

EFFECTS OF NEIGHBOURHOOD ENVIRONMENT ON PHYSICAL
ACTIVITIES IN GATED AND NON-GATED NEIGHBOURHOODS IN
KARACHI, PAKISTAN

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KARACHI, PAKISTAN

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This thesis is dedicated to my beloved family.

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ABSTRACT

While it has been established that neighbourhood environment influences physical activity, gated neighbourhoods, which are a relatively new phenomenon, have been reported to affect the whole urban morphology with their distinct built and social environment as well as the number of physical activity facilities (PAF). However, limited research has been carried out on the effects of neighbourhood environment of gated neighbourhoods on physical activity (PA), especially in the context of developing countries. The aim of this study is to examine the effects of neighbourhood environment (built and social), PAF, and demographics (age, gender, and employment status) on PA in gated and non-gated neighbourhoods of Karachi, Pakistan. Data were gathered using the quantitative research methods: the neighbourhood environment indicators (walkability index, land-use mix (LUM), streets connectivity, housing density, perception of crime (POC), perception of traffic hazard (POTH)), PAF, and demographics were treated as independent variables, whereas physical activity variables (vigorous physical activity (VPA), moderate physical activity (MPA), and walking) were dependent. Data on LUM, streets connectivity, and housing density were collected through objective methods using GIS database and Space Syntax technique, while the number of PAF was enumerated. The data on POC, POTH, PA variables, and demographics were collected through questionnaire. A total of sixteen neighbourhoods eight for each neighbourhood type were studied, involving a total of 1042 participants. The collected data were statistically analysed by using SPSS. A walkability index was developed using data on LUM, streets connectivity, and housing density. The differences between variables of gated and non-gated neighbourhoods were analysed through independent sample t-test. The association of neighbourhood environment indicators and demographics with PA was measured through binary logistic regression. The comparison of walkability index with walking and PAF with VPA were done through γ -tests. Results show that the walkability index, LUM, streets connectivity, POC and walking were higher in non-gated neighbourhoods while the numbers of PAF, POTH, total PA and VPA were higher in gated neighbourhoods. Results also show that there was a significant positive relationship of walkability index and numbers of PAF with PA, but a significant negative relationship of age and employment status with PA. Other results show that the PAF had association with VPA in both types of neighbourhoods while walkability index had association with walking only in non-gated neighbourhoods. It is concluded that PAF is an important attribute to increase VPA, and consequently total PA; therefore more PAF should be built in non-gated neighbourhoods as well. Gated neighbourhoods have less LUM and street connectivity, and consequently less walkability, therefore, gating the communities should not be encouraged at policy level.

ABSTRAK

Walaupun telah dinyatakan bahawa persekitaran kejiranan mempengaruhi aktiviti fizikal, kawasan kejiranan berpagar merupakan fenomena baru yang memberi kesan kepada seluruh morfologi bandar dengan persekitaran yang dibina dan aktiviti sosial yang berbeza serta jumlah kemudahan aktiviti fizikal (PAF). Walau bagaimanapun, kajian telah dijalankan terhadap kesan persekitaran kejiranan berpagar dalam aktiviti fizikal (PA), terutamanya dalam konteks negara-negara membangun. Tujuan kajian ini adalah untuk mengkaji kesan persekitaran kejiranan (dibina dan sosial), PAF, dan demografi (umur, jantina, dan status pekerjaan) PA di kawasan kejiranan berpagar dan tidak berpagar di Karachi, Pakistan. Data dikumpul menggunakan kaedah kajian kuantitatif: indeks penunjuk persekitaran, campuran penggunaan tanah (LUM), perhubungan jalan, ketumpatan perumahan, persepsi jenayah (POC) dan persepsi bahaya lalu lintas (POTH). PAF demografi dianggap sebagai pembolehubah bebas, manakala pembolehubah aktiviti fizikal yang kuat (VPA), aktiviti fizikal sederhana (MPA), adalah tidak bebas. Data tentang LUM, perhubungan jalan raya, dan ketumpatan perumahan dikumpul melalui kaedah objektif menggunakan pangkalan data GIS dan teknik Space Syntax, manakala bilangan PAF juga diambilkira. Data mengenai POC, POTH, pemboleh ubah PA, dan demografi dikumpulkan melalui soal selidik. Sebanyak enam belas kejiranan - lapan untuk setiap jenis kejiranan - dikaji, melibatkan sejumlah 1042 peserta. Data yang dikumpul secara statistik dianalisis menggunakan SPSS. Indeks kebolehlaksanaan telah dibangunkan menggunakan data mengenai LUM, perhubungan jalan, dan kepadatan perumahan. Perbezaan antara pembolehubah kawasan kejuruteraan berpagar dan tidak berpagar dianalisis melalui ujian t sampel bebas. Hubungan penanda aras persekitaran dan demografi dengan PA diukur melalui regresi logistik binari. Perbandingan indeks persekitaran dan PAF dengan VPA dilakukan melalui ujian γ . Dapatan menunjukkan bahawa indeks persekitaran, LUM, perhubungan jalan raya dan POC adalah lebih tinggi di kawasan kejiranan yang tidak berpagar manakala bilangan PAF, POTH, jumlah PA dan VPA lebih tinggi di kawasan kejiranan berpagar. Dapatan juga menunjukkan bahawa terdapat hubungan positif yang signifikan antara indeks kebolehlaksanaan dan jumlah PAF dengan jumlah PA, tetapi terdapat hubungan negatif yang signifikan terhadap umur dan status pekerjaan dengan PA. Hasil kajian juga menunjukkan bahawa PAF mempunyai hubungan dengan VPA dalam kedua-dua jenis kawasan kejiranan sementara indeks kebolehlaksanaan mempunyai hubungan dengan berjalan kaki hanya di kawasan kejiranan tidak berpagar. Kesimpulannya PAF adalah atribut penting untuk meningkatkan VPA dan PA; oleh itu lebih banyak PAF perlu dibina di kawasan kejiranan yang tidak berpagar. Kejiranan berpagar mempunyai kurang LUM dan hubungan jalan, dan akibatnya kebolehan berjalan adalah kurang. Oleh itu, komuniti masyarakat tidak boleh digalakkan di peringkat dasar.

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LIST OF ABBREVIATIONS

AHA	-	American Hearth Association
AT	-	Active Travel
BE	-	Built Environment
BEPAS	-	Belgium Environmental Physical Activity Study
CDC	-	Center of Disease Control
CON	-	Connectivity
DHA	-	Defence Housing Authority
DV	-	Dependent Variable
DC's	-	Developing Countries
GC's	-	Gated Communities
GC'sPA	-	Gated Communities Physical Activity
GC'sPAQ	-	Gated Communities Physical Activity Questionnaire
GIS	-	Geographical Information Systems
GPAQ	-	Global Physical Activity Questionnaire
GPS	-	Global Positioning Systems
HHI	-	Herfindahl-Hirschman Index
IV	-	Independent Variables
IPAQ	-	International Physical Activity Questionnaire
IPS	-	International Physical Acitivity Prevalence Study
KDA	-	Karachi Development Authority
LDA	-	Lyari Development Authority
LUM	-	Land-use Mix
MAPS	-	Microscale Audit of Pedestrian Streetscape
MDA	-	Malir Development Authority
MET	-	Metabolic Equivalent of Task
MPA	-	Moderate Physical Activity
MVPA	-	Moderate to Vigorous Physical Activity

NE	-	Neighbourhood Environment
NEWS	-	Neighbourhood Environment Walkability Scale
NPAQ	-	Neighbourhood Physical Activity Questionnaire
PA	-	Physical Activity
PAF	-	Physical Activity Facilities
PLACE	-	PA in Localities & Community Environments
POC	-	Perception of Crime
POTH	-	Perception of Traffic Hazard
SD	-	Socio-Demographics
SE	-	Social Environment
SES	-	Socio-Economic Status
SNAP	-	Swedish Neighbourhood and Physical Activity Study
VPA	-	Vigorous Physical Activity
WHO	-	World Health Organization

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CHAPTER 1

INTRODUCTION

Urging by wellbeing experts and organizations on physical activity¹ (PA) notwithstanding, numerous grown-ups are not sufficiently active to accomplish ideal medical advantages [Bauman et al., 2011]. Therefore, there is a requirement for enhanced systems that support and promote PA at the populace level. There are different guidelines established by health organizations for different age group people to be physically active. The guidelines established by World Health Organization (WHO) for adults with the age group of 18-65 are: (1) A person should be physically active at moderate level (e.g. brisk walking, cycling etc.) for at least 30 minutes per day and five days per week, (2) or a person should be vigorously active (i.e. sports activity) for at least 20 minutes per day and 3 days per week; (3) or a person should be physically active with any combination of physical activity to get at least 600 MET² per week. In the past 15 to 20 years, there has been a significant increase in the research interest about aspects of the neighbourhood environment³ (NE) supporting PA. In comparison to other approaches promoting health, the adaptation of NE to support PA is more effective and sustainable strategy for encouraging people to increase the levels of PA. At present this has become robust area of research investigation [Day and Cardinal, 2007].

¹Bodily movement produced by the contraction of skeletal muscle that increases energy expenditure above the basal (i.e., resting) level [Handy et al., 2005]

²MET (Metabolic Equivalent of Task) is a physiological measure expressing the energy cost (or calories) of physical activities. MET values indicate the intensity of any activity such as an activity with a MET value of 5 means expending 5 times the energy (number of calories) than at rest. MET minutes are the time engaged in an activity with consideration to the number of METs [World Health Organization, 2015]

³Land Use Patterns (i.e. land-use mix, housing density), transportation systems (accessibility through physical infrastructure, services that provide connectivity among things) and design features (aesthetics i.e. design of buildings and streetscape) all together make built environment at neighbourhood level [Handy et al., 2005]

1.1 Research Background

The neighbourhood environment (NE) has been broadly defined by transportation studies and urban planning studies as to include the built environment (BE); for example, the land use patterns, the transportation systems, and design of a neighbourhood [Handy et al., 2002; Humphrey, 2005]; which can effect PA. The health literature concludes that along with NE variables; the sports facilities/physical activity facilities are also needed at neighbourhood level to enhance PA [Sallis et al., 2009a]. However, the social environment at neighbourhood level effects PA as well, as agreed by both types of experts such as Frank et al. [2005] from urban planning and Sallis et al. [2009a] from public health literature.

The components of built environment such as land-use patterns include the land-use mix, street connectivity and housing density of neighbourhood. Land-use mix is diversity of land use and provides different access to walk to different destinations such as walk to shops, active travel to schools and public transport stations, and leisure walk to public parks [Bourdeaudhuij et al., 2015]. In addition, the neighbourhood is especially considered important where there is land-use mix because it encourages majority of physical activity, including walking and cycling for different purposes [Giles-Corti et al., 2008]. The second important indicator of land-use patterns is street connectivity, which is measured with density of intersections; grid-like street patterns for example, are more supportive to walking in contrast to areas with fewer intersections. This is partly because grid-like pattern offers alternative routes to destinations [Li et al., 2005]. On the other hand, the streets which need less turns to take for reaching any other place are known as more connected and integrated [Baran et al., 2008]. The third important variable of land-use patterns is housing density. The higher housing density is positively associated with physical activity due to utilitarian walk [Coogan et al., 2009; Strath et al., 2007]. The Z-scores of all three components of land-use patterns have been combined to get walkability index in many studies. The results show that walkability index has positive effect on physical activity (i.e walking) [Frank et al., 2005]. The characteristics of transportation system are the accessibility, infrastructure availability, and traffic related characteristics. The accessibility, availability, and quality of pedestrian infrastructure can affect active travel; there has been reported that the accessibility and quality of pedestrian infrastructure encourages walking for transport [McCormack et al., 2008]. The third important variable of built environment at neighbourhood level is the design features. The design features that cause leisure walk at neighbourhood level include building designs and streetscape. For example, there is an association between aesthetical

aspects of a neighbourhood such as landscaping and cleanliness, and leisure walking [Cohen et al., 2010; Hoehner et al., 2003]. The lighting, shade and the presence of street furniture, known together as streetscape, also plays a positive role in this regard [Witten et al., 2012].

The social environment of a neighbourhood is the one related to safety (i.e. perception of crime, perception of traffic hazard, and physical disorder), which affect physical activity. Lack of personal and traffic safety have been found inversely associated with physical activity [Strath et al., 2007; Miles, 2008; Weir et al., 2006]. Finally, the sports facilities such as parks, gym, public pools and jogging tracks also affect the physical activity at neighbourhood level [Bourdeaudhuij et al., 2003]. The details of variables which affect physical activity are discussed in the chapter 2 of this study.

There are different methods to measure the neighbourhood environment and physical activity. The data for neighbourhood environment has been collected by two major methods including the *objective* method and the *perceived* method. Objective methods are when the data is collected through land-use maps, GIS data base, Google Maps, Space syntax and audits. For Audits, there are different standard survey methods to calculate data by trained surveyors such as Microscale Audit of Pedestrian Streetscape (MAPS) and Built Environment Manuals (BE Manuals). While for collecting data through perceived methods, a number of standard questionnaires are developed by researchers [Sallis et al., 2009a] such as Neighbourhood Environment Walkability Scale (NEWS) and Neighbourhood Environment Walkability Scale (NEWS-Short form). The data on physical activity is also collected with different methods for example, objective and subjective. In objective method, different instruments are used to calculate physical activity such as accelerometer, pedometer and fitbits, etc; while for subjective methods, various questionnaires have been developed for example International Physical Activity Questionnaire (IPAQ) [Helmerhorst et al., 2012], Neighbourhood Physical Activity Questionnaire (NPAQ) [Giles-Corti et al., 2006], and Global Physical Activity Questionnaire (GPAQ) [Bull et al., 2009]. The association between neighbourhood environment and physical activity is calculated using different procedures such as correlations and regression, in different studies. Different types of regressions are used such as linear, multiple, and logistic to find out the association between the neighbourhood environment and physical activity.

The above discussion points to many aspects of neighbourhoods which can

affect PA, however, it is necessary to investigate the physical activity level in a new form of neighbourhood, which is growing very fast; the Gated communities (GCs). GCs have recently emerged and gained popularity around the world among consumers. These are the types of neighbourhood that are walled or fenced from the rest of the communities in a city [Blakely and Snyder, 1997]. There are three main types of GCs, which include prestigious, life style, and security zones. Prestigious GCs are designed for upper classes or business tycoons, including film and football stars. Security zone GCs are aimed at gating the communities away from crime. The purpose of life style GCs is to keep upper-middle class retired people physically active [Blakely and Snyder, 1997; Grant and Mittelsteadt, 2004]. The trend of gating is growing very fast in developing countries as well and many studies have been carried out on this issue. In developing countries, it is considered that the GCs are a combination of all the three types of gated communities identified above [Breitung, 2012; Leisch, 2002].

Previously number of aspects related to GCs have been investigated, such as: the general public motivation; [Blandy, 2006; Atkinson and Flint, 2007], the effects on property values and internal governance [Blakely and Snyder, 1997]; the crime rate [Wilson-Doenges, 2000]; the sense of community [Wilson-Doenges, 2000; Sakip et al., 2012], segregation and social exclusion [Atkinson and Flint, 2007; Vesselinov et al., 2010]; travel behaviors [Burke and Sebaly, 2001]; deserted streets around GCs [Miao, 2003] and sustainability [Landman, 2000]. It is generally concluded that the basic motivation level is to get prestigious life in a secured area, and majority of residents are satisfied except for a few, who do not find it good to live separate from the rest of the society. These communities are mostly governed by private home owner associations. The people pay taxes to home owner associations as well as local governments. The home owner associations are a threat for local governments because there is a possibility that these communities may deny paying taxes as they deal with all of their facilities/issues themselves [Atkinson and Flint, 2007]. The property values are very high and, in some cases, it is found that the values increase in the vicinities of GCs as well if the demand is high [Blandy, 2006]. It is found in many studies that these communities are creating segregation among gated and non-gated, and social exclusion, for example, general public has no access to parks inside GCs. At the same time Burke and Sebaly [2001] reported that the streets of GCs are less walkable as compared to non-gated. Miao [2003] reported that because of less connectivity of these communities with the rest of the city, the streets near GCs are deserted in China. Landman [2000] said that these communities are affecting urban sustainability due to fragmentations and separation into small pieces.

1.2 Research Gap

Number of previous research studies investigated correlation between neighbourhood environment and physical activity from the perspective of developed countries such as Australia [Leslie et al., 2005], Belgium [VanDyck et al., 2010], and Sweden [Sundquist et al., 2011], but there is no such large study so far from developing countries in international literature. There is a need to examine whether the associations found in these countries hold up in a developing country. This is important as there are large environmental, social, economic and cultural differences between countries in different parts of the world. Therefore, it has been hypothesized that there is an association between neighbourhood environment and physical activity in developing countries as well. Second important aspect of this study is that no previous study has compared the neighbourhood environment and physical activity variables of gated and non-gated neighbourhoods. Therefore, it is hypothesized that the neighbourhood environment and physical activity in gated and non-gated neighbourhoods are not the same. There are some other important contributions of this study, previous research [Leslie et al., 2005; VanDyck et al., 2010; Sundquist et al., 2011] has calculated street connectivity for development of walkability index by counting the number of street intersections in 1 sqkm buffer area around participants houses while this study used Space Syntax (Axial Maps) method to calculate the street connectivity because it is reported that simply counting intersections may not give the same level of connectivity and integration [Koohsari et al., 2016] and defining and generating axial lines from street center lines through Space Syntax method is better understanding of urban morphology [Liu and Jiang, 2012]. Therefore, this study has hypothesized that street connectivity measured by Space Syntax is more efficient way of calculating street connectivity than simply counting number of intersections in a neighbourhood for development of a walkability index objectively.

1.3 Research Problem

This new type of neighbourhood, the Gated Communities, are gaining popularity among people and are changing the overall morphology of cities. Therefore, It is considered necessary to investigate the effects of Built Environment of these communities on Physical Activity according to the guidelines of World Health Organization (WHO). The second important aspect is at policy level. As it is mentioned in the first part (Section 1.1) of this study that the main concept of Life style GCs is to keep the people physically active [Blakely and Snyder, 1997]. It is found in

literature that the gated communities in developing countries are combinations of three types of GCs also discussed in the Section 1.1 of this chapter, therefore, the physical activity aspect also exists there. It is an integral part of the marketing of these developments. Therefore, the investigation on the physical activity of these communities is necessary as it will help the policy makers (development authorities and local government) to formulate policies that may help such developments become more physically active. Therefore the main aim of this research is to investigate how the neighbourhood environment of gated communities affects the physical activity of the residents and what policy guidelines and what practices may be formulated in order to promote Physical Activity (PA) at neighbourhood level according to the World Health Organization (WHO) guidelines.

1.4 Research Aim and Objectives

The studies of urban/transportation planning and public health conclude that neighbourhood environment is considered one of the main sources for enhancing physical activity at populace level. It has been suggested that neighbourhoods should have a good mix of housing density; land-use should be mixed and well connected with shopping, schools, public transport, and public buildings. This has been considered a sustainable way to get desired level of physical activity according to the guidelines of WHO. On the other hand, gated communities, which are a new phenomenon in the field of urban planning, have mostly low housing density, less street connectivity, and less land-use mix; but at the same time provide more physical activity facilities and less perceptions of crime and traffic hazard inside gated areas, which are for the sole use of residents. This type of development is changing overall planning patterns of cities, which poses a challenge for planners and policy makers. The aim of this study, therefore, is to investigate the level of total physical activity (through Vigorous Physical Activity, Moderate Physical Activity and Walking) among the people living in gated communities.

The objectives of this study are summarized as follows:

1. To identify key neighbourhood environment indicators of gated neighbourhoods, which affect physical activity
2. To develop a walkability index objectively for gated and non-gated neighbourhoods of developing countries

3. To test the differences between neighbourhood environment indicators and physical activity variables in gated and non-gated neighbourhoods
4. To investigate the association between neighbourhood environment and physical activity in the case study area
5. To compare the associations between neighbourhood environment and physical activity in gated and non-gated neighbourhoods
6. To formulate policy guidelines for neighbourhood planning in future

1.5 Research Questions

To achieve the research aim and objectives outlined above, this study seeks to answer the following specific questions using multi-method approach i.e. subjective method for physical activity and objective and perceived methods for neighbourhood environment measurements. Finally, this study uses Herfindahl-Hirschman Index (HHI) and Space Syntax method to develop a walkability index, Independent Sample *t*-Test to calculate variance, Binary Logistic Regression to analyse the association between neighbourhood environment and physical activity and χ -test to compare gated and non-gated neighbourhoods.

The questions of the study are as below:

1. What are the key neighbourhood environment indicators, which affect physical activity as well as important indicators for gated neighbourhoods?
2. How can walkability of neighborhoods be calculated objectively in the case study area?
3. How neighbourhood environment and physical activity are different in gated and non-gated neighbourhoods?
4. What is the association between neighbourhood environment and physical activity in the case study area?
5. Which type of neighbourhood is more physically active due to neighbourhood environment, the gated or non-gated?
6. What recommendations for policy guidelines can be formulated for better planning of neighbourhoods for supporting physical activity?

1.6 Scope of Research

The scope of this study is to investigate the Total Physical Activity in gated neighbourhoods and to compare it with the same category non-gated counter parts in developing countries with special reference to Karachi, Pakistan. The effects of neighbourhoods built environment, social environment and physical activity facilities were investigated with four types of physical activities; vigorous physical activity, moderate physical activity, practical walking, and recreational walking. Walkability index has been developed at stage one then the effects of seven indicators of neighbourhood environment and four variables of physical activities have been tested for their differences in both types of neighbourhoods. At stage three the association has been investigated between neighbourhood environment indicators and total physical activity and it is also investigated which type of neighbourhood indicators has association with which type of physical activity variable. Finally, some policy guidelines have been formulated for future physically active neighbourhood designs.

1.7 Significance of Research

Among others, this study has made four very important contributions. First it has contributed to the body of knowledge about total physical activity of gated communities. This is a new type of planning, which is gaining increasing attention from researchers all over the world. This study will help establish whether these gated communities are physically active according to the guidelines of World Health Organization (WHO).

The second important contribution at policy level is as mentioned in introduction section, the main concept of Life style gated communities is to keep the people physically active [Blakely and Snyder, 1997]. It is found from literature that the developing countries GCs are combinations of three types of GCs, so the physical activity aspect also exists in these gated communities. The present study has shed light on the prevalence or lack thereof of PA in GCs and the factors affecting the same. These findings will help the policy makers (development authorities and local government) to formulate policies that may help make future neighbourhoods more physically active.

Third important contribution of this study is that it has used Space Syntax connectivity instead of only counting the number of intersections at neighbourhood

level because the number of intersections cannot show the integration level of these neighbourhoods

Forth important contribution of this study is that it has developed a walkability index objectively for the neighborhoods of Karachi city with the help of three components of land-use patterns that is the land-use mix, street connectivity and housing density.

1.8 Research Design

This research has been conducted in three main steps to achieve research objectives and to find answers for research questions. The first step was performed through reviewing of literature to identify key indicators of neighbourhood environment and physical activity; underlining suitable methods for data collection; and selecting the most suitable method of calculation and analysis. The second step was collecting data from existing data sources. Two methods were used to collect neighbourhood environment data including objective and perceived, whereas subjective method (questionnaire) was used for physical activity data collection. Objective methods for neighbourhood environment consisted of the land-use maps, which were obtained from concerned departments and transferred into ArcGIS to analyze and used for calculating some indicators in Depth Map Space Syntax. Standard questionnaire was used to collect social environment indicators by perceived method. On the other hand, physical activity was collected through standard questionnaire for physical activity data collection.

This research has four analysis steps. Firstly, a walkability index was developed objectively for gated and non-gated neighbourhoods with the help of HHI and Space Syntax methods. At second stage, the Independent Sample *t*-test tested the differences between neighbourhood environment indicators and physical activity in gated and non-gated neighbourhoods. Binary logistic regression analysis was used to investigate the association between neighborhood environment indicators and socio-demographical factors with total physical activity i.e. how many people get >600 MET as recommended in a week. χ -test was used to compare the source of physical activity in gated and non-gated neighborhoods. Technical aspects of these steps are discussed in chapter 3.

1.9 Limitations of Research

The limitations on the other hand are such as the walkability index of all gated and non-gated neighbourhoods could not be developed because the overall land-use map of all neighbourhoods of Karachi city was kept confidential due to safety and security reasons as Karachi is the only metropolitan city of Pakistan, therefore, the required land-use map was not available as other studies have done in US, Australia and Europe [Leslie et al., 2005; VanDyck et al., 2010; Sundquist et al., 2011]. This study has developed a walkability index for selected neighbourhoods only, which are 16 in number. This is a cross-sectional study, therefore, the effects of different time of year could not be reported. This study has used subjective methods (IPAQ and NPAQ) for calculating physical activity, which could be biased. This study was conducted in a populated city of a developing country where the overall perception of crime is quite high, therefore, people were reluctant to provide some important data, for example, the data about income, car ownership etc. Another constraint of this study was the difficulty to access the gated neighbourhoods and conduct this research; there was quite a big challenge for this study as gated neighbourhoods have strict security procedures. The overall population is less educated as compared to developed countries, therefore, were less cooperative while providing data on such a topic, which was not considered important for them. These issues may limit generalizability of the findings of this study to other developed cities.

1.10 Thesis Outline

The contents of this thesis are as the following: Chapter 1 reviews objectives, research questions, assumptions and limitations. Chapter 2 establishes literature review including research indicators and different methodologies as well as the introduction to the study area. Technical aspects of data collection, calculation and analysis are discussed in chapter 3. Results are summarized in chapter 4 and finally conclusions are drawn in chapter 5. Figure 1.1 illustrates chapter outlines for this research.

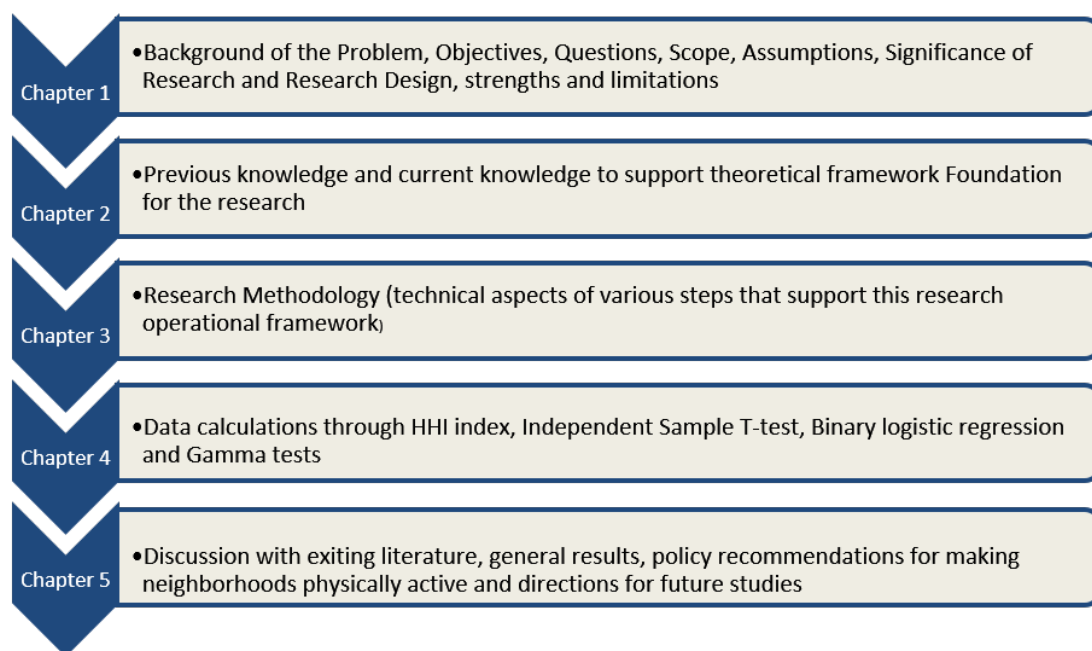


Figure 1.1: Thesis outline

1.11 Summary

Physical activity is important for everyone to be healthy. It is investigated by many researchers from urban and transport planning as well as from public health literature. The important finding is that neighbourhood environment can enhance physical activity if it is designed accordingly by keeping in mind the physical activity of populace through providing different facilities for walking, moderate physical activity and vigorous physical activity in neighbourhoods. At the same time it is investigated by many researches that a new form of neighbourhoods has emerged, which are providing prestigious life, physical activity facilities (PAF), and security from crime and traffic hazards. Therefore, it was needed to know whether these communities are physically active neighbourhoods because the PAF has been found having positive association with physical activity in the literature of this field and perception of crime and traffic hazard has been found having negative associations with physical activity.

This chapter has briefly discussed the background of problem through literature. The research problem, aim and objectives as well as the research questions are discussed in this chapter. The assumptions, scope and significance of present research have been discussed in this chapter. The research design, the strengths and

limitations have been discussed briefly. In the end the outline of total chapters has been presented.

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