Those which have remained in public possession lack investment and creativity that can make them useful and effective to the public. This makes the proposals in this article timely but also relevant as there are intended action plans to improve green spaces in Kenya, but the delay means there is lack of sufficient motivation. The authors in this paper argue that the Covid-19 offers a unique opportunity for policymakers in Kenya and other developing countries to identify green spaces as important aspects of human societies as any other basic needs. Moreover, given that urban areas are often crowded, parks can offer invaluable experience for residents during and after pandemic. The paper begins by examining existing literature on the status of greens spaces in Nairobi and epidemiology of Covid-19 in Kenya. They then discuss the methodological approach and generate findings from the existing literature. The authors use the information generated from the existing literature to discuss the gaps in research and policy and propose some approaches on how urban green spaces can be integrated in pandemic response.

Literature review

The World Health Organization announced the first case of the virus on 7th January 2020 after confirmation from the Chinese Center for Disease Control Prevention (CDC). The virus which causes severe acute respiratory sGopinatyndrome was identified as SARS-CoV-2 later named Covid-19. With rapidly increased cases in over 200 countries, the virus was declared a global health emergency of international concern (PHEIC) on 30th January 2020 by World Health Organization (WHO, Coronavirus Disease (Covid-2019) Situation Reports–, 2020). Coronaviruses belong to family covidinae which are

single-stranded RNA viruses that cause Acute respiratory distress syndrome (ARDS) affecting humans, mammals, and birds.

In Kenya, the Ministry of Health announced the first case of Covid- 19 in the country on the 13 March 2020 after a passenger arriving from the USA via London tested positive of the disease. Since then, despite the various efforts implemented by the government to counter the spread of the disease, there has been an increasing number of cases across the country. The most affected regions are the two largest cities of Nairobi and Mombasa. Figure 1 Shows that Nairobi has over 46, 000 cases as of 17th October 2021.

As a response to counter the spread of the COVID-19, on March 15th the government ordered the closure of schools and universities while workers being directed to work from home. At the same time, other measures were imposed to contain the spread including the ban on international flights except for cargo flights, public gatherings such as weddings, funerals, and religious events, lockdown, and curfew duration were extended (Ministry of Health, 2020). As the country continues to battle the virus, there have been mixed results with the number of deaths and recoveries also gradually increasing. What is clear though, this pandemic will have a lasting impact on mega cities. Already, the lives of millions of city dwellers have been altered as they try to cope with strict government guidelines on social distancing, wearing masks, and in some cases ceding movement completely due to curfews and lockdowns. For those who can manage are now being encouraged to work from home while millions of others have been forced to take leave or lose their jobs. Economically, measures are

taken by the government continue to hurt millions in Kenya and billions of others across the globe as estimates show a drop of global economic to – 3% (Gopinath, 2020).

Scientific literature has acknowledged the beneficial aspects of urban green spaces to the environment, socio-economic, and human health. Green spaces are of invaluable benefit to the city dwellers, yet developing countries still face challenges of unsustainable urbanization. Therefore, it is important to ensure that green space policies are integrated into the emergency response policies to ensure their sustainability. The relationship between public health and urban planning has gain prominence with the outbreak of the COVID-19 pandemic in 2020. Urban areas constantly face different forms of crises, from crime to unemployment, natural disasters, water shortages and floods. Public health crisis is proving to be a major cause of new crisis not only due to the possible infections and death that the COVID-19 pandemic has shown to be possible, but also the negative impacts of government policies such as lockdowns and quarantines. According to Kamara et al (2017) practices such as prolonged quarantine have significant impact on people's mental health. Given that this was an approach widely adopted during the current pandemic, it is important to evaluate alternative means of dealing with the pandemic and resulting consequences such as mental health. This is where urban green spaces come in.

According to Davis et al. (2009) there ways in which humans interrelate with the natural ecosystem are diverse. Various studies have shown humans' preferences for sceneries is particularly dominated by nature (Kaplan & Kaplan, 1989; Seymour & Busch,

Fig. 1 Cumulative cases of COVID- 19 in Nairobi (Source: Ministry of Health (Kenya))

2016). During the past decades, researchers have increasingly focused on the correlation between humans and the natural environment (Thompson et al., 2011). Benefits associated with urban green spaces include; the improvement of mental health (Kuo, 2001), amplification of cognitive functions (Berman et al., 2008), and alleviate stress and fatigue (Harting et al., 2014). Studies on the human-nature relationship have reported a positive outcome on health matters (Maas et al., 2006; Velarde et al., 2007). City dwellers face a triple health burden that comprises of obesity (Flegal et al., 2010), respiratory diseases and cardiovascular diseases (Vorster, 2002). It is therefore important to provide unbiased access to urban green spaces so as to ameliorate urban living affliction. However, this might be a challenge during the COVID-19 pandemic period with the restriction of movement and social distances as a way of reducing the transmission of the virus. In most countries, urban dwellers have severely been restricted from accessing green spaces, this include Rome, New, York, and Barcelona (Honey-Roses et al., 2020). On the other hand some have been provided with a complete access to parks and green spaces. Such unequitable access to green spaces might subsequently lead to adverse mental and physical health problems.

COVID-19 pandemic has led to fear of uncertainty as a result of unprecedented change in people's daily routine. In order to maintain positive mental health, access to green spaces such parks and forest becomes crucial. There is need to take into account the beneficial aspects of sustainable urban green space development. In Nairobi, there is unequal accessibility of green spaces between the rich and the poor. The high income earners getting an upper hand in accessing parks since most of green spaces are located in high-end areas of the city, most of which are privately owned. However, those with open access to everyone such as City Park are currently closed in order to contain the spread of COVID-19. In other countries, the use of green spaces is still low despite the fact that accessibility is open.

Attempts have been made to restore and reclaim green spaces in Nairobi. This follows cases of privatization and grabbing of green spaces and urban forest. For example half of Karura forest was reported to have been privatized to private developers (Njeru, 2012). Nyambane et al., (2016) also reported encroachment of Karura and Ngong forest by the

neighbouring communities. Attempts to reclaim grabbed land has had some limited success in recent years. For example, campaigns by the Green Belt Movement led by the late Wangari Mathai who has been on the forefront to save green spaces including the Karura Forest has had some impact (Mbatia & Owuor, 2014). In addition, approximately 2000 acres of Nairobi National park has been recently reclaimed while the government is mulling similar exercises to reclaim grabbed land in the Ngong forest and City Park. There has been an ongoing rehabilitation of Michuki Park which involved the establishment of tree nurseries and solid waste management by Nairobi Metropolitan Services.

Despite the said efforts, threats to public land and in particular green spaces in Nairobi continue growing. The controversy over government attempts to utilize 1.3 acres from the Uhuru Park on the construction of the multimillion Nairobi Expressway was met with fierce resistance from environmentalists. The construction of the standard gauge railway through the Nairobi National Park has also raised serious concerns over the future of the already low percentage of green space cover in the city. The sustainability of urban green spaces in Nairobi is heavily undermined by a combination of rapid urban population growth, poor planning, lack of an institutionalized culture of developing and using green spaces as well as a poor land tenure system (M'Ikiungu et al., 2012). With overwhelming population growth, the urban green spaces in Nairobi are coming under constant presser and imminent threat as resources and decades-old urban plans that were meant to serve approximately 250,000 city dwellers are becoming limited to accommodate the over seven million people currently living in the city (Makworo & Mireri, 2011).

Methodology

Growing evidence indicate that most urban green spaces are not well designed to offer users with safe environment during pandemics. According to Skider (2020), cities can play an integral part in providing solutions to the problems the world is facing and with this, urban green spaces can be part of government policy response to the COVID -19 pandemic. He argues that the new dynamics of the pandemic have elicited the need to rethink and re -experiment the

theory of urban structures. This paper therefore seek to add two important discussions on urban green spaces in developing countries. The first is to rethink whether these spaces support *connectivity*, *accessibility*, *functionality* and *flexibility* which are necessary in achieving sustainable response to pandemics such as the COVID -19. Secondly, beyond recreational purposes, how do urban green spaces contribute to supporting public health particularly during pandemics? We argue that urban green spaces should be designed in a manner that allows for easy accessibility for all, should be functional in the sense that it can support humanitarian activities, should be flexible and allow for quick transformation.

This qualitative study provides policy makers with information on the relevance of urban green spaces during a pandemic and offer recommendations on how these spaces can be integrated in future policy response during pandemics. Given the negative impacts of the COVID-19 pandemic, there is limitations on the ability to collect primary data. Nonetheless given that part of the audience of this paper are policy makers in developing countries, the qualitative approach makes it reachable to a broader audience. The authors have relied on data from renown academic publishers, reports government and international organizations as well as observation.

The Nairobi Metropolitan area covers a total of 704 km² however, green spaces only cover a total of 9.86% of the area. Such a low percentage of green space coverage means that the city lags behind other emerging mega cities across the world such as Hanoi in Vietnam which has more than 18% of its urban area covered by green spaces (Uy and Nakash, 2008). Increased urban population has been a major threat to the sustainability of UGS as a result of encroachment (Makworo & Mireri, 2011). According to the UN, (2016) Africa showed the highest rate of urbanization between the years 1995–2015 resulting in a rapid increase in population density and in turn demand for land. In Nairobi, the UGS is approximately 14,553 ha and supposed to serve over 4.1 million people (FAO, 2018). Much of these greens spaces are covered forests within the city such as Karura forest, The Nairobi Arboretum, City Park Forest, Olulua forest, Ngong road forest, Uhuru garden, Nairobi National park and Central Park (Mbatia & Owuor, 2014). Due to Corona virus pandemic, the government imposed a partial lockdown and the restriction of movement as a

measure to contain the spread of Coronavirus. Through the ministry of health, guidelines on the pandemic prevention and control were stipulated. National environment management authority (NEMA) provided safety guidelines on the disposal and management of Personal protective equipment (PPE).

The paper is framed around the “Attention Restoration Theory”, a field of environmental psychology tend to give a clear explanation on the relationship between the environment and public health. The theory proposed that “natural environment is cognitively restorative” in contrast with the urban environment which seems to deplete one’s energy and concentration (Kaplan, 1995; Kaplan, & Kaplan, 1989). The hypothesis based on this theory is that suppress mental fatigue in addition to improving one’s attention effectively (Kaplan & Kaplan, 2003). Environment influence brain restoration to brain patients by boosting and rejuvenating them hence hastening recuperation. Moreover, environment brings about relaxation, meditation and restoration of the pre-frontal cortex subsequently influence high-level mental activity that include problem-solving (Lezak, 1982; Mesulam, 1985). Amidst COVID-19 pandemic, mental effect is expected to escalate due to the disruption in the socio-economic life therefore there is need for people to get exposure to nature more often. Unfortunately, the existing urban spaces in Nairobi may fail to support the growing population in the city thus there is not only need for creating more green spaces but also their design and distribution should reflect the one proposed in this study.

Results

Urban green spaces remodeling

Recent studies acknowledge the need to redesign urban areas to enhance the increase in urban green space occupancy (Roberts, 2020; Honey-Rosés et al., 2020). COVID-19 crisis has heightened the debate on footpath expansion and pedestrian crossing points to maintain social distance guidelines (Alter, 2020). Cities like Millan have already implemented permanent changes through the widening of footways and an additional 35 km of bike lanes (EFE, 2020). In Kenya, specifically, Nairobi is still being governed by the

1948 Master Plan and has experienced a drastic decrease of green spaces due to population explosion (Makworo & Mireri, 2011) resulting in the geographical expansion of the city boundary (Oyugi & K'Akumu, 2008). This period may infuse some governments and city planners to amend new city plan and design. Additionally, it will influence the application of urban green infrastructure (UGI) and Nature-based solutions (NBS) which focus on incorporating green spaces within urban planning (Emilsson & Sang, 2017).

Green spaces have been encroached by informal settlements, unscrupulous developers, and expansion of the city as shown in Fig. 1. The Global Liveability Survey that ranks cities based on green space, pollution, healthcare, education environment, and infrastructure indices, Nairobi was ranked among the cities with a decline in livability (Kiboi et al., 2014). Moreover, the city dwellers are yet to embrace the use and importance of green spaces. A study by Mbatia and Owuor (2014), shows that 41% of high residential dwellers pay a visit to urban green spaces while middle-income dwellers were 13%. Given the wide income inequality gap, the findings of this study reveal that only a small fraction of Nairobi residents use green spaces. Poor management and low -quality maintenance are a major problem facing urban green spaces in Kenya.

The nationwide lockdown and curfew imposed in Kenya to contain the spread of COVI-19 pandemic have had unprecedented economic, social, public health, and environmental impacts. The implementation of social distancing has restricted movement and social gatherings with limited access to urban green spaces and forests. Urban green space helps in maintaining mental and physical health through regular exercise, provides space for social interaction, however in the fight against COVID-19, most countries have limited mobility and access to public spaces. According to Stockholm Environment Institute (2020), most parks in various cities have been closed completely while UK accessibility is limited to an hour. In Nairobi, the majority of the urban green spaces and forests are located in leafy suburbs under private ownership where poor people cannot access while those with open access are completely closed during the pandemic.

Restricted access will have a positive environmental impact in urban green space and forestry which

have been affected by human activities. These Parks under closure will not experience waste disposal as compared to the past where irresponsible disposal by hawkers and other park users threatened the natural environments in the parks (Makworo & Mireri, 2011). Travel ban and curfew have also impacted the management and restoration of the urban forest from illegal logging and charcoal burning. Karura and Ngong Forest have experienced illegal logging native species being a target (IUCN, 2003). Based on a report on the analysis of the Ministry of Environment, Water and Natural Resources (2013) transportation of charcoal was done at night to avoid law enforcers and Nairobi has been the major market of the illegal charcoal in Kenya.

On the other hand, the lockdown restrictions and other government policies such as social distancing and curfew have resulted in the suspension of major international events related to environmental conservation that include World Earth Day and World Environmental Day. In most cases, some of the activities that take place during these events include tree planting, general cleaning of public places, and creating public awareness on biodiversity. This year will be a setback in rehabilitating degraded urban green spaces at the same time slow down efforts in achieving 10% forest cover. Without a definite timeframe upon which the COVID- 19 related restrictions will come to an end, policymakers must begin to develop mechanisms that will enable continuity in the planting of trees or ensure that environmental-related events are postponed to a later date. The secession of on movement of people and transportation including travel restriction in and out on major cities such as Nairobi and Mombasa has led to a decrease in the use of vehicles. Emission from vehicles is the major source of air pollution in metropolitan cities (Kakouei et al., 2012). Kinney et al., (2011) recorded the mean daytime concentration of fine particulate matter ($PM_{2.5}$) to be $98.1 \mu g/m^3$ in Nairobi. The concentration is expected to reduce with restriction of both private and public transport within the city and shut down of industries.

Although the rate of global air pollution from vehicles, industries, and electricity plants has declined due to the reduction of fossil fuels, household air pollution from charcoal, wood-fuel, and other sources of fuel is intended to rise. In Kenya charcoal, wood-fuel, and agricultural waste contribute up to 70% of

Kenya's final energy demand in both rural and urban settings (Githiomi & Oduor, 2012). Indoor air pollution is not only a climate change pollutant but also results in severe non-communicable diseases such as acute lower respiratory infection and pneumonia. The effects are more prevalent in developing countries like Kenya where most houses have poor ventilation systems (Smith et al., 2000; WHO, 2018). With many people confined in their homes during the lockdown period, P.M_{2.4} concentration is expected to accelerate.

Amid the pandemic, an ambitious initiative dubbed the *Kazi Mtaani* a National Hygiene Program was launched by the government seeking to employ over 300,000 young people to engage in environmental management activities. Already, a total of 26,000 youths from informal settlements in major cities of Nairobi, Mombasa, and Kisumu have benefited from the program. The program aims to provide jobs to young people and at the same time improving the environment and manage public sanitation and hygiene during the COVID-19 pandemic. Under the program, workers are involved in various activities that include, cleaning the streets, collecting garbage in markets, shopping centers, fumigation, and disinfection of public places, they also help in watering tree nurseries. The program if sustained has the potential to create a huge positive impact in waste management in urban green spaces and nature reserves where the most solid waste ends up being disposed of especially during this period where the generation of solid waste is expected to increase.

The majority of rising number of COVID-19 infections in Kenya are in Nairobi and given the status of the city as the economic and political hub in the country, disruptions from the pandemic will have national and regional consequences. On the positive side, most industries, cars and other potential sources of carbon emission are located in the city. During the lockdown, there has been relatively low number of cars (both public and private) on the streets as well as closing down of most industries resulted into decrease in Carbon dioxide and Nitrogen dioxide concentration in the atmosphere. The reduction in carbon emission may have a positive impact on the environment and if complemented with improved quality of urban green spaces can have long term environmental impact.

As the lockdown becomes a popular approach in dealing with COVID- 19, mixed reactions have emerged over its impact on the environment. While

some praise reduced emissions by factories and automobiles as fewer people are traveling, others have pointed out a serious oversight over the consequence of people staying at home. This school of thought begins by looking at how people live at home. For the relevance of this paper, we look at the forms of energy used for cooking and lighting and how that impacts the quality of air and the pollution of the environment in general. The majority of Nairobi residents are low-income earners and rely on mostly kerosene, charcoal, wood, and sometimes plastics for listing and cooking. Previous studies as shown in Fig. 2 have revealed that the source of energy being used by many households in Nairobi negatively affects the environment. The figure reveals that only 13% of the households are below 25 µg/m³ per 24-h limit as recommended by the WHO. In addition, while the remaining household exceeds the set limit, they do so excessively. For example, most of them produce roughly 100 µg/m³, and the highest recorded emission being 261.8 µg/m³. With this background, one would expect that the current air pollution from households has increased during the pandemic as more families are at home that means an increase in the use of energy sources, most of which are found to be negatively affecting the environment. The impact of this on green spaces cannot be emphasized enough. A combination of polluted air and poor maintenance of green spaces will lead to further destruction (Fig. 3).

Despite the concern over the impact of household pollution of urban green spaces, the decline in mobility and use of parks can be beneficial to the environment. According to the World Bank, outdoor pollution is 40% higher than the level recommended by the WHO. This can be attributed to the rapid increase in the number of cars on the roads of Nairobi (estimated to be 3 million in 2017 from 2 million in 2013) and doubling of motorcycles (Miaron, 2018). With a 33% decline in the use of public transport, 3% decline in the number of people reporting to work, this includes factories and 19% decline in the number of people visiting the parks as shown in Fig. 4, the resulting decline of pollution and pressure on the parks can help these green spaces and the environment in general to regain (Google mobility, 2020). However, there must be a deliberate well-planned effort to rehabilitate green spaces during the pandemic and serious efforts to develop new ones in the future should also be considered.

Fig. 2 Map of Nairobi showing population density. (Source: Compilation from ERSI, HERE, GeoBase, GIS user Community (2020))

Fig. 3 The declining cover of Nairobi's green spaces between 1988 and 2016 (Source: Miraza, (2017))

COVID-19 pandemic has shown a growing environmental crisis related to the overwhelming generation of solid waste both in hospitals, public spaces, and homes. With a rapid increase in COVID-19 infections, the demand for personal protective equipment such as masks, gloves, disposable plastics, respirators, and syringes is expected to increase worldwide. Such a

case scenario has been reported by (Campbell, 2007) where movement restriction due to the spread of Ebola in Liberia, Sierra Leon, and Guinea led to a huge accumulation of waste. This poses a serious environmental risk considering the fact that worldwide solid waste management has been stumbling block in ages. China recorded a dramatic increase in medical waste

Source: Google Mobility, (2020)

Fig. 4 Impact of lockdown on human mobility in Nairobi between April and June 2020 (Source: Google Mobility, (2020))

up to 207 kt, Huabei province recording (+ 370%) increase in medical waste generation. Most of the protective gear such as non-reusable masks, gloves, and sanitizer bottles are made of plastic which might end up in both terrestrial and aquatic environments causing long-lasting effects (Hellewell, 2020). Nairobi is notorious of its poor solid waste management system that sometimes leaves the streets littered with all types of waste. Therefore, if serious measures are not taken to ensure effective disposal of the protective gear, then there will be a crisis in the city. Already NEMA (National environmental management authority) has reported an increase in the accumulation of single used protective equipment from hospitals, marketplaces, offices, and homes which are harmful to the environment. In response, NEMA has implemented various strategies including the provision of waste bin in residential areas and shopping centers for proper waste disposal. In addition, the WHO (2020b) has stipulated guidelines on waste management during the COVID-19 pandemic.

Closure of recycling centers in several cities has impaired waste management. Countries like the USA, Europe, and Italy have been affected due to the suspension of recycling services. Moreover, companies have embarked on disposable bags for packaging owing to increased online orders. As a result, more domestic waste is being generated (Zambano-

Monserate et al., 2020). In Nairobi, informal settlements are characterized by congestion, poor sanitation, and lack of solid waste management the rate of environmental pollution is expected to proliferate. Even in the middle -class residential areas, there is no effective waste management system as a culture with most neighborhoods depending on private waste collectors who now are not able to work. Most of this solid waste will eventually end up in the nearby green spaces which will eventually lead to a long-term degradation and destruction of the existing green spaces.

Lessons on ugs from the pandemic

One of the biggest challenges with establishment and management of green spaces in developing countries can be found in the planning process. Of the many challenges, corruption and poor planning undermine the establishment of sustainable green spaces. The two affect green spaces in three ways; the first way is that green spaces are not the cheapest unit to maintain. They need continued working, water, electricity, and general maintenance all of which need adequate resources. Secondly, the space needs to be provided to set up the green spaces. However, corruption and inadequate resources can affect the important process

especially given that spaces in urban areas are highly valuable. Another challenge facing planning for green spaces is lack of innovation which is sometimes a result of flawed recruitment process and nepotism. To help address these challenges we recommend the following planning process.

(1) To adopt an elaborate short-, medium- and long-term strategy for establishing and maintaining green spaces in the area. This will be a guiding tool to ensure continuity and sustainability of green spaces. (2) passing necessary legislations or by -laws to protect green spaces from individuals with private interests. This will help reduce instances of grabbing public land meant for green spaces which is a common occurrence now. (3) engage members of the public on the importance of utilizing green spaces and in doing so ensuring that their actions are responsible. This includes informing members of the public which parks/green spaces are open for use, how to handle the facilities provided in the areas and reduce vandalism. (4) plan to include creative facilities that can encourage people to use the parks especially during pandemic periods. These include adequate security, water, free Wi-Fi, sanitation facilities, study areas, cooking areas while keeping in mind that planning ought to also ensure persons with disability and other pandemic protocols can be observed. (5) part of the planning process out to ensure that the organization is able to guarantee resources will be available even if it means collaborating with the private sector and that when these resources are made available, they are properly utilized without corruption. The lesson below are drawn from the experience of COVID -19 in Nairobi and propose ways urban planners can improve the utility of green spaces especially during public health crises.

Remodeling urban putting into account health basis

Studies conducted on the impact on the social impacts COVID -19 including on mental health are concerning. More so, if such consequences are further aggravated by government lock down policies to curb the spread of the disease. Most studies have found that the implementation of social distancing and restriction of human movement has resulted in loneliness especially to those confined in quarantine and the elderly. If the situation prolongs might lead to a rise in cases of

stress which eventually leads to depression. Prohibiting social gatherings such as weddings, circumcision and funeral ceremonies can be a source of depression particularly in Kenya where the three are highly valued (BBC, 2020). Many researchers have sought to determine the correlation between green space and human health (Irvine et al., 2013; Braubach et al., 2017; Honey-Rosés et al., 2020). Urban green spaces such as forests, parks, and playgrounds have shown to play a significant role in the health of urban dwellers in addition to mediating the impacts of human activity through improving air quality and cooling effects (Harting et al., 2014). According to Barton and Pretty, (2010), human interaction with nature creates a positive impact on human health, and the impact increases with duration and magnitude. In Nairobi such benefits are undermined by the inadequate and quality green spaces. COVID-19 has enlightened the concept of urban green space and human health, with most developing countries recording an increased number of park visits through Google mobility during the lockdown period. Planning and designing urban spaces in Nairobi should therefore take into consideration public health benefits. This will help transform the city into a more healthy, safe, greener, and vibrant place to live and work (Nieuwenhuijsen et al., 2019).

Temporary transformation influence permanent change in urban green spaces

Similarly, existing research on the long term effects of COVID-19 pandemic show that even with the emergency approval for the use of various vaccines, about the pandemic has had unprecedented changes that might eventually become permanent (Bliss, 2020). According to Laker, (2020) several cities such as Philadelphia, Viena, Boston, Oakland, Meapolis have halted roads to promote pedestrianization which may influence the enhancement of public spaces. This can offer a good lesson for city planners and designers in Nairobi to enact a new typology of green spaces basing on distances, social density, crowding, or public health risk. City planners could reconsider examining the current typologies in Nairobi so as to facilitate major parks to acquire new functions. According to Samuelsson et al., (2020) the role of some green spaces has considerably changed during the pandemic.

The functionality of urban green spaces such as parks has been evaluated using manual counting of

people (Akaltin et al., 2019; Anderson et al., 2018). Due COVID-19 pandemic could ease the assessment process through digital tracers such as Google mobility and CCTV. Increased movement of people in public space is a major indicator that the parks are in good condition and functioning (Sadik-Kahn & Solomonow, 2017). However, the surveillance and tracking strategy might have a drawback as it will result in spatial-Hawthorne effect. Due to fear of being tracked most people will opt to spend more time at home rather than in public places changing mobility patterns (Honey-Rosés et al., 2020).

COVID-19 pandemic has heightened policy priorities progress more specifically environmental policies, nations displaying preparedness and response through provision of hygiene and sanitation interim guidelines including World Health Organization (WHO, 2020b). The Kenyan Government approved funds in supporting youth empowerment programs to maintain hygiene and sanitation in urban areas at the same time improving livelihood (Government of Kenya, 2020). Nairobi has been a priority area for this project which is having visible impact in the city. It has led to improved solid waste disposal and management with the provision of waste bins in public places and residential areas National Environmental Management Authority (NEMA). Such policies will have long lasting environmental impacts post-COVID-19 pandemic especially given the struggle Nairobi has had with solid waste management over the years.

Behavioral change in public spaces

To better deal with the outbreak and spread of the COVID -19 pandemic, public health researchers and practitioners have recommended a raft of measures to be adopted by governments. Among them is the policy of social distancing which require more than one meter spacing between people. The adoption of social distancing during the pandemic has led to an increasing pressure over space in sidewalks, parks, and other urban spaces in Nairobi and other parts of the world. This has seen some cities resorting to shutting down roads to create more space for pedestrians and cyclists (EFE, 2020). Nairobi's central business district has seen over 50 Kilometers of new pedestrian walkways constructed in 2020, which is much more than any time in history. The pandemic has brought about

spatial segregation in urban spaces with higher income workers being the most advantaged. It may also bring about a social and class difference. According to (Valentino-Devries et al., 2020) knowledge economy workers are more likely to access parks and green spaces due to their ability to telework compared to middle and low-income workers. The pandemic may affect social interaction in public spaces. People may restrict themselves from interacting with strangers thereby impacting the social role of public space. Planners in Nairobi will need to adopt innovative ways in distributing, designing and establishing future green spaces in the city so as to reduce inequality in accessing the spaces.

Public spaces perception

According to Nasution and Zahrah, (2014) perception of the community consists of seven factors which include accessibility, usage intensity, facility, activity management, and natural environment's element. The perception of public spaces is of significance in the research field and may influence the type of design and how it can be made (Heffernan et al., 2014; Pugalís, 2009). Public open spaces accessibility has always been free for everyone to do various activities. Since they offer many benefits including economic, social, and health values, they often face several problems such as alteration of the environment and decreasing functions. The ongoing pandemic might shift our perception of public spaces. Social distance measures might change the sense of gathering/crowd in public spaces especially in social events that promoted social cohesion. The prolonged isolation might result in loss of value of recreation places such as parks, city squares, and river fronts, places where people could share cultural experiences. On the other hand, relentless confinement may replenish the appreciation of urban green spaces such as parks to some. Perception change will correspond with the austerity of COVID-19 effects within a city. COVID-19 crisis might procreate a new model of use thus reshaping public spaces in cities something that urban planners and policy makers in Nairobi ought to be aware of and adjust appropriately. Whilst some urban green spaces may be highly regarded, regulation of social distancing may raise the perception of insecurity, consequently reducing the use of urban green space in Nairobi.

Table 1 Proposed recommendations for park designs (*Source:* Author Compilation)

Concept	Action
1 Connectivity	Inclusion of public transport and taxi stops near the parks Provision of wireless hotspots and electricity charging areas
2 Accessibility	Initiate one-way exit and entry point and optimize accessibility Main entry points within the park destinations should have a queue marker indicator Pack entrances spaces should be expanded for pedestrians and cycles Provide enough space for multiple queues meeting points
3 Space	Ensure proper utilization of space to ensure appropriate distance and population density Ensuring the environment is well kept, clean and maintained
4 Safety	Signs regarding social distancing be placed in junctions and crossings Signs regarding social distancing be placed in junctions and crossings Reinforce trained personnel to ensure on-site guidance Avoid pedestrians flow deceleration by signing on the existing street furniture Installation of lights, cameras, and public address systems as well as frequent patrols by designated
5 Mobility	Initiate crossing points to ensure the safety of pedestrians Expand footpaths within the park Expanded footpath from the neighboring streets to the main entrance

Inclusion of vulnerable groups in the public space design plan

In Nairobi, vulnerable groups such as persons with disabilities, racial minorities, children, youths, low-income residents tend to have less access to urban green spaces. Studies that have been conducted indicate that the low usage of public spaces can be attributed to poor planning and implementation of green space projects which sometimes do not take into consideration unique needs of different groups. According to Makworo and Mireri (2011), the percentage of women visiting the park was low due to crime (sexual violence). Informal settlers have less access to green spaces since most of the green spaces with open access are currently closed as a way of containing the spread of COVID-19. The close existing green spaces are either under private ownership or unfit for recreation purposes. The pandemic has severely hit immigrants and the homeless especially those with temporary shelters in parks since most of them have been shut down. According to Du et al., (2020) the most affected are the racial minorities, the poor, and the homeless currently finding it difficult to self-isolate. The use of surveillance in public spaces might create fear of being caught among the immigrants and homeless on the other security will improve

allowing more people to access the park (Honey-Rosés et al., 2020) (Table 1).

Given the possible long-term impact of the pandemic, designing new green spaces in urban areas of Nairobi need to take into consideration new models and designs. Therefore, for urban green spaces in Nairobi to fit the needs and unique circumstances of the city, there is need to rethink and redesign urban green spaces in Nairobi. This is because, existing parks in Nairobi focus on beautification and overlook vital aspects of green spaces that can add value to the sustainability of urban areas during and after pandemics. Therefore, the proposed recommendations on park design will add to this paper's proposed *connectivity, accessibility, functionality, and mobility* of the park for Nairobi residents.

Conclusions

COVID -19 has brought forth a reawakening for many people on how important green spaces are for natural recreation. With a majority of Nairobi residents working on minimum wage and for long hours, visits to the park had been low, and with that city planners had put little emphasis on designing existing parks beyond beautification purposes. In fact, much of the

land designated for green spaces remain unutilized or have been grabbed for private development. However, having been confined to their homes for a long period of time during the lockdowns, the perception and attitude towards parks will definitely change. Therefore, urban planners in Nairobi need to rethink and redesign parks with much more in mind. First the level of inequality in the distribution of green spaces in the city as well as inadequate quality housing mean that many families not only lack access to parks, but also risk being contained in slum houses. This means that parks could provide major alternative spaces for large multi -generational families who could find themselves confined in single -roomed houses during lockdowns. Secondly, COVID-19 has had a huge impact on the mental health of many people across the world.

Given the role and the potential of utilizing green spaces in promoting mental health, the importance of green space become even more pronounced during the pandemic. Similarly, the nature of existing parks in the city in terms of lack attention and security means many people have avoided visiting parks for safety purposes. For this to change, more efforts need to be put in place so that parks in Nairobi become attractive and people can benefit from the numerous advantages that come with it. Already, there has been some level of recognition by the government of Kenya to revamp green spaces in urban areas through programs such as the ‘*kazi kwa vijana*’ (jobs for youths) initiative that targets environmental cleaning as well as substantial investment in the regeneration of the Michuki Park at the center of the city. This makes this paper timely as it may influence in the qualitative and quantitative design and establishment urban green spaces. It hopes to improve the perception towards urban green spaces so that they become part of solutions for global challenges.

Declarations

Conflict of interest The authors declare that they do not have any conflict of interest.

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