EFFECT OF THE COVID-19 PANDEMIC IN THE URBAN PUBLIC SPACE: A SOCIO-SPATIAL STUDY IN THE CITY OF TRIPOLI TO RESPOND TO THE HUMAN BEHAVIOR NEEDS

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Abstract

Pandemics have always shaped cities and covid-19 is one of them. It has had a direct effect on the foundation of urban planning and the participation of people in public spaces. This study is aiming to analyze the effects of covid-19 on cities and urban public spaces. Also, to respond to human behavior and their needs. During the pandemic, observations and an online survey questionnaire were conducted from 1 to 10 January 2021. With the information collected from 130 Residents of Tripoli during the pandemic, the results indicated that there were changes in human behavior in the urban public space. Behavioral changes related to the need are an increase in people walking to green and urban spaces, cycling in order to reduce the stress level and improving physical, psychological and mental health. This paper emphasizes the critical role of the green spaces and sidewalks for Tripoli to improve a safe and healthier space for its inhabitants. The present study examines the changes to inform urban planning and design in a post-COVID world to deal with the pandemic considering the economy of countries and the time to manage to build a safe and healthier environment. This paper heads to the urban planners and designers to rethink when designing any spaces to a safe, and flexible environment for any future pandemic.

Keywords

1. INTRODUCTION

The Covid-19 pandemic was first identified in December 2019 in Wuhan – China, the virus spread to various countries (WHO, 2021). The pandemic and the rapid spread of the virus affects the way we live and socialize by creating a tension in public spaces. Most people apply the recommendations of the World Health Organization which are quarantine, social distancing, and self-isolation. These strategies become essential to reduce the spread of this global epidemic. The dense cities transform into empty cities because of the restrictions on the use of public spaces which has been a key policy measured to reduce the transmission of the virus and to protect the public health. Isolation and decrease in daily physical contact with others and the current way of living can lead to depression. In this case, people prefer to visit urban green areas to improve overall health and decrease the stress level and do their individual activities by avoiding gathering and respecting social distance.

The research problem: the COVID-19 pandemic has different effects on the urban public space, the urban public spaces in the world is not ready to contain and overcome this crisis, since cities are designed with a big density that encourages gatherings, how can urban planners and architects redesign our cities to be safer and healthier for their inhabitants in order to meet the needs of people to reduce the stress level of them? And what is the impact affecting the urban public space during the pandemic that shows a change in human behavior?

The objective of this study:
- To study the change of human behaviors before and during the pandemics.
- To study the effect of covid-19 on the urban public spaces.
- To provide a safe and healthier city for their inhabitants.

Frederick Law Olmsted says: "The lungs of the city". In the 19th century during the Civil war, Olmsted convinced New York city, to build a central park by using the public health concept. In the places that have gardens, these green spaces provide the highest level of safety and the presence of fresh air. (Levine, 2020). In describing the importance of nature in urban form, Frederick Law Olmsted said, "The enjoyment of scenery employs the mind without fatigue and yet exercises it, tranquilizes it and yet enlivens it; and thus, through the influence of the mind over the body, gives the effect of refreshing rest and reinvigoration to the whole system." Olmsted may have never used the term "healing design" to describe his work, but his grand parks and playgrounds fit the prescription well. (Garofalo, 2020)

Social and physical distance have the same meaning, they both mean to keep a safe space between you and another person. To apply social distancing, one should stay at least 6 feet away from other people. The spread of the virus among people happens with direct contact with an infected person when coughing, sneezing, or talking because the droplets emitted from the COVID-19 carrier will be transmitted to the nearby person and cause him an infection. (CDC, 2020)

In public spaces, the safe social activity when going to walk, bike or practice own personal sports is to leave at least 6 feet of distance between yourself and other pedestrians and cyclists. Physical activities are one of the best ways to let your body and mind remain healthy because you are keeping your body active. Also, visiting parks and open spaces are ways to reduce stress levels by in taking healthy air to remain active. (CDC, 2020)

The methods and tools used in this paper are: an online questionnaire and observation, the results of these two are compared with the result of the mobility of peoples taken from the observation and simulation of google maps. Finally, in the last parts, we discuss the safety distance between peoples when they are walking or running from Ansys simulating program and compare the result with the space used by peoples in the selected area.

The methodology of this study: The paper studies the effects of covid-19 on the urban public spaces and the literature review discusses the history of pandemics and the effects on the cities, and the optimization of urban space and realizes a safe environment. After selecting the case study area, Al-Maarad and the streets of Dam Wl Farez, the secondary resources indicate to study the mobility of people on Google maps, and as primary resources, the observation and the online survey questionnaire is compared to respond to the human behaviors needs. Finally, this paper studies the safe distances for walking and running between people as a secondary resource and compares the results of Ansys software to the distance of sidewalks in Al-Maarad and Dam Wl Farez if it is enough or needs more space to be safer for people.

2. EFFECT OF COVID-19 IN THE URBAN PUBLIC SPACES AND CITIES

This paper defines the history of pandemics and their effect on shaping the city, on responding to the health and the behavior of people. Also, this paper discusses the optimization of cities and public spaces to realize a safe environment for their inhabitants to avoid any new pandemic in the future. optimization in many factors as: air quality and environmental factor, socio-economic factor, density of cities, streets design, green spaces, public spaces, transportation and provide smart cities, create a safe and healthy environment.

2.1. History of Pandemic and the Effect in the Cities

There have been several pandemics other than the coronavirus, that have hit the world and ended the lives of millions of people. When epidemics, especially the respiratory kind, overtake the world the recommendations taken are isolation in houses and the closure of public spaces. In this case, the cities and public spaces turn into an empty environment but mostly after the end of this stage, it requires a change in the city's shape to coordinate between the health and behavior of people and thinking about safe urban spaces (Eltarabily, 2020).

The history of pandemics started from the past from the Athenian plague in 430 B.C. to the black death that was in the 14th century in Europe, they resulted in a change in the design of cities and started to up-bring thoughts about the concept of quarantine. At this time, the urban design of Europe called for large open spaces connected with nature to reduce the feeling of isolation in the house and have some fresh air. (Eltarabily, 2020)

In the early 19th century, when the cholera epidemic swept the world, this disease created a major impact on managing waste in streets and added day lighting and ventilation in the open spaces where people could move (Eltarabily, 2020). From 1870 to 1914, the industrial revolution formed an important phase of urbanization. In those days, the cities became densely populated and presented a huge number of tall residential buildings with usage of urban spaces and transportation. After that, the deadliest Spanish flu pandemic killed more than 50 million people worldwide in 1918-1919. This pandemic slowed down urban growth and limited public life for a period of time. (Eltarabily, 2020)

In the current century, Covid-19 has been added to a long list of rapidly spreading infectious and deadly diseases. Covid-19 has killed 1.080.000 peoples in less than a year (WHO, 2021). This pandemic may cause a challenge for cities to change to a healthy city and avoid any new disease in the future.
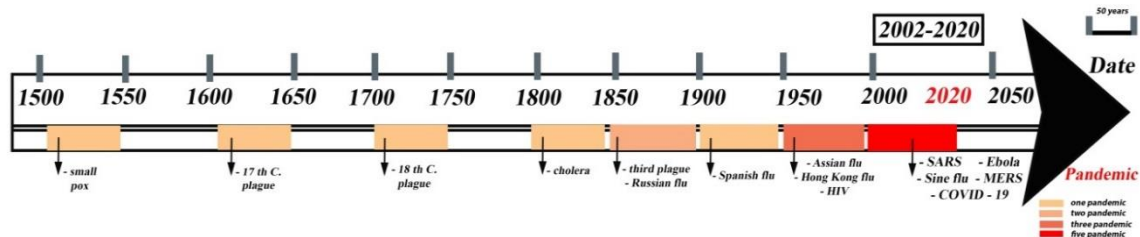

Fig.1: history of pandemics through time – source: Author after adapted from (Eltarabily, 2020).

The graph (figure 1) is divided from the year 1500 and ends in the year of 2050, the scale has been adopted in 50 years per division. This graph shows that from the year 1500 to 1850, one pandemic appears sometimes and then disappears again. From the beginning of 1950, the pandemics started to increase to be three pandemics in 50 years. Finally, from 2000 to 2020 in a twenty year period, the world had already registered five pandemics in the short duration which is still till today considered a huge number of pandemics.

In the last few years, the world witnessed a remarkable increase in the number of epidemics due to the pollution that dominates the world. In this case, the design of cities, spaces, and the way of living in public spaces must be changed to avoid infections from any epidemic that will come and sweep the world in the future.

2.2. Optimizing Urban Spaces and Realize a Safe Environment regarding Pandemic

To create safe cities, urban planning and urban design should respond to the new behaviors and needs of people during the times of pandemic. Covid-19 pandemic may be a change to optimize cities. Based on historical and recent views, cities should follow many factors to provide optimization in the urban spaces.

- **Air quality & environmental factors:** the lockdown may contribute to enhance urban air quality, reducing air pollution can contribute to control the rapid spread of the virus. Several studies show the correlation between transmission of covid-19 and the high level of air pollutions, the long-term exposure to pollution can increase the vulnerability to covid-19 that affects the respiratory system. A recent Harvard study has indicated a possible correlation between air pollution and the likelihood of dying from Covid-19 in the US, while Italian scientists have detected the virus on pollutant particles and are looking at whether pollution may aid its spread. (Holland, 2020). Also, the environmental factor can affect the dynamic transmission by affecting the survival of the virus on the surfaces and it's airborne diffusion. The temperature, wind speed, humidity, and pollutions level plays an important role in the transmission of the virus. Some studies show that lower temperature is more suitable for the transmission of the virus (Sharif, 2020). An analysis using temperature data obtained from the Weather Underground website and global confirmed cases obtained from the CSSE indicates that most of the cases (~60%) have occurred in areas with temperatures ranging between 5 °C and 15 °C . In Italy, a study of different regions, based on data obtained from the Ministry of Health and ilmeteo.it, shows lower rates of transmission in warmer regions. . In line with these results, an analysis of 122 Chinese cities (using data obtained from the National Meteorological Information Center and official health commission websites) shows that, with a threshold of 3 °C, there is a positive linear relationship between temperature and the number of COVID-19 cases, and the relationship becomes flat beyond that threshold. The significant correlation between temperature average and the spread of COVID-19 was also found in a study in Jakarta, Indonesia (Tosepu, 2020). Overall, more research is needed to better understand how temperature is related to COVID-19. (Sharif, 2020)

- **Socio- economic factors:** Many factors such as very high density and inadequate access to the infrastructure service make the way difficult to contain the spread of the virus through promoting social distancing and quarantine measures. Overall, the pandemic has once again exposed inequalities and social fault lines that exist in many societies and make it challenging to prepare for, respond to, and recover from pandemics (Sharif, 2020). There is large disparity between rich and poor neighborhoods in terms of available public green space. The city parks and forests are concentrated in high-income suburbs where homes typically also have private gardens. In the middle- and low-income districts green spaces are rare. WHO guidelines recommend that to maximize equity in the health benefits of green space, all households should as a minimum have a publicly accessible green space of 0.5ha or larger within 300 meters of their home. (Lambe, 2020). Accordingly, reducing inequalities is critical for enhancing the coping and response capacities of cities. Also the long term of closing because of the lockdown due to the covid19 pandemic, creates a negative impact on the urban economy. Some cities that don't have several economic businesses are more vulnerable. Due to this long period of lockdown, cities began to popularize its local production, this way create more attention to the local supply in post-pandemic. (Sharif, 2020)

- **Density of the city:** cities and urban planning, need to change the concept of population density, this is the basic factor that affect the spread of the covid-19 pandemic. Cities should apply a sustained way to deal with any pandemic in the future. The gathering is stopped when they close the public space to avoid population density (Eltarabily, 2020). The densely populated spaces and the well connecting areas could be the hotspots of transmission of the covid19 pandemic due to the high level of face to face contact. Social distancing should be challenged in high-density spaces (Sharif, 2020). Public spaces should respond to which kind of density allowed to maintain the social distancing. For example, if

the capacity of the areas contains 100 persons, the density of people should reduce to 25 persons. (Hollander, 2021). Architects and urban planners can also design buildings and communities to better manage density and make them more flexible. By creating spaces that prioritize the attributes of healthy giving, through airflow circulation, spatial design, biophilic elements, natural light, and in selecting appropriate building materials, architecture can be built to heal and control disease spread. (Garofalo, 2020)

- **Streets design:** streets must be capable to contain different behaviors activities such as walking, bicycling, running, and shopping. (Jalaladdini, 2011). The important part to overcome the covid-19 pandemic is street redesigning, which adds a new passage for pedestrians and cyclists, to create healthier and sustainable cities. Many planners find, to achieve social distancing, a good opportunity to think about barring cars from some streets and add pedestrians and cyclists paths which turn the city into green and decrease the carbon emission. Several cities, such as Vienna – Boston – Philadelphia, and others respond to the pandemic, by closing some roads and increase the pedestrian's sidewalks. (Eltarabily, 2020). The integration and connection of the streets and urban spaces create more walkable streets with investing in green spaces to improve air quality and well-being. Improving adaptability of squares, streets, semi-public, and semi-private spaces – through providing natural features, green street networks, amenities for physical activity. (Zandieh, 2020). Also, the number of green areas allocated to public spaces will have to be extended to be able to create more resilient cities, the expansions of streets is seen as an impactful measure to make physical distancing of two meters possible on sidewalks. (UN, 2020) Going forward, urban planners can make cities healthier by taking space back from cars and turning it over to pedestrians.

- **Urban green spaces:** to create resilient cities, urban planning and urban design should provide large parks that can offer an open-air, to be useful for visitors of urban green spaces during the pandemics (Ugolini, 2020). The access to green spaces and parks is a human need that reduce stress level and improve physical, psychological and mental health. In the cities, designers may need to create places for individuals to practice their sports in the green spaces with respecting the social distancing circles for each person (Eltarabily, 2020). The behavior of people change positively when people walk to a small urban garden. The European commission transform the concept of isolation into a comprehensive vision of green infrastructure, the importance of urban green infrastructure is to be well articulated in all type of greenery (Ugolini, 2020).

Urban parks, open spaces, and outdoor spaces can provide a safe outdoor place to practice activities and social interaction in the green environment during the pandemic. This place is considered a buffer area to maintain a healthy life. A study on Korean women, it reports that outdoor walking for one hour, three times per week could improve cardiopulmonary function, flexibility, and emotional state. Urban green spaces provide a range of ecosystem services which help people to deal with any disease and improve the health state and reduce the level of stress of people. The decrease in daily social behavior and physical contact with people can lead to depression and a sense of isolation. (Xie, 2009). The attraction of people to the green spaces form difficulties due to, the inequalities in access to green spaces in cities like the people living in high rise building or the green spaces are far from their houses, and the high density of people in green spaces, because of the limited number of green spaces in the cities. The observation shows that the green spaces are the first attractive place to walk or to do exercises during the pandemic resulted in a high-density of people using these limited spaces, in some cities, green spaces had to be closed due to the risk of transmission created by overcrowding. Creating sufficient green spaces to accommodate the city's population and improve adaptability of streets, and squares may help in improving mental health during the pandemic (Zandieh, 2020). Urban green space is important for well-being during the covid19 pandemic, incorporating nature into cities provides multiple other benefits for sustainability (Lambe, 2020). Cheris Percht designed the park de la distance (fig. 2), this park is formed with several routes and divided to 90 centimeters to provide physical distance between the visitors.

The paths are arranging in form of fingerprint-shaped, the layout provides 20-minute walking routes that can, in theory, be completed while maintaining distance from others. Percht designed this park with respecting the social distance in response to the current covid19 pandemic. (Ravenscroft, 2020).

Fig.2: park de la distance showing the social distancing _Source: (Ravenscroft, 2020)

- **Public spaces:** pandemic may generate new patterns and configurations of use and reshape public space. One of the most important policies to confront this pandemic is social distancing, the designers can be directed to redesign the cities, taking into consideration the human need and flexible space. After this pandemic, public spaces need many new guidelines in designing in terms of social distance, densities, and public health risk. (Eltarabily, 2020)
  - ➢ **Material used in furniture:** Materials used to maintain public space, it is the key in fighting the spread of the covid19 pandemic (UN, 2020). The surfaces that are touched by a large number of people such as non-automatic doors, shared furniture and others should be non-porous, smooth, and easy to clean. Some materials such as copper have anti-microbial properties. Urban designers should look to the way of designing seating areas, and incorporate barriers between individuals. (KASHDAN, 2020)
  - ➢ **Designing new furniture:** the policies of six feet unit, social distancing, and the presence of barriers should be used when designing new furniture (fig. 3) and want this unit to be flexible. (Holland, 2020)

Fig.3: Design of new furniture _ source (Holland, 2020)

  - ➢ **Providing social distance:** the use of signs, posters, and social media posts remind people to keep a 2m distance from each other. The footprint markers or circle zones are painted on the ground to define the social distance that people should maintain from each other. Also, signage or markers at the entry to a park or high street and expect people to remember that as they continue their journey. People will need regular reminders and cues to check that they are maintaining the 2m distance in the environment. Using 'one-way' systems or signage with simple messages such as 'keep left' (Nocco, 2020).

- **Transportation:** many local governments, in order to contain the spread of the virus, they applied partial and complete mobility restrictions. This restriction causes a reduction of visits in entertainment space, retail, public transportation stations, and workplace mobility, it reduces the spread of the virus. The decline in road use during the lockdown has seen dramatic falls in air pollution, the benefit of the pandemic, and the use of quieter roads for cycling. A study of the effect of the covid-19 pandemic on the urban public space shows that bike-sharing network decrease the use of the subway system (Rannard, 2020). This means that non-motorized transportation is more flexible and resilient during the pandemic. The travel behavior and people's mobility are affected by covid19 pandemic and could have a long-lasting on the transportation concept. Most of the people used their private vehicles to avoid the gathering of people in public transportation (Sharif, 2020). In China, when the lockdown is ended the private car usage doubled at the rate of 34% before the outbreak and increase to 66% after lockdown. (Rannard, 2020). For the individual transport, the small devices might be more welcoming in the post-pandemic, and could benefit from the redesigning of the new streets. Some cities like Milan start to use the e-scooters instead of cars and public transport. A study in Hubei found that the spread of Covid-19 from one person to nine over, let the people prefer to use their own vehicles or ride-sharing services, that can provide a virus-free driver (Jordi Honey-Rosés, 2020). For the public transportation, "Streets for Pandemic Response and Recovery", provides more guidance on how to plan and implement this. Strategies include monitoring ridership, crowding and travel time data, and adjusting capacity to optimize operational performance, meet public health guidance, and prioritize transit-dependent communities. Increasing the frequency of services during busier periods to reduce rider density. This is linked to the public transport improvements outlined below. An alternative approach is to extend ticket duration to allow passengers to wait for less crowded services. Enabling physical distancing at bus stops and in stations, by marking 2m spots for passengers to wait. In London, bus stops have been enlarged to enable physical distancing. (apolitical, 2020)

- **Smart cities:** smart cities can contribute to helping us to deal with this pandemic. The technologies of smart cities is used to achieve smart quarantine information system by obtaining the information of any patients movements to help them in time. Smart cities are safer than the public health view, these technologies digitalize the behavior of people in urban areas. Smart cities provide a safe city, comprehensive city, and sustainable city (Eltarabily, 2020). The technologies used in smart cities form big data analytics to enhance the efficiency and efficacity of urban spaces and improve quality of life (Sharif, 2020). In China, they deployed a "color-coded ranking" program enabled on the smartphone application to detect the movement of residents. In India, they discover a quarantine watch has been used to track adherence to self-quarantine rules (Sharif, 2020). The technologies could be useful to fight against covid19 pandemic, by discovering, a new monitoring digital technology the "facial recognition", also they discover a mobile phone location, that used to monitor the movement of people, and truck the infected people in the same time (Zhang, 2020).

Fig.4 : relation of optimizing urban spaces and respond to human need - source: Author after adapted from (Sharif, 2020)

In conclusion, air quality and environmental factors, socio-economic factors, the density of the city, street design, urban green spaces, public spaces, transportation, and smart cities, all these factors (fig. 4) should be optimized to create a safe city and respond to the need of people. These factors that affect the urban public space, while optimizing it can contain the spread of the virus and provide a safe city for their inhabitants.

The pandemic may reinforce social and class differences in the use of public space. Lower income households are more likely to be in public because of employment obligations. Knowledge economy workers may make more use of parks, promenades and green spaces, whilst those who cannot work from home will be more exposed working in public spaces and streets.

3. A SOCIO-SPATIAL STUDY IN THE CITY OF TRIPOLI TO RESPOND TO THE HUMAN BEHAVIOR NEEDS

This study starts in a dataset from Community Mobility Reports as a secondary resource to provide insights into what has changed in response to policies at combating COVID-19, this international study test the mobility of people through Google map to see where people head a lot. As a primary resource, the selected study area is Al-Maarad, dam wl farez, it is chosen because it has an active and attractive area in Tripoli, the other regions is a popular lanes and have a big density of people. The observation and online survey lead a consistent result with the international mobility reports that show the change in human behavior during the pandemic.

−   Epidemic diseases spread in three main ways: the hierarchical model between large cities, the local model through neighborhoods, and the jump model along transports routes. Public spaces most used during covid-19 pandemic are: grocery, parks, street spaces, food shops, pharmacy. The spread of virus increase in the indoor spaces where people touch different surfaces. These places must be clean all the time, and provide a queue to enter the people to these spaces one by one and avoid face to face contact. And for transportation, the reduction of people entering the bus and provide social distancing can reduce the transmission of the virus but this vehicle

must be clean before other persons enter this vehicle. The open-air and green spaces is safer because people can consider social distancing and avoid touching any surfaces.

3.1. Mobility of People on Google Maps

A study on 5 January 2021 in "Mobility changes", the dataset is intended to help remediate the impact of COVID-19. The data shows how visits to places, such as grocery stores, workplace, and parks, are changing in the North governorate region. Location accuracy and the understanding of categorized places varies from region to region. This dataset study:

- Retail & recreation: Mobility trends for places like restaurants, cafes, shopping centers, theme parks, museums, libraries, and movie theaters
- Grocery & pharmacy: Mobility trends for places like grocery markets, specialty food shops, and pharmacies.
- Parks: Mobility trends for places like national parks, public beaches, plazas, and public gardens.
- Transit station: Mobility trends for places like public transport hubs such as subway, bus, and train stations.
- Workplaces: Mobility trends for places of work.
- Residential: Mobility trends for places of residence.

These reports show how visits and length of stay at different places change compared to a baseline. We calculate these changes using the same kind of aggregated and anonym zed data used to show popular times for places in Google Maps. Changes for each day are compared to a baseline value for that day of the week: The baseline is the median value, for the corresponding day of the week, during the 5- week period Jan 3 to Feb 6, 2020. And the reports show trends over several weeks with the most recent data representing approximately 2-3 days ago, this is how long it takes to produce the reports. (Mobility changes, 2021)
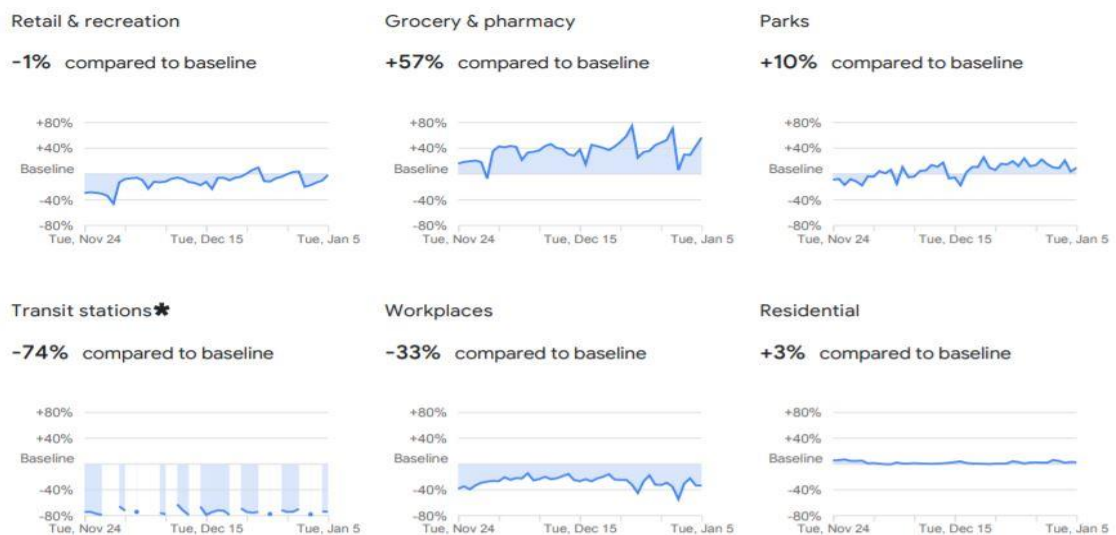

Fig.5: dataset of mobility changes in North governorate region _ source: (Mobility changes, 2021)

This dataset from mobility changes in the North governorate region (fig. 5) shows that the mobility of people, during the pandemic for the grocery and pharmacy is 57% that represents a high range compare with the other variables. And for the parks and green areas, the mobility of people represents a second positive number 10%. This dataset shows a very low mobility on the transit stations that is -74%. And finally, the workplace, and retail show a reduction in the mobility of people in this region.

3.2. Selection of the Study Area

The study depends on two methods to find the new behavior of people during a covid-19 pandemic, on a selected urban public space in Tripoli city. The first method used is observation and the second method is a questionnaire survey.

Tripoli is located 85 kilometers from Beirut, it is the second-largest city in Lebanon. The city contains many public gardens in Al-Maarad, dam wl farez, and others. Al Mechiet garden in Tal is the oldest garden in Tripoli city. (Saleh, 2016). Tripoli has a minimal area of gardens and green spaces. The research depended on selecting Al – Maarad and Dam wl Farez area, it is chosen because it has an active and attractive area in Tripoli, they use this area people above 15 years old for running and walking, the other regions is a popular lane and have a big density of people (figure 6).

The selected area is near to the waterfront, but they differ in terms of functions. The selected area used for walking and running by peoples above 15 years old. And the waterfront area, is used for several functions as walking, playing, and cycling, this area is used by all the age type as kids, teenagers and older peoples.
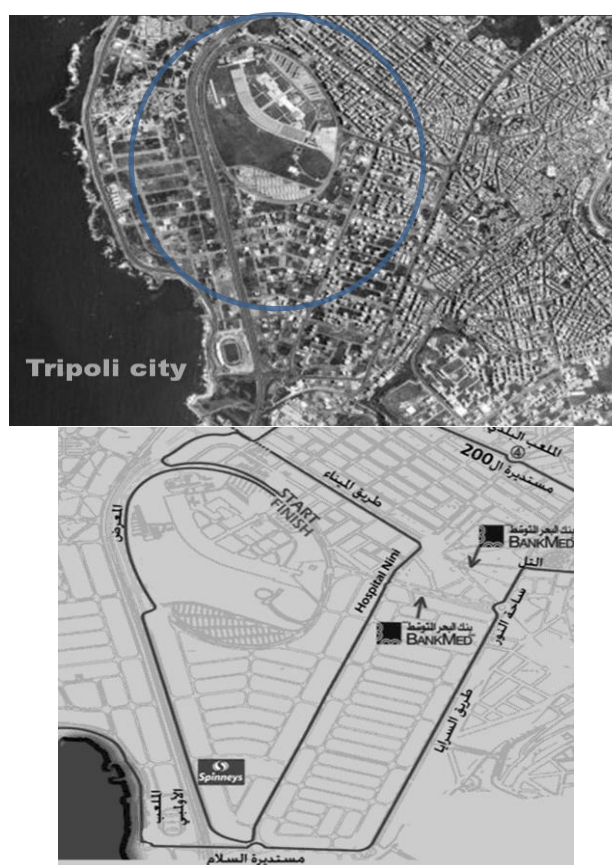

Fig.6: map of Tripoli and the selected area - source: (UN-Habitats).

Tripoli is divided into two different types of unequal regional development. The first is Al- Maarad and Dam w Farez, this area has a good socio-economic level, this appears from the quality of buildings, streets, presence of gardens, and public spaces. The second is AL-Tall, El Zehriyi, Beb Ramel, Tebbeneh, and others, this area has a low socio-economic development, this appears from the old buildings, the narrow streets, lack of gardens and public space (figure 7).

Fig.7: socio-economic level between the two regions in terms of park presence _ source: Google

3.3. Case Study Analysis

Based on the current study to investigate the relationship between people's behavior and the urban public space. It applied to the selected case study, which is Al- Maarad and Dam w Farez.

Urban public space analysis during covid-19 pandemic, of main road and secondary road in the selected area, green area and activities, these impacts on the people behaviors observed by the authors.

Fig.8: map of Al-Maarad & Dam w Farez showing the main, secondary roads and parks source: (Google)

Fig.9: map of Al-Maarad & Dam w Farez showing pedestrians roads _ source: (Google)

Fig.8: map of Al-Maarad & Dam w Farez showing the movement of people in this area in the summer season. source: (Google)

Fig.9: movement of people in the winter Season_ source: (Google)

The observations of social life during the pandemic in these areas reveal a vibrant character, the movement of people in Al – Maarad and Dam Wl Farez, is very active (figure 12). Because of lockdown, people choose to reduce the stress level by walking and running in green spaces or street areas. The majority of people prefer to practice their sport by walking or running all around Al- Maarad international fair, because of the circular one-way circulation, in this area people start at a point and end at a finish point, this way reduce the face of face contact that reduce the level of transmission of the covid-19 pandemic. (figure 10). People try to find a better place to practice their sports, and improve physical, psychological, and mental health, in a green space. The movement of people in Dam Wl Farez, main road is moderate, in this road the restaurant and entertainment spaces attract some people to walk on the pedestrian streets (figure 10). And in the secondary roads of Dam Wl Farez, present a light people movement, in this streets people who fear from the gathering walk in these spaces (figure 10). And finally, Al – Maarad and Dam Wl Farez, are the most active spaces in Tripoli city in summer, but these spaces are empty in the winter seasons (figure 11).
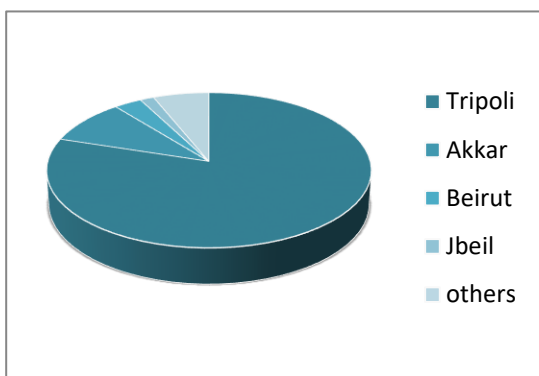

Fig.10: people running all around Al - Maarad international fair _ source: (Author)
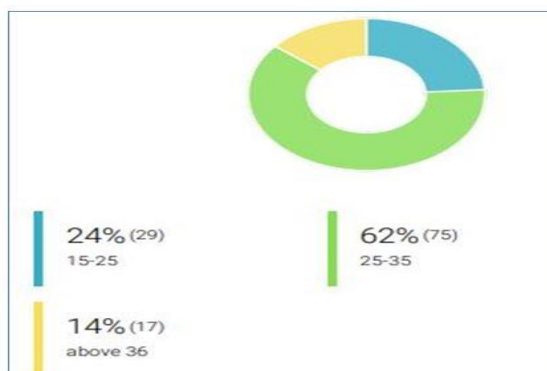
3.4. Study design and Participants

During the pandemic, based on an online questionnaire, for ten days (1 to 10 January 2021). The questionnaire was released through a free online survey. This paper studies the effects of Covid19 on urban public spaces. The questionnaire was developed to study the changes of people's behaviors before and during the pandemic in the outdoor public spaces. A total of 130 people were submitted.
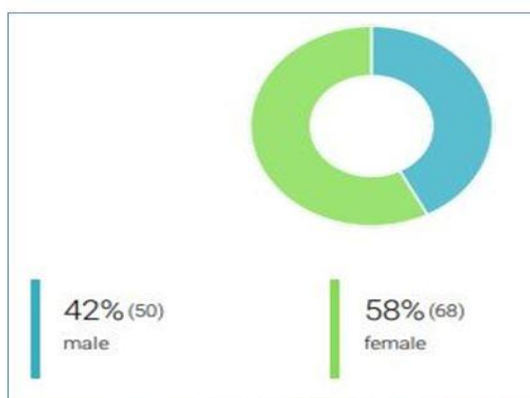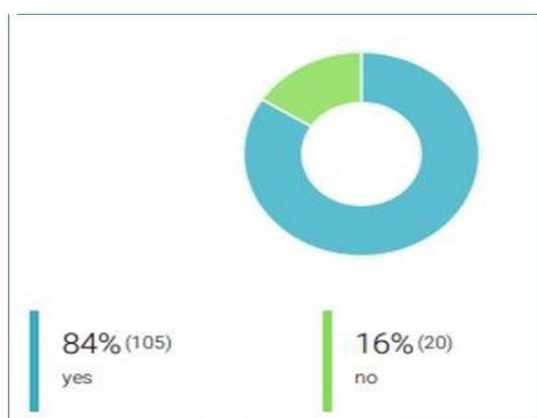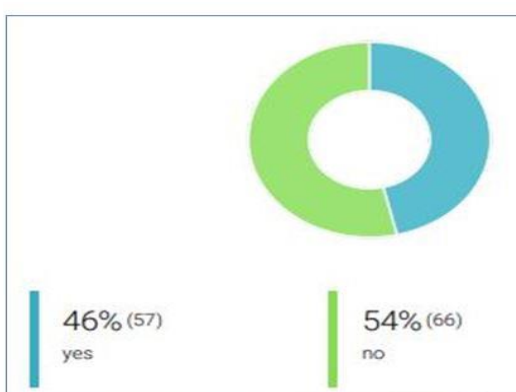
1- Place of residence

- Tripoli
- Akkar
- Beirut
- Jbeil
- others

2- Participant's age categories

24% (29) 15-25

62% (75) 25-35

14% (17) above 36

3- Participant's gender

42% (50) male

58% (68) female

4- Percentage of people under lockdown

46% (57) yes

54% (66) no

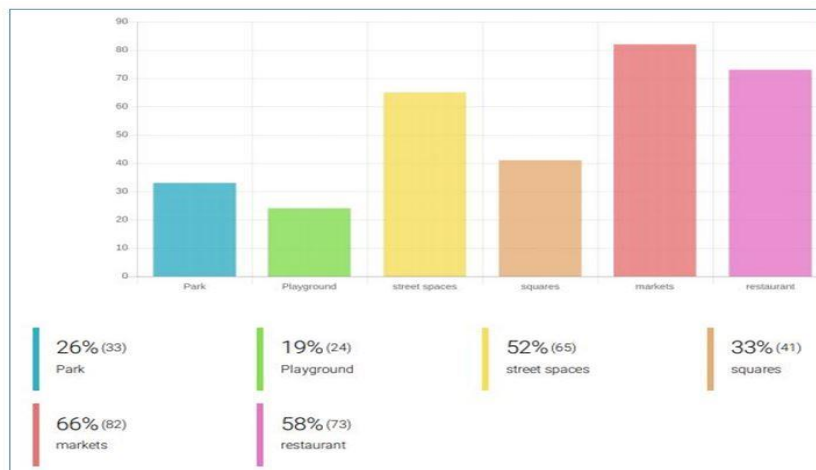
84% (105) yes

16% (20) no

28% (35) yes
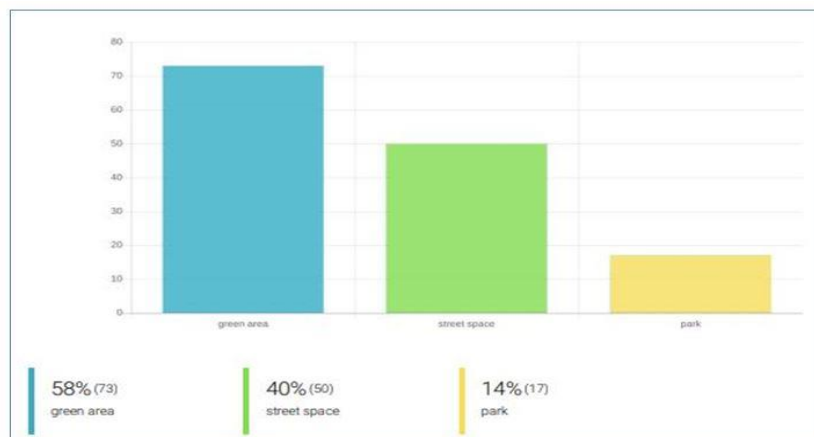
72% (90) no

5- Percentage of people wearing mask
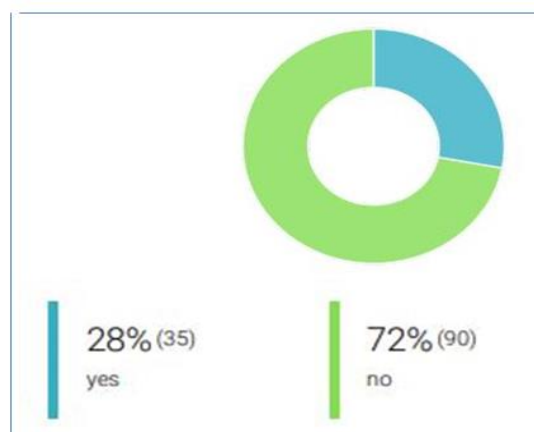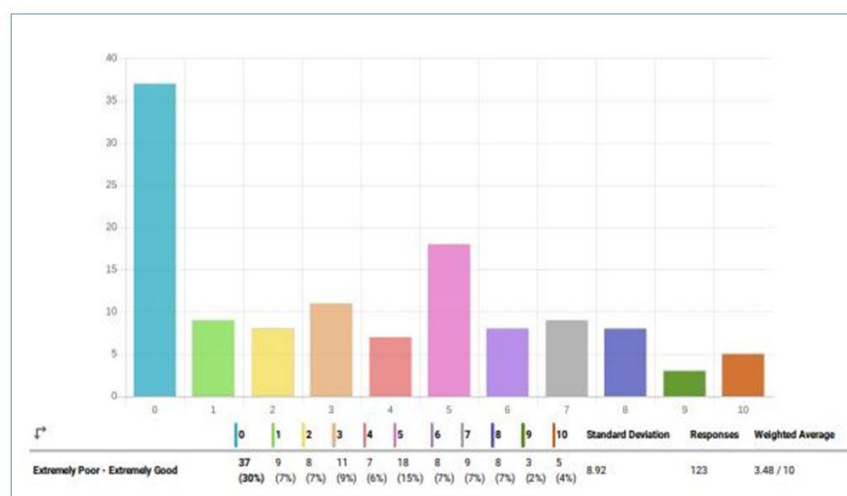
6- Percentage of people following distancing rule

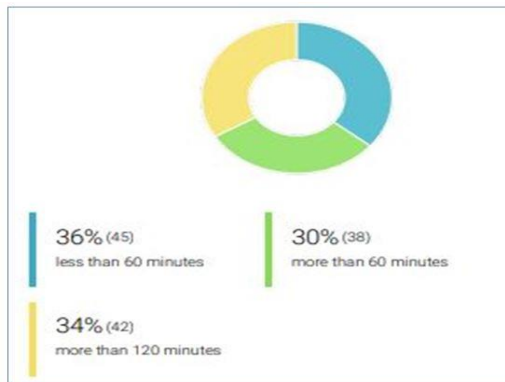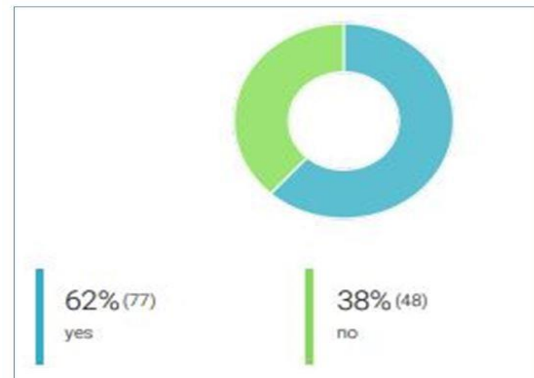**7- Public spaces currently used by people during the pandemic**

8- Before Covid-19 pandemic, when you feel a psychological stress, you prefer to go:

9- Walkable space in Tripoli are sufficient with considering social distancing for each person?

10- Time spending outside   **11- Behavior of people change in public space**

Among 130 participants, the majorities are from Tripoli – Lebanon, 62% were age categories 25-35 years. And 58% females. The majority of responses showed awareness of the Covid-19 pandemic by wearing masks when they leave their home in 84%. But not all peoples follow the social distancing 28% only respect this rule. The survey shows that the behavior of people during the pandemic change, people head to the markets in 66%, restaurant in 58%, and street space 52% instead of gyms, sports centers, and shopping before the pandemic. Now, during the pandemic, they used the green spaces and streets for walking and practice their own sports to reduce their stress level by improving physical, psychological, and mental health, in a green space. Peoples living in Tripoli think that they don't have sufficient place with considering a safe social distance for each person. In addition, the amount of people spending time outside vary some spend less than 60 minutes 36%, part of people spend more than 60 minutes. And finally, after observation people behaviors and activities are affected in the urban public space during the pandemic, 62% says that the behavior of people has changed.

3.5. Analysis of Results

During the covid-19 pandemic, the results of the questionnaire in Tripoli, show a correlation with the result of mobility change simulation taken by Google map. The survey show that people head the markets, the result from the mobility change show the same average. And the second-place people head it is the green spaces and parks, the same result is shown by mobility change. In addition, the observation of the green spaces and parks show that people head to Al- Maarad and Dam Wl Farez to walk and reduce the stress level. In conclusion, the mobility of people is shown first in the grocery and second in the green spaces to practice their own sports.

4. SAFETY DISTANCE FOR PEOPLE WHEN WALKING AND RUNNING

Peoples in al Maarad, and Dam w Farez, practicing their sport activities as walking and running, but the social distancing taken is 1.5 meters between people. In a study, Ansys software study the new safe social distancing while running or cycling as secondary resources. the comparison of the new social distancing while walking of cycling with the width of the current streets shows that is unsafe for people.

4.1. Data from Ansys software Studying the Safe distance between people, while Walking and Running

Within a period of time no more than a few months, the COVID-19 virus has spread to many countries in the world. Previous research has shown that the spread of this type of virus can be effectively caused by saliva, often in the form of micro-droplets. When a person sneezing, coughing, or even exhaling, emits tiny droplets - often too small to be seen with the naked eye it can carry the virus. Receiving people can become infected by inhaling these drops or by getting them drops on their hands and then touch their faces.

A variety of researchers use simulations to understand how potentially contaminating droplets can spread and put others at risk. This enables them to better prevent the droplets from spreading.

Simulation software "Ansys" support the healthcare professionals, policy makers and communities around the world in the fight against COVID-19. Simulations are designed to replicate physical behaviors under specific conditions. For example, consider the 2 meters (6 feet) suggested earlier by the National Social Distancing and Simulation Guidelines. Partners Ansys Bert Blocken, Fabio Malizia of Eindhoven University of Technology and, KU Leuven have created a model that indicates that more space is needed to avoid spreading cough droplets between runners and cyclists. Medical practitioners, policymakers and organizations (like the Centers for Disease Control and Prevention and the World Health Organization) can use this information to improve the social distancing guidelines that protect us (Marchal, 2020).

A study in "Ansys" shows the airspeed features in the vertical central plane of two people running at a distance of 4.5 meters, clearly indicating the wake (slipstream) behind both runners (figure 13) shows snapshots of a number of the simulations where the droplets exhaled by the leading runner are visualized. The (figure 14) a and b represent two runners in the line with a speed of 4 m / s and a separation distance of 1.5 m. Smallest part of the droplets exhaled by the leading runner, due to their lower inertia, do not move along with the leading runner but being dragged in his wake. The trailing runner present in this wake will be exposed to these droplets. (Figure 14) c is a similar figure for runners side by side. The droplets again are entrained in the wake of the exhaling runner and in this case do not reach the body of the second runner. (Figure 14) d finally displays the situation for two runners in staggered formation at a distance of 3 m in the moving direction. Again, the droplets are entrained in the wake and the trailing runner is not exposed to these droplets. (Marchal B. B., 2020)
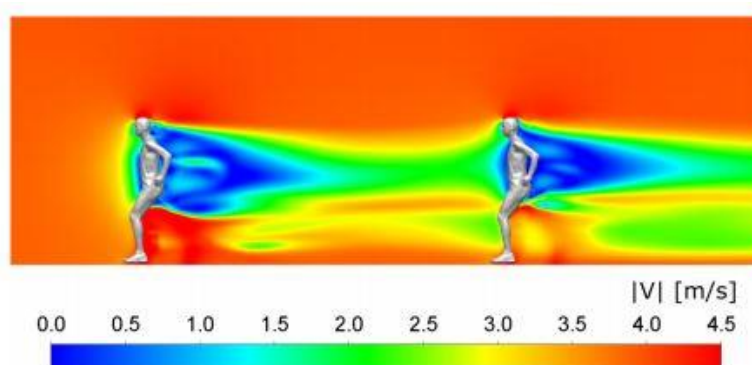

Fig.11: Contours of air speed in the vertical center plane when running at 4.5 m distance at 4 m/s - source: (Marchal B. B., 2020)
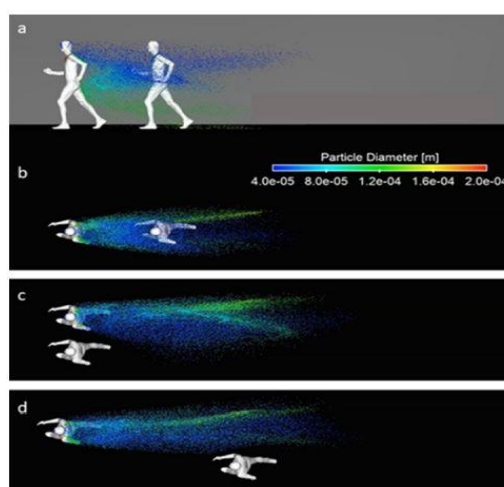

Fig.12: Droplet spreading when running at a speed of 14.4 km/h when (a,b) running behind each other; (c) side-by-side; (d) in staggered arrangement. Source: (Marchal B. B., 2020)

When analyzing the results of all simulations, the main conclusion is that high exposure to droplets occurs when the trailing runner is positioned in the slipstream of the leading runner, even the distance between both depends on the travel speed. For walking at a speed of 4 km / h, a distance of about 5 meters results in no droplets reaching the upper torso of the trailing runner. For running at a speed of 14.4 km / h, this distance is about 10 meters. This means that if one assumes that 1.5 meters is a social distance to be maintained for two standing people, then this value should be increased to 5 meters or 10 meters for slipstream walking fast, and slipstream running, respectively, to obtain roughly equivalent non-exposure to droplets as two people standing still at 1.5 meters distance. This leads to the initial advice to walkers and cyclists that if they wish to run behind and / or overtake other walkers and runners with regard for social distance, they can do so by moving off the slipstream into a staggered formation upon reaching that distance of about 5 m and 10 m for walking Fast and running. (Marchal B. B., 2020)

4.2. Comparison of this Data with the spaces in Tripoli city if it is Safe?

The surrounding sidewalk width of al Maarad is approximately 1.5 meters (figure 15), this street should be redesigned, and expanding sidewalks to facilitate safe walking and expand the amount of land allocated to public space, with considering social distancing. The current streets are unsafe of the people who is walking and running, and because of the overcrowding the transmission of the virus in this case increase.

In al-Maarad, it has a huge space inactive, this space can have integration with the streets and green spaces to have sufficient place for people practicing their sports as walking and cycling in a safe way and by decreasing the stress level.

Fig.13: the empty space of Al- Maarad international fair _ source: Google

Dam Wl Farez streets sidewalks, is approximately 2 meters (figure 16), these streets should be redesigned, and expanding to facilitate safe walking and safe social distance between people. With the integration of green spaces to attract people to walk and run in these sidewalks.

Fig.14: the streets of Dam Wl Farez _source: Google

5. DISCUSSION

The shape of cities may have a big change in the redesign of streets, sidewalks, green spaces. Redesign of cities does not happen in a year or two, it needs many years to rebuild our cities taking into consideration the economy of the country. But to start in changing our cities, first step any new building should have its own green space, and the density of people in the city should be reduced. After that the expanding of the streets to create a safe space for pedestrians to walk and run. In addition, the green spaces and parks can have changes to be for walking instead of seating only. The redesign of the cities want time to transform it into a smart, safe, and healthier cities. Also, the public transportation, during the pandemic could have changed by specifying the number of people in one trip with taking into consideration cleaning all the time.

Peoples prefer to head to Al-Maarad more than the streets of Dam wl Farez or the parks presented in this region. The parks also can have ahead, if the redesign of this parks became to walk instead of siting only, for example, create a continuous path between the greenery attract the people to walk and improve the physical, physiological and mental health. And the main streets of Dam Wl Farez can be more active if we expand the width of the streets and integrated with greenery. People's behavior change after the pandemics, they prefer to keep their safe distance between themselves and other people. Peoples during the pandemic, start to walk more than use public transportation, in France they start to rethink on the redesign of streets by expanding the pedestrian road more than the road dedicated for vehicles. The integration of greenery on the sidewalks, and expanding the width can attract people to use it more, considering the safety distance between others. Sidewalks, streets and parks could be the relaxing space for people to practice their sports as walking or running in the greenery, in a safe way by applying social distancing between people and reduce their stress level. Peoples prefers walking in the green space instead of sitting in the house to have some fresh air and reduce the stress of them.

6. CONCLUSION

In conclusion, cities and urban spaces should be changed and adapted for any new pandemic that might suddenly appear without warning and take over the world. From the history of pandemics, many diseases attack the world in the last twenty years, due to the pollutions and several causes, that means our cities and people behaviors should be changed to adapt to the new situation and improve a safe environment to live. But this transformation and redesign of our cities need many years, taking into consideration the economy of the country.

This paper studies the different factors that affect the city during the pandemic, as socio-economic factors, air quality and environments, the density of cities, street design, green spaces, public spaces, transportation, and smart cities. And the optimization of these factors to provide a safe environment.

The behavior of people change during the pandemic, the survey released on free online survey, and the results of surveys in the mobility changes, the results show that people head to the grocery markets, green spaces, and sidewalks instead of gym, shopping, and retails.

The circular one-way circulation is the best practice of the people, it avoid the face to face contact while practicing their sports, in addition walking, cycling in a green space is a need to improve physical, psychological, and mental health and reduce stress levels of people.

The safe social distancing should be more than 1.5 meters for people walking fast or running, Ansys simulation program finds that the safe social distance for two peoples walking behind others is 5 meters, and 10 meters for those who running.

The sidewalks should be redesigned and expanded to provide a safe and healthier space for people who want to reduce their stress and go out from the home without exposure to transmission of the covid-19 pandemic.

Human behaviors, change while the pandemic, to head to walk in a green spaces. the awareness of people plays an important role in the fight against the covid-19 pandemic. The urban designers and architects should redesign our cities to be safer and healthier to attack and overcome any future pandemic.

The changes that should have to start redesigning our cities want many years with considering the economy of the countries, but these changes create a safe, flexible and healthier city.

In the post-pandemic, cities and urban spaces can be safe and healthy for their inhabitants? And for how many years these cities could be changed?

LIMITATIONS

This paper is a prelude to a larger research, this paper starts to study the behavioral change before and during the pandemic by using an online survey. After observation of the people behavior in the urban public space, we can extract many analyses related to the human behavior need. And with studying the safe social distancing for people doing sports, we conclude that our streets and sidewalks should be expanded to create a safe environment for those people. For future work, the study can include primary changes in our Tripoli city to be safer and healthier. Also, the parks should be designed for walking not only for sitting, with simulating the spread of the virus in many urban spaces. The factors that affect the urban spaces should be optimized to create a safe environment.

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