

Designing Non-Depressive Urban Built Environment: Case Study of Damietta City, Egypt

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1 ABSTRACT

Maintaining mental well-being in urban built environments with the help of technology in cities is a huge challenging trend, especially with the increasing number of people living in cities. Nowadays, urban life style has raised the risk of anxiety and mood disorders by 21% and 39% respectively. This paper aims at investigating the relationship between several attributes of the urban built environment with mental health and raising the issue of how mental health can be improved through urban design.

Basically, mental health depends on human inner feelings and emotions reacting from surrounding environments. The study is based on analysing the individual experience of people and their lifestyle in several neighbourhoods of Damietta City, Egypt by using Hamilton Depression Scale as an instrument to evaluate the severity of depressive symptoms. The attributes of the built environment in those neighbourhoods are investigated using geographic information systems (GIS), on a sample of 445 individuals distributed in four different city areas. The socio-economic characteristics, built-up attributes and results from the depressive symptoms are analysed and compared in the four areas. A positive relationship has been detected between some attributes of the urban built environment and the severity of the depressive symptoms, emphasising the possibility of improving open public spaces and producing psychologically healthy cities.

Keywords: Hamilton rating scale, urban health, mental health, urban built environment, emotions

2 INTRODUCTION

Urbanisation is one of the leading global trends that has a significant impact on health. By 2050 almost 70% of the world population will live in cities. City leaders, architects and urban planners need to adopt improved strategies to create cities that are healthier and inclusive for all inhabitants. Evidence has been confirmed on the negative effect of urbanisation on human physical health. However, the impacts of the attributes of the urban built environment on mental health require more research and investigation.

Mental disorders are the third largest source of disease after cancers and cardiovascular diseases, and the largest source of disability (Begg S. et al., 2007). One out of four people has a diagnosable mental illness (WHO, 2016), and every forty seconds someone in the world takes their own life - that's 800,000 suicides a year. By 2030, depression alone will become the most burdensome illness, more than cancer, diabetes, and chronic respiratory diseases combined. Today, depression is responsible for an estimated \$2.5-\$8.5 trillion loss in annual global output (Moiteyee Sinha at World Economic Forum Annual Meeting, 2018). In this regard, this paper aims at investigating the relationship between several attributes of the urban built environment with mental health and raising the issue of how mental health can be improved through urban design.

Several evidences depict that urban living has both positive and negative effects on mental health. Urban living is related with increases in mood disorders by up to 39%, anxiety disorders by up to 21% (Peen et al, 2010), double the risk of schizophrenia (up to 2.37 times above average) (Vassos et al, 2010) and increase in rate of cocaine and heroin addiction (SAMHSA, 2012). On the other hand urban living is related to decreases in the following mental health problems: almost half the suicide risk (varies with community size/density) (CDC, 2015), decrease in dementia by 10% (compared to rural living) (Russ et al, 2012), half the risk of Alzheimer's disease (compared to rural upbringing) (Nunes, 2010) and decrease in alcohol, marijuana, methamphetamine, prescription drug abuse (SAMHSA, 2012). Previous studies explored the relationship

between some urban attributes and mental health (e.g. urban spaces, urban density, transportation and accessibility, socio-economic characteristics... etc), as follows:

2.1 The effect of urban built environment attributes on mental health

2.1.1 Green spaces and mental health.

Recent estimates of WHO Global Health Report 2016 (REF) shows that physical inactivity, linked to poor walkability and lack of access to recreational areas, accounts for 3.3% of global deaths which led to great interest in bringing green areas to the heart of cities to preserve healthy life rights for people. Studies have found a close correlation between green spaces and mental health diseases (depression, stress and anxiety, schizophrenia, post-traumatic stress disorder, dementia...). Alcock et al. (2014) found that mental health of individuals has improved due to their relocation to areas with more green space in the UK and that these benefits were sustained three years post move (n=594). Maas et al. (2009) found that higher levels of neighbourhood green space in Wisconsin were associated with significantly lower levels of symptoms of depression, anxiety and stress, after controlling a wide range of confounding factors (n=2,479). Then research has evolved to determine the appropriate design distance to obtain the effect of green spaces. For example, exploring morbidity data in Danish medical practices serving a population of 345,143, found that the prevalence of psychological morbidities (i.e., for anxiety disorder and depression) was lower in neighbourhoods with more green space (i.e., in a 1 km radius around the home). In a New Zealand study, Nutsford, Pearson, and Kingham (2013) found statistically significant relationships between the quantity of green space (i.e., both total and useable green space within a 3 km radius around a home and distance to nearest useable green space) and decreased anxiety/mood disorder treatment counts in an urban setting. Lower risk of depression was strongly associated with green space quantity measures, including a higher percentage of neighbourhood tree canopies. Adverse mental (and other) health consequences are resulting from an absence of green space. After allowing for demographic and socio-economic characteristics, a study of three hundred and fifty thousand people in Holland found that the prevalence of depression and anxiety was significantly greater for those living in areas with only 10% green space in their surroundings compared to those with 90% green space (Maas J, et al., 2009). In general, there is now considerable evidence to indicate that “green exercise,” that is, walking in green spaces including parks and streets with trees, generates significant mental well-being benefits over and above walking in non-green environments, including increased mood, self-esteem, and energy (Roe & Aspinall, 2011a; systematic reviews by Thompson Coon et al., 2011; Bowler et al., 2010). On the other hand, there is good scientific evidence that contact with nature in urban areas can improve mental health and can help in the restoration of psychological well-being. People may still experience positive emotions in more natural environments (Victoria Houlden, 2017). According to Ulrich (2002), viewing of plants and flowers ameliorates stress within 5 minutes or less. Viewing nature for longer periods helps to calm residents and can foster improvement in mental health.

2.1.2 Blue space and mental health

In general, People feel comfortable inside the natural environment. The beach has always been associated with relaxation. The effect of blue space does not depend solely on vision but it addresses all senses, whether hearing or smell. As the basic inputs of the human mind, there is a natural reaction to its mental health. This is what A. Pawlowski, 2016 confirmed as he said, “Think about looking out at the ocean: you can hear it, hear the waves, and there's a rhythm to that. You can also smell the ocean. Furthermore, Kingham (2016) proved that blue space is good for mental health. Interestingly, this research did not find strong links between green space and mental health. This explains that the population of New Zealand has managed to reach a very large proportion of green areas, so that they are not distinctive and have no real effect on the equivalent of exposure to water.

2.1.3 Density and mental health

Behaviours, feelings and mental health are affected by constant movement and social interactions which is the nucleus of the positive side of high densities. According to a study in Turin, Italy, 2015 densities could contribute to reduced risk of depression, especially for women and elderly by increasing opportunities to move around and have an active social life (Giulia Melis, et al., 2015). On the other hand, Recsei (2013) conducted a study on over four million Swedes and examined whether a high level of urbanisation (which

correlates with density) is associated with an increased risk of developing psychosis and depression. Adjustments were made to cater for individual demographic and socio-economic characteristics. It was found that the rates of psychosis (such as the major brain disorder schizophrenia) were 70% greater for the denser areas. There was also a 16% greater risk of developing depression. The conclusion states: "A high level of urbanisation is associated with increased risk of psychosis and depression" (Sundquist, et al., 2004).

2.1.4 Transportation & Accessibility and mental health

Local transport conditions affect mental health and happiness (Montgomery 2013). Transportation conditions, services and availability can create a socially cohesive happy city where people can create places of social communication in stations and during journeys. Melis, et al. (2015) reached similar results, and proved that access to public transport reduces depression, especially in women and the elderly. In 2011, using data from the Quality of Life Survey, which asked residents in 10 major cities (New York, London, Paris, Stockholm, Toronto, Milan, Berlin, Seoul, Beijing, and Tokyo) to rate their happiness, Leyden, Goldberg and Michelbach (2011) conclude that happiness tends to increase if cities have efficient public transport; convenient access to cultural and leisure amenities; are considered affordable, safe, clean and attractive; and foster social connections.

Distance between housing and work

UK Office of National Statistics study (2014) found that commute duration is negatively related to personal well-being. The data indicate that automobile commutes exceeding 15 minutes are associated with reduced happiness and increased anxiety, while public transport commuting does not reduce personal well-being until journey times exceeds 30 minutes. The Gallup Health ways Index 2012 indicates that large, compact, multi-modal cities such as Boston, San Francisco, Chicago, New York and Washington D.C. have significantly higher rates of exercise, and significantly lower rates of depression, obesity, diabetes and smoking than sprawled, automobile-dependent cities such as Fort Wayne, Indianapolis, Oklahoma City, Tulsa and Durham-Chapel Hill (Gallup 2016). The Index indicates that, controlling for age, education, and income levels, longer commutes reduce subjective well-being, as illustrated. Among employees with commutes exceeding 90 daily minutes, 40% experienced worry for much of the previous day -- significantly higher than the 28% among those with commutes of 10 minutes or less, and extremely long commuters were less likely to have experienced enjoyment for much of the previous day or report feeling well-rested. People with shorter commutes tend to have higher well-being ratings. This suggests that more compact development can increase happiness, as commute duration is affecting mental health directly, and a healthy environment can be achieved through safety, fast public transportation or housing close to work.

Walking paths (walkability)

As stated by Robertson, et al. (2012), walking provides mental health and happiness benefits. Since walking whether for recreation or transportation is considered an accessible means of gaining moderate physical activity, it has been reasoned that mental health benefits from physical activity could be reasonably applied to walking. Improved walking conditions and increased walking activity can increase community cohesion, community security, public fitness, and health (Appleyard, 2012). Strawbridge et al. (2002) found that high levels of physical activity were associated with low prevalence of baseline depression. This relationship also existed at the five year follow-up, where degree of physical activity was a strong predictor of new onsets of depression. For women, engaging in regular physical activity may also prevent mental health disorders or at least indicate the risk of future onsets of depression. Farmer et al. 1988 recorded physical activity levels for 1497 women without depressive symptoms and followed up with a self-reported mental health questionnaire eight years later. Results of the study revealed that the women who reported little to no physical activity were twice as likely to have developed depressive symptoms as those who reported moderate to high levels of activity. A study by Kramer et al. 1999 found that subjects assigned to an aerobic walking programme as opposed to anaerobic stretching and toning showed substantial improvements in mental functions, such as the speed at which they could switch between tasks.

2.1.5 Socio-Economic Characteristics .and mental health

Social factors contribute to how healthy people are. These social factors come from both our environment and our social world. Socioeconomic status is a term that social scientists use to capture a number of different factors. It refers to a person's income level, education, and general position in society. Socio-

economic characteristics vary from region to region and affect the urban environment. There are great disparities between the environments of those who live in slums or those who live in a sophisticated and distinctive community. Evidence indicates a strong relationship between socioeconomic characteristics and mental health where studies have confirmed that disadvantaged neighbourhoods are associated with mental health diseases and high crime rates. According to Patel, 2015, mental health problems are more prevalent in socioeconomically disadvantaged people. Mair C, et al. (2008) concluded that poor urban design has been associated with depression and depressive symptoms and has also been implicated in the creation of dysfunctional spaces and weakened infrastructure i.e., waste disposal, water supply, and sewage systems with resulting health inequities. Living in high density, overcrowded conditions, with limited amenities and social services puts urban dwellers at increased risk of poor mental health. This was consistent with the results of a study which analysed British twins (which enabled researchers to separate genetic from environmental factors). Newbury, et al. (2016) found that children in deprived urban neighbourhoods were ~80% more likely to experience psychotic symptoms than those in non-urban neighbourhoods, but this primarily reflected increased social disorder and crime risk in deprived neighbourhoods, and so does not apply to affluent urban areas. Economic stresses may also contribute to mental illness and unhappiness (Tobin 2014; Winter and Li 2016) and poverty has been associated with mental illness, due to exposure to physical and social stressors that limit the capacity to respond to adverse life events (Lorant V, et al., 2003). On the other hand, a randomised controlled trial that moved families from high poverty neighbourhoods to nonpoor neighbourhoods showed that both parents and children who moved reported fewer psychological distress symptoms than did control families who did not move. Sandro Galea, et al., 2005 found that workers who move from impoverished rural areas to cities with better economic opportunities can gain happiness overall because their income gains more than offsets any happiness reduced by city living (Albouy, 2012). Other studies discussed the relationship of happiness with socioeconomic characteristics. Montgomery argues in *Happy Cities* (Montgomery 2013) that people can be happy in cities provided that they are designed to meet residents' emotional and social, as well as physical needs. Happiness tends to increase with housing prices, which probably reflects a combination of increased productivity and therefore economic opportunities, and improved livability in higher-priced areas. In these regions, individuals can afford and benefit from neighbourhood-related amenities, which in turn increases happiness, (Florida, Mellander and Rentfrow, 2013).

Previous studies confirm the impact of elements of the physical environment on mental health and they are considered the beginning of a deliberate step towards building a better mental health environment. Hence, initiatives have emerged around the world to protect mental health through the physical environment.

2.2 Global efforts of facing urbanisation effects on mental health

Several international organisations have carried out initiatives that recognise the negative impact of urbanisation on mental health and citizens' wellbeing. Sustainable Development Goals (SDGs), aim at achieving 17 goals by the year 2030. The goals address several development issues such as poverty, economic growth as well as a range of social needs including education, health, social protection, and job opportunities. Other environmental issues such as climate change and environmental protection are also addressed. It is worth mentioning that goal 3 is concerned with health and well-being, and goal 11 is dedicated to achieving sustainable cities and community (UN Sustainable Development Goals, 2030 Agenda).

Similarly, the World Health Organisation investigated health determinants in cities, addressing several issues such as urban planning for cleaner air, safe and more active living to ensure healthy lives and promoting well-being for all at all ages. Dora (2018), claims that urban policies could play an important role in preventing mental illness and protecting mental health through improving elements of the urban environment, such as green space, housing, transport, land use and waste management. Sustainable urban development that could positively impact mental health includes improving accessibility to green spaces and nature, achieving safety, injury prevention, reducing air pollution and noise, encouraging physical activity in cities and maintaining high levels of social interactions. A WHO report, 2016 entitled 'Prevention of mental disorders, effective interventions and policy options' indicated that socioeconomic characteristics are the most important mental health driver.

In this regard, the Centre of urban design and mental health in London developed a framework through which to consider any urban project using the lenses of four key opportunity themes for good mental health, summarised by the acronym GAPS: Green places, Active places, Pro social places, and Safe places. Evidences demonstrated the positive impact of green spaces and access to nature on mental health; green spaces have been found to be protective, providing opportunities for relaxation and therapeutic value inherent in interaction with nature (Mitchell R, et al. 2008).

3 METHODOLOGY

The research framework attempts to answer two main questions: (i) How to measure mental health? and (ii) How to test these measurements on urban areas? (figure 1).

The assessment of mental health in urban areas could include one or more of four main dimensions: life satisfaction, positive affect, anxiety and depression. In this research, depression was selected as it constitutes 17.3% of all global diseases (WHO, 2016). It is the most common mental disorder that occurs in people of all ages across the world (Ferrari et al., 2013). According to Elfeki (2018) depression and anxiety constitute 65% of the mental illness in Egypt. It was also noticed by Okasha (2017) that 1.5 Million Egyptians suffer from depression of the 350 million people with depression around the world. The selection of depression as one important dimension of mental health in urban Egypt was also supported by interviews that the researcher conducted with 18 psychiatrists and psychologists from public clinics in densely populated urban areas.

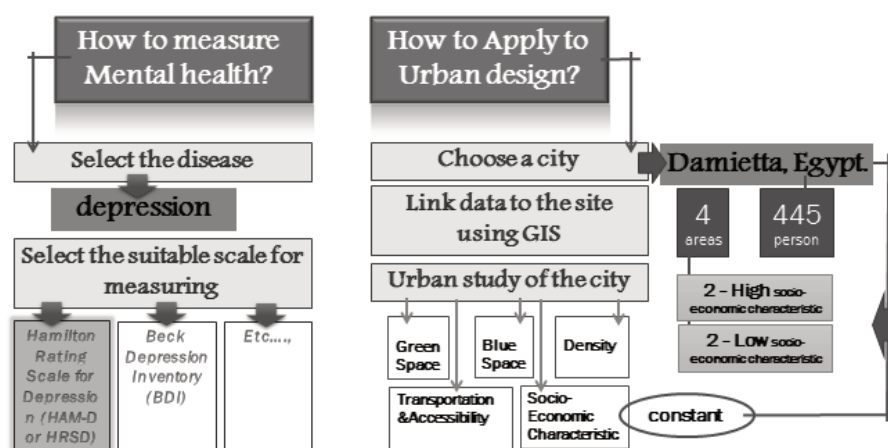


Fig. 1: Research Framework

Several methods of measuring depression were considered. First, the methods that are medically invasive and dependent on diagnostics and statistical manual (DSM) criteria were out-ruled. Then, some tools that could be used to measure the presence of symptoms and their severity were analysed. Five scales of depression were reviewed: (a) Beck Depression Inventory (BDI), (b) Inventory of Depressive Symptomatology (IDS or QIDS), (c) Montgomery–Asberg Depression Rating Scale (MADRS), (d) Zung Self-Report Depression Scale (Zung SDS) and (e) Hamilton Rating Scale for Depression (HAM-D). Hamilton Rating Scale for Depression (HAM-D) has been selected, due to its adequate reliability (Bagby RM, et al., 2004). HAM-D assesses depression severity among people through 17 items, including questions about sadness, anxiety, and symptoms such as loss of appetite and weight loss. The total score is obtained by summing the score of each item, 0–4 (symptom is absent, mild, moderate, or severe) or 0–2 (absent, slight or trivial, clearly present). For the 17 items version, scores can range from 0 to 54. (0-7) indicated normal, (8-13) mild, (14-18) moderate, (19-22) severe and (≥ 23) very severe.

The case study selected for this research is Damietta city, located on the eastern bank of the Nile. As shown in the attached figure, the main city, both with New Damietta and Ras ElBar cities constitute one large urban agglomeration (shown in figure 2). The city is characterised by a high living standard per capita – compared to National figures – due to its informal economy based mainly on carpentry and wood industry. The unemployment rate in the city is low, and the business structure depends on small private enterprises. In addition, Damietta contains one of the largest ports of the region. This economic activity directly affects social characteristics and creates a diversity of urban characteristics.

Four city areas (neighbourhoods) were selected to investigate the relationship between depression (mental health) and some attributes of the built environment. The attached figure depicts the location of the four selected areas A, B, C and D (shown in figure 3). It is worth-mentioning that both areas A and B are characterised by low socioeconomic conditions, while areas C and D have higher overall conditions. Nevertheless, the four areas have different urban characteristics.

Depression occurrence was measured using HAM-D on a sample n=445 distributed mainly in the four city areas (n=97 in each area). A questionnaire was prepared and distributed during summer 2018. The urban analysis of the four areas was conducted using Geographic Information Systems and visual surveying and focused on some attributes of the built environment such as green spaces, blue spaces, population density, public transportation availability, accessibility, as well as socio-economic characteristics. The results from both the HAM-D measurements and the analysis of the built environment were compared.

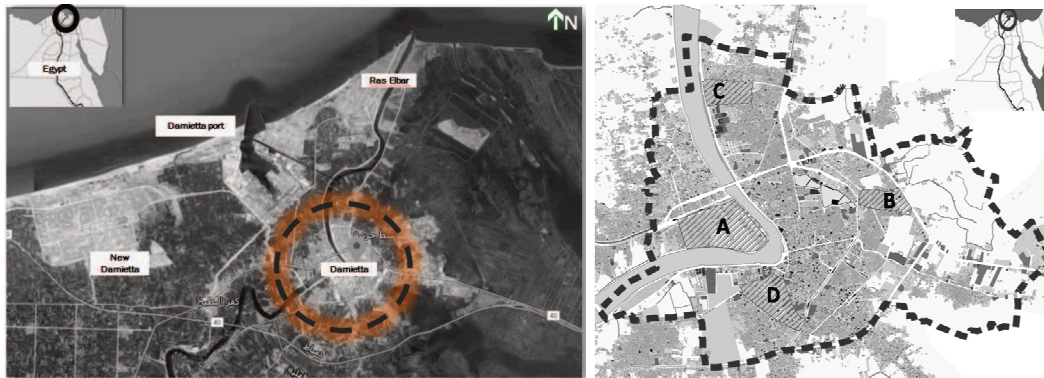


Fig. 2: Location of Damietta City, Fig. 3: Location of the four study areas.

3.1 Urban analysis

The urban analysis has revealed some similarities among the urban features of areas A and B. Both areas are recent expansions on agricultural land and are inhabited by low to middle income workers and craftsmen. Typical houses in the two areas are privately owned and include ground floor workshops and storage spaces. In contrast, areas C and D have higher socio-economic characteristics, and include several social and financial amenities such as banks, hospitals and business centres. Area D contains the commercial city centre with various markets, shops, offices and services. Residents of these areas have higher educational levels as well as job opportunities in banks and private/public companies. In contrast to the former two areas, the inhabitants in C and D occupy mainly apartments.

Green spaces in Damietta are generally scarce. Areas A and B are surrounded by vegetation (agricultural land). The urban expansion and building prototypes in both areas do not benefit from the surrounding open spaces and are mainly inward looking. As a result, the interaction of the residents with the open spaces is minimal due to the lack of accessibility from the built area to open spaces. In contrast, areas C and D have very few green areas except on main roads (as it shown at figure 4).



Fig. 4: Types of green spaces in Damietta city.

The following table describes the interaction between people and the blue spaces, mainly riverfronts, in their daily life, and how this creates interactions between Nile and people in different classes.

Analysing densities and types of land uses reveals that area D is considered the highest density area in Damietta. It contains commercial activities and mixed uses. In this area the streets are used not only for movement but as shops for artefacts and furniture. In contrast, the streets in areas A and B are mainly packed with workshops (shown in figure5).

low socio-economic characteristics	High socio-economic characteristics
People use ferry boats which takes 5 min to move from one bank to another.	People depend on their own cars to commute, with less exposure to blue spaces
There are trips from Damietta to Ras El Bar that take 1 hour; people join it for fun and movement especially in holidays and weaken.	
Walkability and entertainment in the Cornish path	

Table 1: Comparison between the use of blue spaces by people of low and high incomes.



Figure 5: street activities in area D and A

Transportation and mobility are considered important elements in the logistics of the city’s economic activities. For example, the industrial furniture clusters include warehouses, neighbourhood workshops, stores and shipping services. All of the above are distributed in and around the city and are connected by a network of roads, highways, and a railway. Area B which is unplanned is still very well connected to the coastal highway. As depicted in the attached figure 6 and 7, all four areas are very well connected to a good road and transportation network except area A which is separated by a rail way line.

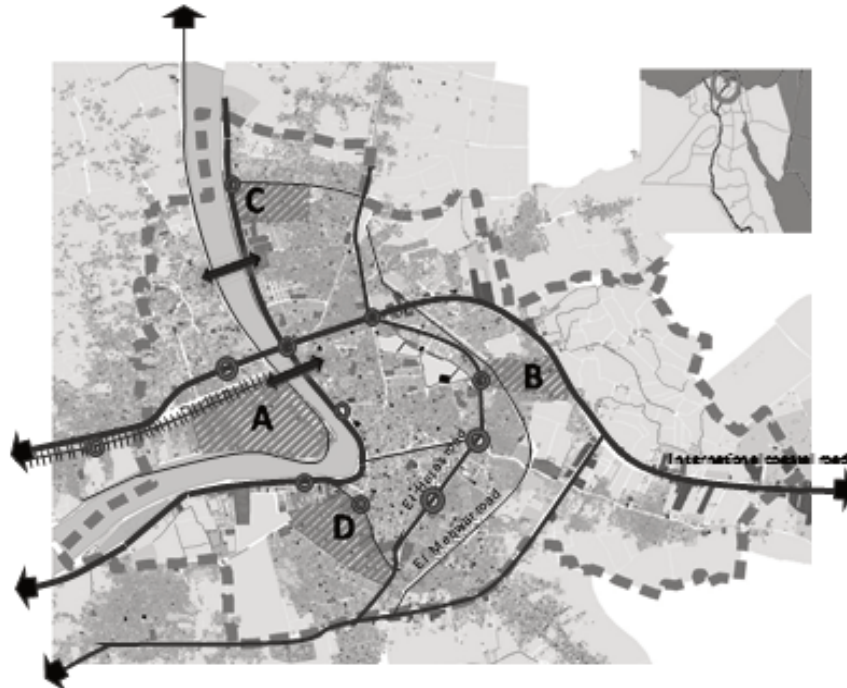


Figure 6: Road network in Damietta



Figure 7: prototypes of streets in Damietta

3.2 Statistical Analysis

Data are analysed using IBM SPSS software package version 20.0. (Armonk, NY: IBM Corp). Qualitative data are described using number and percentages; quantitative data are described using range (minimum and maximum), mean, standard deviation and median. Significance of the obtained results are judged at the 5% level. The used tests are 1 - Chi-square test, for categorical variables, to compare between different groups, 2 - Monte Carlo correction, Correction for chi-square when more than 20% of the cells have an expected count of less than 5.

Study areas	Severity of depressive symptoms										Total	
	Normal		Mild		Moderate		Severe		Very severe		(n=445)	
	(n=97)		(n=105)		(n=94)		(n=63)		(n=86)			
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
A	26	26.8	17	16.2	15	16	24	38.1	15	17.4	97	21.8
B	20	20.6	23	21.9	30	31.9	7	11.1	17	19.8	97	21.8
C	15	15.5	31	29.5	20	21.3	13	20.6	18	20.9	97	21.8
D	25	25.8	19	18.1	17	18.1	12	19	24	27.9	97	21.8
Others	11	11.3	15	14.3	12	12.8	7	11.1	12	14	57	12.8
χ^2 (p)	29.428* (0.021*)											

Table 2: Relation between severity of depressive symptoms with areas in Damietta (n=445). χ^2 Chi square test, p: p value for comparing between groups , *: Statistically significant at $p \leq 0.05$

4 RESULTS

According to the Hamilton scale to measure severity of depressive symptoms and its link to urban areas, the severity of depression symptoms is assessed; 21.7% of the total sample is normal, 23.5% mild, 21.1% moderate, 14.1% severe and 19.3 % very severe. According to Hamilton, the score indicated at least as moderate severity is usually required for entry into a clinical trial (shown in figure 8).

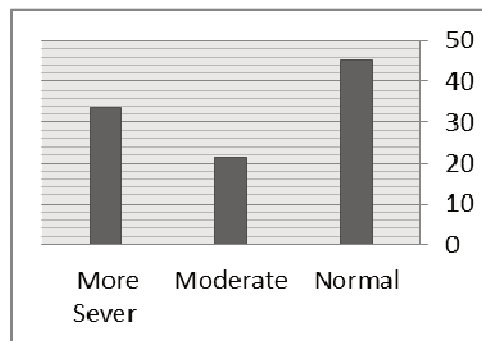


Figure 8: Severity of the depressive symptoms in the four areas

5 DISCUSSION

As depicted in the attached figure, the results from the survey – using the HAM-D method were somehow unexpected: Both areas A and B had similar socio-economic values; however area A scored the highest value of severity of depressive symptoms (40.2%) while area B scored lowest (24.7%). The most significant difference between the two areas is accessibility and availability of transportation modes, whereby area B is more accessible and therefore encourages walkability. It is therefore most likely that accessibility and proximity to public transport have a positive effect on mental health and depression.

On the other hand, in areas C and D – endowed with low socio-economic conditions - high scores on the severity scale of the depressive symptoms are recorded with a rate of 31.9% and 37.1% respectively. In those areas, open spaces (blue and green) could play an important role in alleviating daily work pressures and are providing natural spaces within a built up environment characterised by high density and prevalence of hard-scape.

Generally, Damietta is endowed with several assets and opportunities to improve mental health; such as a long riverfront and a good network of public transportation system. Pedestrian safety is also an advantage,

due to the mixed-use nature of the street and its high liveability during the day. Workers already maintain the security in their areas and create small communities where they spend break hours, so it was found that ‘GAPS’ framework applies to low socio-economic areas.

On the other hand there are negative factors that need to be addressed in the city, such as weak connection with green areas (especially agricultural land) and the unplanned urban growth on agricultural land, usually for workers and their families. To a great extent, the new formal expansions in the two neighbouring cities, New Damietta and Ras El Bar are attracting mainly people who have high socio-economic status.

At the policy making level, it is crucial that an urban health agenda be adopted within the planning process. This could be achieved through a more inclusive and participatory approach, where the planners and decision makers involve the local community in satisfying their needs. The outcomes from such policy implementation could be enormous in terms of better living conditions and their impacts on mental health.

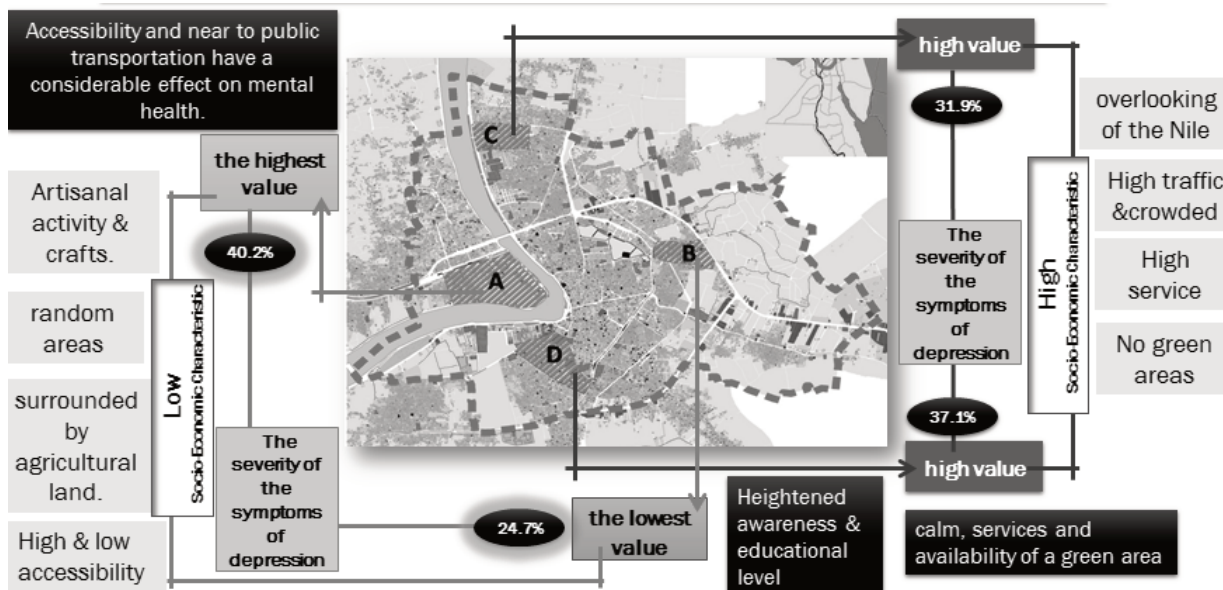


Figure 9: Relationship between urban environment and Hamilton scale results.

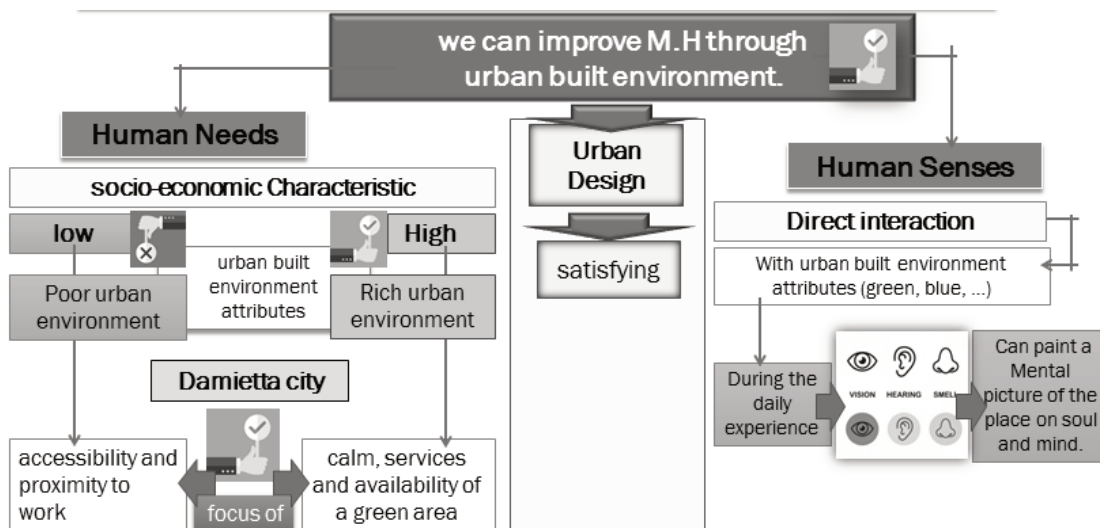


Figure 10: two keys to improve mental health.

6 CONCLUSION

- Mental disorders (depression) could be alleviated through health oriented urban planning. Evidence-based research suggests that open spaces, greeneries, walkability, public transportation, accessibility and soft-scapes are all attributes of the built environment that could have an outstanding effect on mental health of the local community. Mental health could be improved through urban built environment.

- The research on Damietta case studies indicates that there are two 2 keys to improve mental health (figure 10).

(1) Human needs: which reflect needs of socio- economic characteristic for different classes. As it was revealed, poor mental health is not necessarily associated with poor socio-economic conditions. Working on understanding human needs in specific cases is a key guide to the successful implementation of urban improvement strategies that are health oriented.

(2) Human senses: which reflect direct interactions between people and urban built environment attributes (green, blue spaces, buildings, streets,...) during daily experience. These important interactions give the brain a chance to paint a mental picture of the place through its senses.

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