

**SUBSTANDARD HOUSING ON TENANTS' HEALTH STATUS IN
MUKURU ESTATE; A SOCIAL DETERMINANT OF HEALTH
PERSPECTIVE**

BY

ALEX MWANGI MUCHERU

**A Research Paper Submitted to the School of Economics in Partial
Fulfilment of the Requirement for the Award of the Degree of Masters
of Science in Health Economics and Policy, in the School of Economics,
University of Nairobi.**

2019

STUDENT'S DECLARATION

I, the undersigned, declare that this is my original work and has not been submitted to any other institution, or university other than the University of Nairobi for academic credit.

Signed _____ **Date** _____

ALEX MWANGI MUCHERU

REG. NO. X53/6506/2017

This report has been presented for examination with my approval as the appointed supervisor.

Signed _____ **Date** _____

DR. MOSES MURIITHI

SENIOR LECTURER

SCHOOL OF ECONOMIC

UNIVERSITY OF NAIROBI

COPYRIGHT

All rights reserved. No part of this proposal report may be photocopied, recorded or otherwise reproduced, stored in retrieval system or transmitted in any electronic or mechanical means without prior permission of University of Nairobi or the author.

Alex M. Mucheru © 2019.

DEDICATION

This work is dedicated to my wife Mercy Waweru and our three children Ivan, Jabali and A-Ray for their encouragements, motivation and believing in me. Above all I thank God for the wisdom, knowledge and understanding He gave me to accomplish what initially was impossible to me.

ACKNOWLEDGEMENT

First, I thank my Heavenly Father for giving me knowledge, wisdom and understanding to do this project. I wish to thank my supervisor Dr. Moses Muriithi who has been more than generous with his knowledge, expertise and time. Once again, my special thanks to his countless hours of reading, encouraging, invaluable comments and most of all patience throughout the entire process.

I am deeply indebted to my wife Mercy and my children Ivan, Jabali and A-Ray for allowing me time to concentrate on this project, may Heaven always smile on you! I would like to thank my colleagues in class of Health Economics 2017 for their motivation, encouragements and granting me an opportunity to serve them as their class president and also in the process of writing this paper.

I would like to also acknowledge the School of Economics for the facilities and providing assistance requested in doing this research. Thank you to all the members of staff in the School of Economics and everyone who supported me in doing this project.

TABLE OF CONTENTS

STUDENT’S DECLARATION	i
COPYRIGHT	ii
DEDICATION	iii
ACKNOWLEDGEMENT	iv
LIST OF TABLES	ix
LIST OF FIGURES	xi
LIST OF ACRONYMS	xii
ABSTRACT	xiii
CHAPTER ONE	1
1.0 INTRODUCTION	1
1.1 Background of the Study	1
1.2 Statement of the Problem	4
1.3 Research Objective	6
1.3.1 General Objective.....	6
1.3.2 Specific Objectives.....	6
1.4 Research Questions.....	6
1.5 Justification of the Study	6
1.5.1 Government.....	6
1.5.2 Scholars	7
1.5.3 Policy Makers.....	7
CHAPTER TWO	8
2.0 LITERATURE REVIEW	8
2.1 Introduction	8
2.2 Theoretical Framework.....	8
2.2.1 Social Determinant of Health.....	8

2.3 Empirical Review	12
2.3.1 Type of Housing Structure	12
2.3.2 Access to Health Services	13
2.3.3 Affordable Quality Housing	13
2.3.4 Household Living Conditions	14
2.3.5 Sanitation.....	14
2.3.6 Age	15
2.3.7 Marital Status	15
2.3.8 Education.....	16
2.3.9 Employment Status	16
2.3.10 Gender	17
2.4 Overview of the Literature	17
CHAPTER THREE	19
3.0 RESEARCH METHODOLOGY	19
3.1 Introduction	19
3.2 Conceptual Framework.....	19
3.3 Model Estimation and Specifications	20
3.4 Definition of Variables.....	21
3.5 Data Source.....	23
3.6 Sampling Methodology	24
3.6.1 Population.....	24
3.6.2 Sampling Technique	24
3.6.3 Sample Size	25
3.7 Ethical Considerations	26
3.8 Data Analysis Methods	27
3.8.1 Correlation Analysis	28
3.8.2 Regression Analysis	29

3.8.3 Sample Size	29
3.9 Data Issues	31
3.9.1 Heteroskedasticity	31
3.9.2 Multicollinearity	32
CHAPTER FOUR.....	33
DATA ANALYSIS, INTERPRETATION AND DISCUSSION	33
4.1 Introduction	33
4.2 Response Rate.....	33
4.3 Descriptive Statistics	34
4.4 Type of Housing Structure.....	37
4.5 Access to Health Services.....	41
4.6 Affordable Quality Housing	43
4.7 Sanitation.....	45
4.8 Household Living Conditions.....	48
4.9 Diagnostic Tests.....	50
4.9.1 Reliability Test	50
4.9.2 Normality Test	51
4.9.1.1 Skewness/Kurtosis tests for Normality	51
4.9.1.2 Shapiro Wilk Test for Normality	52
4.9.3 Heteroskedasticity	53
4.9.3.1 White/Koenker Test for Heteroskedasticity	53
4.9.3.2 Solution for Heteroskedasticity	53
4.9.4 Multicollinearity Test.....	54
4.9.4.1 Variance Inflated Factor	54
4.10 Correlation Matrix	56
4.11 Regression Results.....	58
4.11.1 Marginal Effects among the Variables.....	59

4.11.2 Discussion of Results	60
CHAPTER FIVE	64
SUMMARY, CONCLUSION AND RECOMMENDATION.....	64
5.0 Introduction	64
5.1 Summary of Findings.....	64
5.2 Conclusion.....	66
5.3 Recommendation.....	68
5.4 Contribution of the Study to Theory/Existing Knowledge	69
5.5 Areas of Further Research	69
REFERENCES.....	70
APPENDICES	77
Appendix I: Questionnaire.....	77
Appendix II: Consent form.....	85
Appendix III: KNH-UON Ethics and Research Committee Approval Letter	86
Appendix IV: Research Authorization Letter from Nairobi City County.....	87
Appendix V: Budget	88
Appendix VI: Letter from University of Nairobi	89

LIST OF TABLES

Table 4. 1: Stratification.....	31
Table 4. 2: Response Rate.....	34
Table 4. 3: Descriptive Statistics.....	34
Table 4. 4: Frequencies	36
Table 4. 5: Type of Household Units	37
Table 4. 6: Number of Showers, Toilets and Handbasins	37
Table 4. 7: Staircase Accessibility to the Household Unit	38
Table 4. 8: Descriptive for Observation Questions.....	39
Table 4. 9: Type of Wall Material	40
Table 4. 10: Type of Roof Material.....	40
Table 4. 11: Type of Floor Material	41
Table 4. 12: Access to Health Services	41
Table 4. 13: Problem Diagnosed With	42
Table 4. 14: Easiness of Accessing Healthcare Services	42
Table 4. 15: Financial Constraints while Accessing Healthcare Services	43
Table 4. 16: Features of a Standard Quality House	43
Table 4. 17: Living Conditions of the Respondents.....	44
Table 4. 18: Main Source of Water	45
Table 4. 19: Summary.....	46
Table 4. 20: Duration Water Source.....	46
Table 4. 21: Main Waste Disposal.....	47
Table 4. 22: Main Type of Toilet Facility.....	47

Table 4. 23: Natural Lighting of the Household Units.....	48
Table 4. 24: Ventilation of the Household Units.....	48
Table 4. 25: Living Conditions	49
Table 4. 26: Main Lighting Mode	49
Table 4. 27: Main Type of Cooking Fuel	50
Table 4. 28: Cronbach Alpha Test.....	51
Table 4. 29: Normality Test.....	51
Table 4. 30: Shapiro Wilk Test for Normality.....	52
Table 4. 31: Variance Inflated Factor	55
Table 4. 32: Probit Binary Model	58
Table 4. 33: Marginal Effects using Delta-Method.....	60

LIST OF FIGURES

Figure 2.1: Conceptual framework	19
Figure 4. 1: Correlation Matrix.....	57

LIST OF ACRONYMS

BC	Building Code
BECF	Building Energy Codes Program
BIM	Building Information Modeling
GBI	Green Building Initiative
HVAC	Heating, Ventilation, and Air Conditioning
LSC	Life Safety Code
NEC	National Electrical Code
UMC	Uniform Mechanical Code
UPC	Uniform Plumbing Code

ABSTRACT

In recent years, the Kenyan government have introduced a number of housing reforms with the most-high profile being improved and better housing. This study sought to determine the impact of substandard housing on tenants' health status in Mukuru estate; a social determinant of health perspective. There has been little research into this field in the country. The objective of the study was to evaluate if substandard housing has effect on health and safety of occupants, to evaluate the effects of others correlates of social determinant of health that have effects on tenant's health status and to draw conclusions and policy recommendations based on the study. The findings indicated that majority (62.2%) of the units were single room and slightly more than a quarter (29.1%) were self-contained. Only less than 10% of the household units were double rooms. Additionally, (76.6%) of the household units had cracks on the wall while only 24.2% did not have cracks on the wall. The study showed that majority (88.9%) of the respondents used electricity as their main mode of lighting and compared to pressure lamp, lantern and tin lamp, only 7.7% of the respondents indicated that they used pressure lamp for lighting. the study further showed that majority (63.6%) of the household did not have adequate waste disposal. This included inadequate dumping as well as human waste disposal. Only 36.3% had adequate solid waste disposal.

The Probit regression results were statistically significant at 10% ($p < 0.1$) indicating that there was a significant relationship between health status and substandard housing in Mukuru Estate. The marginal effect, standard errors and the z-value showed that an increase of 1% in age lowers the probability of being in good health by 13.6%. An increase of 1% in sourcing water from a dam lowered the probability of being in good health by 33.8% while an increase of 1% in sourcing water from a borehole increased the probability of being in good health by 13.8%. Policy measures aiming at reducing health inequalities should be sensitive to those specificities that characterize not only the objective health status of the Mukuru Estate (and other vulnerable places) but also their perceptions about this. Health mediators can play an important role in this area. Mobilization of the citizens to adopt the National Hospital Insurance Fund (NHIF) in order to reduce the out of pocket spending towards health care could be one channel to improved health status. Consequently, proper lighting and ventilation need to be applied in order to reduce the rate at which rickets and respiratory infections are reported. This includes constructing or expanding sewerage disposal sections in order to avoid discharge of this waste to the river.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background of the Study

The conditions or circumstances in which people grow up, are born, work and age are often referred to as social determinant of health. These circumstances also have a well-defined system to deal with illness and health complications that arise (World Health Organization, 2017). Social conditions that affect health includes housing, level of education, employment and their physical environment (Castañeda et al., 2015). The most basic social determinant of health includes access to safe and quality housing (Madrigal et al., 2015).

Substandard housing does not necessarily mean that the house is old or outdated. It's the type of housing that poses a risk to the health and physical well-being of its occupants, neighbours and visitors. According to Taylor (2016), housing stability, affordability and quality housing are all components that affects health outcomes. Increased mental health and risk to diseases are signs of substandard housing. Provision of housing and their quality are both strong socio-economic indicators of growth and development in an economy (Davidson et al., 2009). In addition, proper housing provides families and individuals with a sense of security, stability and privacy (Jacobs et al., 2008). Housing is a critical factor of health as well an important component of productive and meaningful lives (McGranahan, 2010).

In Philadelphia, substandard housing conditions that have mostly been reported are hole, crack, paint peeling from walls, roof that are leaking and broken heating system. This study indicated health conditions linked with substandard housing include respiratory infections such as asthma and other infectious diseases caused by lead poisoning (Krieger et al., 2012).

Bachelder (2016) cited that Arkansas has not adopted an implied warranty of habitability that enabled landlords to be an important aspect in changing the health outcomes of their tenants by providing the basic services such as; heated houses, hot water, plumbing and a sound structure absent of physical defects not caused by the tenant, that do not pose unreasonable safety risks to the occupant residing in the housing unit.

In Uganda, malaria is among the leading causes of morbidity and mortality with about 8 - 13 million cases and 103 deaths per 100,000 being reported each year. This has been associated with poor-quality construction materials being used in constructing houses. This has increased mosquito entry, malaria incidence, and parasite prevalence among the households in Uganda (Synman et al., 2015).

In Kenya, substandard houses are characterized by lack of safe drinking water, ineffective waste disposal, intrusion by disease vectors such as insects and rats, poor food storage has long been identified as contributing to the spread of infectious diseases (Kimani et al., 2012). The high cost of construction, statutory fees, supervision and tedious bureaucratic process involving multiple agencies has resulted in circumventing of the approval process leading to compromised standards of construction, with many developers resorting to substandard materials, lack of supervision by professional personnel and at the expense of

quality build environment full of substandard and unsafe buildings which are prone to collapse (Olivier et al., 2015). Previously, a number of other cases have been documented to have collapsed occasioning the same consequences. These include Sunbeam supermarket 1996; Ushirika Estate Juja Road Nairobi, 1998, Tena Estate, 1998, House of Manji, 2000, Karanja Road – Kibera Nairobi, 2001, Kilimani Estate, 2001, Ronald Ngala Street, Nairobi, 2006; Mombasa, 2009; Kiambu, 2009 and Pipeline 2011 (Thomas et al 2018).

A total of 2035 buildings were inspected in Nairobi by national building audit team. The findings indicate that 65% of the buildings have reached the minimum structural standards while others require further research with a view of strengthening them and those that cannot be strengthened to be demolished. The survey identified structurally sound buildings that need further attention as far as public health and compliance issues are concerned. 38% of these buildings need to improve on solid waste and liquid waste management, natural lighting and ventilation and setback of each building. Additionally, only 30% of the buildings are compliant on approval, plot coverage, building ratios, accessibility and ownership (Brenda et al., 2018).

In 2017, the Mukuru informal settlement in Nairobi was declared a Special Planning Area (SPA) due to its unique environmental, health and development challenges. The Special Planning Area designation prevents development for a two-year period, requiring that the Nairobi City County government develop and adopt an integrated improvement plan for the area by August 2019 (Sarah et al., 2018). Despite a previous transfer of land titles to private developers in the 1980s, the land in Mukuru remained undeveloped and was settled

upon by migrant families and industrial workers drawn to jobs in the neighbouring industrial area and Nairobi's city centre. As the settlements began to grow and densify, issues of land tenure and threats of eviction intensified the contestation of land ownership in Mukuru (Samira et al., 2018).

1.2 Statement of the Problem

Chapman (2009) indicates that about 13.6 million injuries in the United States occur in and around home. Moreover, house fire has been reported with close to 2,900 people being injured while 2 million people visit hospitals and emergency rooms because of asthma attacks each year. Consequently, an estimate of 1 million of Nigerian population lives in homes with physical problems while an estimate of 2 million live in homes with less or moderate troubles (Ogundahunsi et al., 2014). In addition, population living in substandard houses is not equally distributed across the population in Malawi. About 1.7 times of the low-income earners have the highest probability of living in homes with more problems in relation to the other population (Zezeza et al., 2009).

In Kenya, the function of housing assessment is limited by the lack of close monitoring of houses being built in the counties. Conditions such as water leaking, ventilation problems and infestation by pest and infectious insects are major health hazards (Amendah et al., 2014). The Kenyan Government through the Ministry of Housing implemented a project to build 200,000 housing units per year to meet the demand for better housing. The policy projected that each year; 150,000 units need to be constructed in order to meet this demand. This level of production was to be met by fully utilizing the existing resources and sensitization of private investors with government support (Republic of Kenya, 2007).

Urbanization in Kenya has rapidly escalated with an estimate of 5.9% per annum (Muchukuri et al., 2009). This creates the urgency of better housing in the country.

Mukuru Estate has been faced with many challenges; housing being one of them. There are families living from one-room corrugated iron shacks to apartments which are crowded with poor ventilation and drainage systems. Majority of the families in the Estate might share a communal water tap and toilet latrine (Muindi et al., 2012). One of the hospitals in Mukuru Estate is the Medical Missionary of Mary where many cases of cholera has been reported there (Kyobutungi et al., 2012). Some of the apartments are up to 8 storey which are fully occupied and congested. The houses are quite congested with poor dumping and garbage collection system. This has accelerated the spread of infectious pest such rats (Mberu et al., 2012). Due to congestion of the apartments, occupants experience poor lighting in the houses and some little infants suffer from diseases such as rickets which arise from lack of vitamin D (Ettarh et al., 2012).

However, there exists scarce literature majoring on social determinant of substandard housing on tenant's health status. Previous studies focused on determinants of housing in the context of financing; this study therefore seeks to shed new light by assessing the major social determinant of substandard housing on tenant's health status of Mukuru Estate, Nairobi County.

1.3 Research Objective

1.3.1 General Objective

The general objective of this study is to assess the major social determinant of substandard housing on tenants' health status in Mukuru Estate, Nairobi County.

1.3.2 Specific Objectives

- i. To evaluate if substandard housing has effect on health and safety of occupants.
- ii. To evaluate the effects of others correlates of social determinant of health that have effects on tenant's health status.
- iii. To draw conclusions and policy recommendations based on the study

1.4 Research Questions

- i. Does substandard housing affect health and safety of occupants?
- ii. What effect do other correlates of social determinant have on tenant's health status?
- iii. What policy conclusions can be drawn from the two research questions?

1.5 Justification of the Study

This dissertation will provide information relevant to the following:

1.5.1 Government

The Kenya government aspires to improve the demand for better housing and health for the citizens. Thus, the findings of this study benefit the government especially the county government in understanding how substandard housing affects the health of the tenants.

This is critical in developing policies aimed at improving housing standards with the ultimate goal of having good health status on tenants.

1.5.2 Scholars

Scholars interested in housing and health will find this study important since it extends and diversifies the body of existing knowledge. This study provides a starting point for scholars interested in understanding the relationship between housing and health.

1.5.3 Policy Makers

The results from this research will provide relevant information that can inform the senior management both on national housing and building audit task force and Nairobi county government the major social determinant of substandard housing on tenant's health status. This will enable them come up with appropriate actions that can uphold construction of better houses.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Introduction

The chapter begins with the review of theories on which the study variables are anchored. The chapter will then present an empirical framework and the research gaps of the study will be identified.

2.2 Theoretical Framework

2.2.1 Social Determinant of Health

Housing is a major field of interest for public health even though it's been forsaken in such a long time. Nevertheless, housing is a crucial aspect to better health and sufficient well-being. A good home is important for many psychosocial factors as well protection from hazardous elements. It's the environment where most people spend their time. Better houses require a proper structure, hazardous free, with improved facilities for sleeping and personal hygiene. Due to increasingly unstable economic situation in many countries, the affordability of housing has become a hurdle for many people (World Health Organization, 2014).

Barnes (2011) conducted in a study in Britain do determine the mortality rate during winter season. The findings indicated that 25,000 deaths a year were attributed by continuous exposure to cold. Evidence provided with some evidence with incredible theoretical background to suggest that exposure to cold is greater in homes with poor insulation or

poor home heating. The study established that measure to improved insulation and the adequacy of home heating to be put in place in order to have benefits in health in terms of reducing mortality and morbidity. Moreover, Roys (2010) in England established that a high percentage of accidents and hazardous activities occur around the home particularly with the elderly and children. There are 650 deaths and 210,000 injuries that occur in a year from falls on the stairs. Poor architectural design and maintenance attributed to the highest risk and many falls in the country. Epidemiologists have proven that damping effects and moulds are complex because damping and moulding tend to be worst and hectic in overcrowded homes and apartments that are occupied by people of low socio-economic status. Damping is associated with increased house dust mites and humidity which are known allergens for growth of fungal spores and causes increased respiratory problems such as nausea (Mara et al., 2010). Additionally, poisoning from carbon monoxide occurred in poorly ventilated houses that constantly maintained combustion sources such as fire and gas boilers.

Faragher (2013) established that majority of population in employment tend to live in better houses which are in a healthier neighbourhood. This implies that even their children tend to enjoy living in homes that have better ventilation and aeration and safe from hazardous activities such as falling down on stairs. Additionally, better neighbourhoods offer the tenants with a good platform to have physical exercise and have better gyms in place. On the contrary, families that have low income class tend to live in substandard houses that tend to be hazardous to the families. In his study, majority of single mothers with more than two children lived in houses that were poorly ventilated with low aeration because they were cheap and could manage to pay rent and support their children. Notably, men

who were not married preferred living in houses that were cheap because they didn't have paternal responsibilities and were easier to manage. Chiavarini (2014) cited that the increased rate of lack of employment on health outcomes has been greatly studied by both medical practitioners and in the social-science literature. Lack of employment causes many health problems like experiencing a stressful life event that were caused by increasing rate risk of poverty and economic deprivation. This leads to people shifting from houses that were well equipped to low substandard houses to enable them pay for their upkeep and house rent.

Proper sanitation accompanied by good hygiene systems in homes are the key and most important aspect in social and economic development in a home. Additionally, access to safe water for drinking and house chores also contributes to proper hygiene practices (Mara et al., 2010). Proper measures to improve these components helps in reducing the rate of morbidity. Notably, these improvements assist in reducing the spread of diseases and increases the quality of life. (Trouba et al., 2010). There is direct association between poor sanitation, poverty and infancy which accounts for about 11% of the global pandemic of infectious diseases. Many countries across Asia, Africa, and Latin America have a direct link with poor sanitation (WHO, 2014). Countries such as Salvador and Brazil established that an increase in sewage coverage from 29% to 85% of the target population reduced diarrhoea prevalence by 22% among the children under three years of age (Scott et al., 2010).

The major concern to improve the household living conditions cannot be forsaken. The place of residence for the households is very important and crucial since it plays the key

role in shaping their well-being and physical state (Pollack et al., 2008). The economy is dependent on the population whom are in good health in order to grow and meet the optimum goals. Healthy nation causes the economy to be vibrant. Researchers such as Easterlow (2000), Ineichen (2003) and Matte (2000) have provided sufficient evidence to show the association between health status of the people and their housing condition.

A proper system of laws is critical to successful public health outcomes. It reduces exposure to risk diseases by enforcing sanitary codes such as public health act, building code, water quality monitoring, sanitation and housing and food safety.

The gap between law enforcement and monitoring and evaluation results in a poor public health system. This is mainly caused by inadequate financing of public health with inadequate leadership and dedication to the health functionaries. Reviving public health regulations can mainly be done by consulting relevant stakeholders and increase public awareness of the existing laws (Lakshminarayanan et al., 2011). To enhance effective public health laws, the Ministry of Health need to establish strong partnerships and associations with agents involving health matters.

There is sufficient evidence to show that poor health is highly correlated to poor housing. The findings indicate that improving housing can improve tenants' health, in particular their mental health. Also improving housing leads to increase in rent being paid hence better income to the landlords. Thomson (2015) indicated that investments in housing potentially lead to health improvement. His studies were in agreement with the studies conducted by Howden-Chapman (2008) which targeted individuals with inadequate warmth and existing chronic respiratory disease were most likely to report health improvement after improving

the state of their housing. Howden-Chapman (2008) concluded that housing improvement such as improving thermal comfortability in the home can lead to health improvements, especially for people who have chronic respiratory disease. Therefore, investing in housing provides an essential platform for the tenants to lead an improved and healthy lifestyle.

2.3 Empirical Review

2.3.1 Type of Housing Structure

In USA, Gan (2017) conducted a study to explore whether different type of housing structure affects respiratory health outcomes of tenant. Evidence has shown that different housing structure affects the health outcomes of tenant. Multiple logistic regression was used to compute the odds ratio at 95% confidence interval. The results indicated that tenants that lived in single houses were associated with wheezing and dyspnea and whereas tenants who lived in apartments were less associated with respiratory diseases. The findings were statistically significant at 5% implying that there was association between type of housing structure and respiratory diseases. Consequently, regression results for a study conducted in Canada by Rourke (2012) indicated that type of housing structure significantly influenced the physical and mental health of the tenants. The results were significant at 5% level of significance. The findings were in agreement with the results of Northridge (2010) which indicated that differential exposure of asthma attacks were associated with the type of housing structure where the tenants lived in. The results were statistically significant at 5% implying that different housing structure significantly influenced the health status of the tenant.

2.3.2 Access to Health Services

Mwaura (2012) indicated that the biggest challenge facing the poor and the vulnerable is the inability to pay the out-of-pocket expenditure required to access health services. The correlation results of a study conducted by Tran (2016) in Vietnam indicated a strong positive correlation between access to health care services and health status. Consequently, Jacobs (2011) indicated that there was a strong association between housing and access to health care services. The ANOVA results indicated significant differences in the means of different housing with access to health care services. Moreover, the multiple logistic regressions analysis indicated that the odds of access of health care were higher among the tenants who lived in apartments as compared to the tenants who lived in single houses. Majority of the tenants who lived in better houses with proper ventilation and aeration reported a better healthcare lifestyle as compared to majority of the respondents who lived in an iron sheet houses with poor ventilation and aeration. The regression results imply that accessibility to health care services is significant to a healthy lifestyle at 5% level of significance.

2.3.3 Affordable Quality Housing

Maqbool (2015) conducted a study in the USA to determine the impact of affordable housing on health status. The findings indicated that households in substandard houses were thirteen times more likely to suffer from serious psychological distress than homeowners were currently paying their mortgages and whom could pay their monthly payments. The study used the maximum likelihood logarithms to estimate the parameters of the logistic regression model. The study was conducted at 5% level of significance

implying that affordable housing is a powerful predictor of health status. Additionally, a study conducted in China by Wang (2011) indicated that poorly-housed children are significantly more likely to have behavioural problems and to fall behind housing-stable students in school. Moreover, the regression results indicated that provision of low-cost affordable quality housing is a core factor in influencing the health status of the tenants (significant at 5% level of significance).

2.3.4 Household Living Conditions

Durand (2015), conducted a study in Pakistan to determine the relationship between household living conditions and health status. The study ran ANOVA test to confirm the relationship and level of significance among the variables. The ANOVA Test F-value was 2.36, significant at 5%, indicated that household living condition significantly affects the health status of tenants. Additionally, Luo (2014) conducted a similar study in Venezuela to determine the influence of household living conditions in regards to their health status. However, the study used probit regression model to determine the probability of whether health status of the tenant is influenced by their living conditions. The results indicated that household living conditions significantly influenced the probability of adequate health status of the tenants at 5% level of significance.

2.3.5 Sanitation

In Nigeria, accessibility to safe water and proper sanitation is the lowest in all developing regions with averages of about 53% for safe water and about 28% for sanitation (Alemu et al 2017). Fixed effect regression with corrected heteroscedasticity was statistically

significant at 10% implying that improved sanitation influences the health status across the world. Consequently, the multiple logistic regression results of a study conducted by Rah (2015) in India indicate that household with access to improved water supply or piped water were associated with good health status. Additionally, personal hygiene practices were strong among the tenants with access to clean toilet facility. This was strongly associated with excellent health status. These findings were statistically significant at 5% level of significance implying that sanitation influences health status of the tenants.

2.3.6 Age

In USA, Jamoom (2008) conducted a study to determine the impact of age on health status. Bivariate logistic regression analysis modelled the relationship between age and self-perceived health status, adjusting for confounding variables. The results indicated that the adjusted odds ratios (OR) were statistically significant at 5% meaning that age is a critical variable in assessing health status. Similarly, Lorem (2017) conducted a study in Peru where the ordinary least square regression results indicated that age negative effect on the health status of tenant. This indicates that as one ages, there's a deterioration in their health status. This was conducted at 5% level of significance.

2.3.7 Marital Status

Lawrence (2018) conducted a study in France to examine the association between marital status and health status. The Chi-Square Test for testing independence of Marital and Health Status was statistically significant at 1% (Pearson (6) $\chi^2 = 61.5667$). Ordered probit estimation results for marital status on health status were statistically significant at 1%

implying that marital status significantly affects health status. In China, Han (2014) sought to determine the effect of marital status on the health status of the tenants. The multi-level analysis was conducted at 5% level of significance and the results indicated that there was significant relationship between marital status and health status of households.

2.3.8 Education

Van der Heide (2013) conducted a study in Canada to determine the impact of education on health status. The study ran a linear regression analysis and the results for the total effect and direct effect of education on health status were statistically significant at 5% implying that education influences health status. A similar study conducted in Bangladesh sought to examine the relationship between education and health status among the tenants of that community. The multi-variate analysis results indicated that probabilities of good health increases as the education level of the tenant also increases. This implies that tenants with higher education understands the importance of good health and hence seeks better medical behaviours. These results were statistically significant at 5% implying education influences health status (Rana et al., 2009).

2.3.9 Employment Status

In South Korea, Kwon (2016) conducted a study to determine whether employment status influences health status. According to this study, employment status was divided into employed and not employed. The logistic regressions results indicated a statistically significant difference in self-rated health for household members who worked in weekly work hours, occupational groups, shift work, and tenure. Odds ratio of poor self-rated

health on employment status from the logistic regression models were statistically significant at 5% implying there was a significant difference in all characteristics of the subjects depending on employment status and health status of each tenant. In Poland, the multifactorial logistic regression results conducted by Kaleta (2008) established that both in men and women, self-rated health was associated with employment status of each tenant. The results were significant at 5% level of significance.

2.3.10 Gender

In a study conducted in Turkey (Dreyer et al., 2015), 80766 respondents were interviewed and an ordered logit model used to examine the influence of gender of the tenant to their health status. The results indicated that women reported a poorer health status as observed in the unadjusted model which became significant after adjustment for age. Physical health status at for women reported poorer physical health status. This effect persisted when adjusted for age. In India, similar study conducted by Saikia (2016) determined that the differential effect of health status in male tenants was significantly higher as compared to the female tenants. The multivariate analysis confirmed this finding. The results were computed at 5% level of significant. There was also a strong positive correlation between gender and health status of the tenants.

2.4 Overview of the Literature

This study reviewed both theoretical and empirical study in respect to substandard housing on tenants' health status in Mukuru Estate; a social determinant of health perspective. From the review its evident that different methods of housing and health data show that

inadequate housing is linked with increased major risk of heart diseases, respiratory diseases; anxiety, depression, nausea and diarrhoea, infections, hypothermia, physical injury from accidents and food poisoning (Power et al., 2008). These findings show that poor health status is highly correlated to poor housing. It states that poor health be improved by improving housing (Thomson et al., 2015). The findings from this theory indicate that improving housing can improve tenants' health, in particular their mental health. Additionally, improving housing led to increases the rent being paid hence better income to the landlords. Thomson (2015) indicated that investments in housing potentially lead to health improvement.

The concern for better housing on health is now being adhered and put into considerations by policy makers. Housing is studied by researchers and its main component of social determinants of health. There are some selected housing policies that have been sited and found to improve health status and reduce costs on health care. Findings from different studies have proven that low-income earners are more likely to live in an unhealthy habitat with substandard houses. Majority are able to pay for the repairs required to rectify the conditions. This overview indicates the literature and provides the direction for further research and policy agendas. However, there exists limited literature focusing on social determinant of substandard housing on tenant's health status. This study therefore seeks to shed new light by assessing the major social determinant of substandard housing on tenant's health status of Mukuru Estate, Nairobi County.

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 Introduction

This chapter focuses on the research methods that were used in the study. The conceptual framework, economic model, its specification and estimation, data issues, data sources, sample and sample size determination, definition and measurement of variables and their expected sign are also discussed in this chapter.

3.2 Conceptual Framework

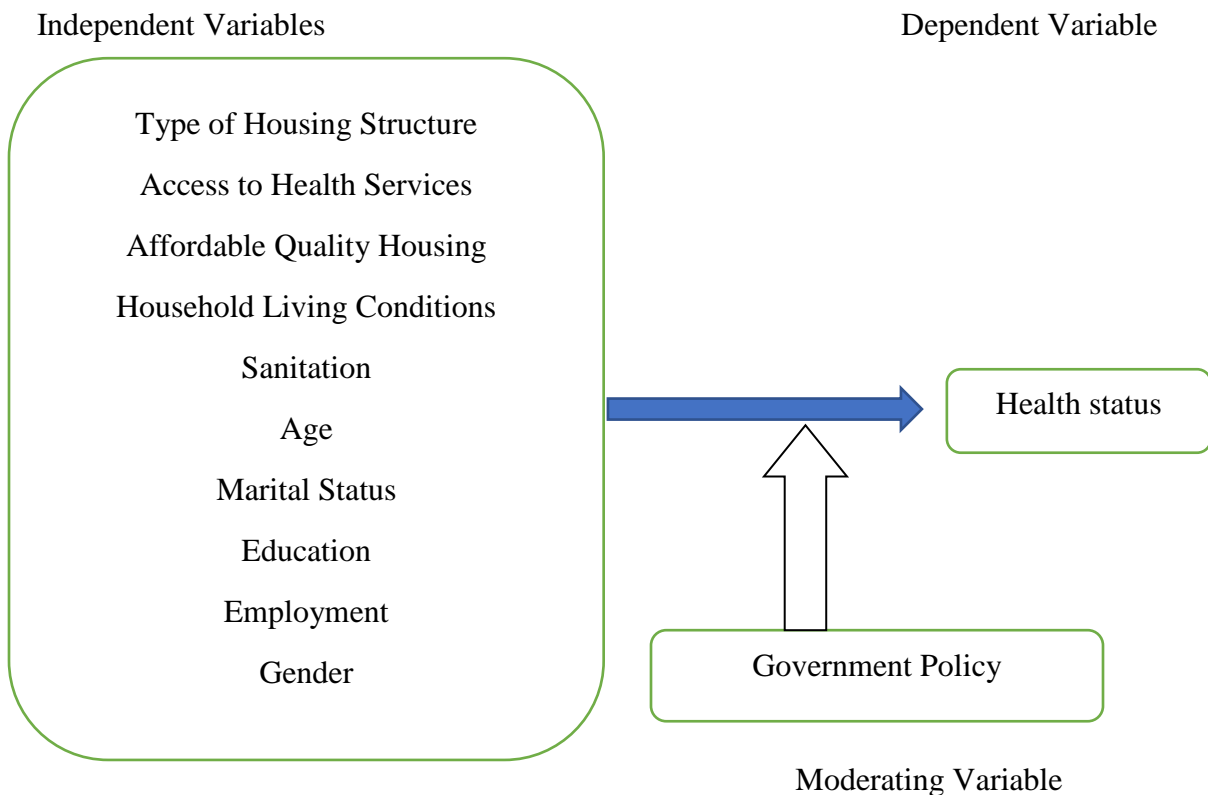


Figure 2.1: Conceptual framework

3.3 Model Estimation and Specifications

This study used Probit regression model for the empirical estimations. This regression model is used to model dichotomous or binary outcome variables. The inverse standard normal distribution of the probability is modelled as a linear combination of the predictors. The dependent variable is a dummy variable which makes the model appropriate.

The general equation of the model is represented as:

$$y^* = X_i\beta + \varepsilon \quad \text{where } \varepsilon \sim N(0, \sigma^2) \dots\dots\dots 1$$

Where y^* is the dependent variable (health status) which is either 0 or 1, X_i represents a vector of independent variables and ε is the error term. The explanatory variables include: type of housing structure, access to health services, affordable quality housing, household living conditions, sanitation, age, marital status, education level, employment status

In probit we observe,

$$y_i = \begin{cases} 0 & \text{if } y^* \leq 0 \\ 1 & \text{if } y^* > 0 \end{cases} \dots\dots\dots 2$$

The y^x is the probability of whether there is good health status or otherwise which will be regressed against the independent variables, X_i ; to determine the influence of housing on health of the tenants. Assuming that the error term has a standard probit distribution, the probability of whether there is good health or not can also be expressed as

$$p_i = E \left(\frac{1}{X_i} \right) = \frac{1}{e^{-(\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \varepsilon)} + 1} \dots\dots\dots 3$$

Where p_i is the probability of whether there is good health or otherwise. 1 if there is good health, 0 otherwise. β_0 , β_1 and β_2 are the parameters and ε is the error term.

The final equation is defined by:

$$HS_{p_{ij}} = \beta_0 + \beta_1 THS_i + \beta_2 AHS_i + \beta_3 AQH_i + \beta_4 HLC_i + \beta_5 SAN_i + \beta_6 Age_i + \beta_7 MS_i + \beta_8 Educ_i + \beta_9 Emp_i + \beta_{10} Gen_i + \varepsilon$$

$$NBHp_{ij} = \alpha_0 + \alpha_1 THS_i + \alpha_2 AHS_i + \alpha_3 AQH_i + \alpha_4 HLC_i + \alpha_5 SAN_i + \alpha_6 Age_i + \alpha_7 MS_i + \alpha_8 Edu_i + \alpha_9 Emp_i + \alpha_{10} Gen_i + \varepsilon \dots\dots\dots 4$$

Where: **HS_p** is the probability on health status

THS = Type of housing structure; **AHS** = Access to health services; **AQH** = Affordable quality housing; **HLC** = Household Living Conditions; **SAN** = Sanitation; **Age** = Age; **MS** = Marital Status; **Educ** = **Education Level**; **EMP** = Employment Status; **Gen**= Gender; ε = Error term

3.4 Definition of Variables

The dependent variable of this study was to look at the health status whether good health or otherwise. The independent variables that were used were both demographic and social

economic characteristics that affect health status. The variables as used in probit regression model with their signs are well discussed in table 3.1 below.

Table 3.1: Definition, measurements and expected sign

Variable	Definition	Measurement	Expected Sign and Source
Dependent Variable			
Health status define	This is an individual's level of wellness or illness.	1 Good health 0 otherwise	
Independent Variables			
Type of housing structure	housing that poses a risk to the health and physical well-being of its occupants.	1 substandard 0 otherwise	Positive sign Gan (2017) and Burgard et al., 2012
Access to health services	This is the number of times the household have visited a health care facility in the last three months.	1 sick 0 otherwise	A positive sign Mwaura (2012) and Page (2012).
Affordable quality housing	Is whether households can afford to pay for their housing	1, if they are able to pay for their housing 0 if otherwise	Positive sign Bakhtyar (2012) and Faragher (2013).
Sanitation	Health conditions associated with clean drinking water and adequate treatment and disposal of human excreta and sewage	1 Clean drinking water/liquid waste disposal 0 otherwise	Positive sign Alemu (2017) Bartram (2014)
Household Living conditions	Refers to whether the households can access adequate lighting and proper ventilation in their rented houses.	1 natural lighting and ventilation 0 otherwise	Positive sign Durand (2015) (Pollack et al., 2008)
Age	This the age of the household head (According to Kenyan	1 if the age is greater than or equal to 18 years 0 otherwise	Positive sign

	law, an adult is aged 18 years and above)		(Blackwell et al., 2012) Iwarsson (2012),
Marital Status	It's the marital status of the household head.	1 married 0 otherwise	Positive sign Joung (1997) Prior (2003)
Education Level	It's the education level of the household head	1 if primary 0 otherwise 1 Secondary 0 otherwise 1 College 0 otherwise 1 undergraduate, 0 otherwise 1 Postgraduate. 0 otherwise No education	Positive sign (Barnett et al., 2012) (Mercer et al., 2012).
Employment status	The employment status of the head of the household	1 employed 0 otherwise	Positive sign (Faragher et al., 2013) Robroek (2013).
Gender	The sex of the household head	1 if male, female otherwise	Positive sign Vlassoff (2007) Conron (2010)

3.5 Data Source

The study used primary data. The data was obtained through a structured questionnaire administered to the tenants of Mukuru estate and targeting the household head. The questionnaire was entered into CSPro to ensure there is accuracy and minimal errors.

3.6 Sampling Methodology

3.6.1 Population

Target population is defined as the entire aggregation of respondents that meet the designated set of criteria (Singleton & Straits, 2010). It is a set of all members of a real or hypothetical set of people, events or subjects to which a researcher wishes to generalize his/her results (Ngechu, 2004). Saunders et al. (2012) defined population as all elements under study. Mukuru is one of the largest of over 150 informal settlements in Nairobi, Kenya. The Mukuru area includes the settlements of Mukuru Kwa Njenga, Mukuru Kwa Reuben, Viwandani, Mukuru Kayaba, Fuata Nyayo, and Mariguini, which are situated in an industrial zone approximately seven kilometres southeast of Nairobi's central business district. In this case, the target population is the entire aggregation of individuals living the settlements mentioned above.

3.6.2 Sampling Technique

According to Singleton and Straits (2010) sampling techniques can broadly be classified as either probability or non-probability sampling. For probability sampling the chance of selecting a house or an apartment for inclusion in the sample is known. Some of the probability sampling techniques include simple random sampling, stratified random sampling among others (Schutt, 2012). On the other hand, non-probability sampling is sampling procedure whereby the chance of selecting a house or an apartment to be included in the sample is not known. Some of the non-probability sampling technique include; convenience sampling and snow ball sampling. The study used stratified random sampling which is a method of sampling that involves the division of a population into smaller groups

known as strata. In this technique, the estate was divided into two strata namely: apartments and low-density houses. Since the total number of low-density houses and apartments is not known, the researcher incorporated disproportionate stratification, otherwise referred as deliberate sampling, purposive sampling or judgement sampling. This is where items for the sample was selected intentionally by the investigator and what the researcher chooses concerning the items is superlative (Kothari, 2004; Saunders et al., 2012). Then simple random sampling was used to collect respondents in each chosen stratum.

3.6.3 Sample Size

Cooper and Schindler (2011) assert that a sample is a subset of a population. A sample enables a study to gain information about a population. Kothari (2004) formula provides a simplified way to calculate sample sizes for an infinite population. This formula was used to calculate the sample size of the study. A 95% confidence level and p value of 0.05 is assumed. Using the formula, the sample size was calculated by:

$$n = \frac{z^2 * p * q}{e^2} \dots\dots\dots 5$$

- Where **n** is the sample size
- z** is standard variate at any given confidence level
- p** is the sample proportion
- q** = 1 – p
- e** is the given precision rate or acceptable error

Therefore, given z = 1.96 (at 95% confidence interval from table), p = 0.5; q = 1 – 0.5 = 0.5; e = 0.05, and substituting in the formula gives:

$$n = \frac{1.96^2 * 0.5 * 0.5}{0.05^2} \cong 385$$

.....6

3.7 Ethical Considerations

Studies that consist of human as research participants must be carried out in a way that shows consideration for the self-respect, security, and civil liberties of the participants. Researchers worldwide have progressively more acknowledged the necessity of external supervision in gaining ethical guidance thus sovereign ethics boards or institutions have been founded to conduct this function. Similarly, a great number of intellectual studies and global regulation have offered the theoretical and operational guidelines for refining the ethical behaviour of studies and also assisted in creating necessary precautions (Hurst *et al.*, 2013). According to Powell, Fitzgerald, Taylor and Graham (2012) ethics mechanisms, such as ethical rules and guiding principles, and research ethics boards are ways of ensuring that moral principles are nurtured and maintained in studies.

The concerns regarding ancillary use of data are largely based on probable maltreatment of distinct subjects and the problem of consent. When the secondary data has no classifying information or is absolutely lacking this information or it is correctly systematized with the intention of the making the researcher not have access to the cryptograph, then a complete review by the ethical committee is not necessary except the committee has to ascertain that the data is really anonymous. In case the data comprises classifying information on study members or it has information that could be associated to recognize the research participants however, the committee must then carry out a total evaluation of the proposal (Tripathy, 2013). The relevant board or committee in Kenya that are responsible for the

review of such proposals is the National Commission for Science, Technology and Innovation (NACOSTI) and Kenyatta National Hospital-University of Nairobi Ethics and Research Committee (KNH-UON ERC),

Therefore, the research sought a clearance certificate from Kenyatta National Hospital-University of Nairobi Ethics and research Committee (KNH-UON ERC) and an authority letter from University of Nairobi indicating the purpose of the research. The researcher ensured that the names of the respondents and their houses/apartments will not be made public and by doing so the rights of the respondents will be protected. During data collection, the research assistants ensured that any respondents who opted out from participating in the survey did so without been coerced. This ensured that ethical issues were upheld.

3.8 Data Analysis Methods

This section discusses the techniques that were used to analyse data. Before processing the responses, data preparation was done on the completed questionnaires by editing, coding, entering and cleaning the data. This was done through both STATA 13.0 and SPSS 22.0. Data collected was then analysed using descriptive statistics and inferential statistics. Descriptive statistics enables the researcher to work out a number of statistical procedures, such as frequency distributions, frequency tables, percentages, minimum, maximum, sum and means, as well as graphical presentations of frequencies and values in order to describe and/or compare variables numerically (Procheş, 2015). On the other hand, inferential statistics involves testing hypotheses using regression models among others (Greene, 2012).

3.8.1 Correlation Analysis

Correlation is an alternative method of evaluating the association between variables. Particularly, it evaluates the degree of correlation between the layouts of two random variables. Regression and correlation greatly resemble each other save for the different methods of interpretation of the correlation. Correlation analysis is utilized in the assessment of a potential linear relationship between two uninterrupted variables. It is preferred due to its simplicity both in calculation and interpretation. Misapplication of correlation is however common among investigators such that some researchers have wished it never been in existence in any way (Mukaka, 2012).

The correlation coefficient (denoted r) allows the study to compute the intensity of the linear association between two variables. This coefficient r can assume any value between -1 and +1 whereby a value of +1 indicates an absolute positive relationship. This has the implication that the two variables are indeed associated and hence as the values of one variable rise, values of the other variable will subsequently rise. On the other hand, a value of -1 indicates an absolute negative association such that the two variables are accurately associated and as the values of one variable rise, the values of the other variable will however decline. When the value of r is between -1 and +1, it shows a weaker positive and negative relationships, whereas a value of 0 implies the variables are completely independent. (Saunders, Lewis, & Thornhill, 2015).

Kendall's rank correlation coefficient (Kendall's tau) and the Spearman's rank correlation coefficient (Spearman's rho) are two of the most widely used correlation coefficients. Both of these coefficients make the assumption that the sample is randomly chosen and that the

data is ordinal in situations whereby the data in use is obtained from a sample. Therefore, a researcher can use both Spearman’s rank correlation coefficient and Kendall’s rank correlation coefficient although Kendall’s rank correlation coefficient is commonly regarded to be the more applicable if the study data has tied ranks (Chok, 2010).

3.8.2 Regression Analysis

Saunders, Lewis and Thornhill (2015) describe regression analysis as the practice of computing coefficient of determination (R^2) and regression equation by means of one independent variable. According to Kothari (2004), regression refers to the process of ascertaining an arithmetical association between two or more variables. There are usually two variables simple regression whereby the independent variable influences the behavior of the dependent variable. The study conducted a probit regression analysis as defined by equation 4 above.

3.8.3 Sample Size

Cooper and Schindler (2011) assert that a sample is a subset of a population. A sample enables a study to gain information about a population. Kothari (2004) formula provides a simplified way to calculate sample sizes for an infinite population. This formula was used to calculate the sample size of the study. A 95% confidence level and p value of 0.05 was assumed. Using the formula, the sample size was calculated by:

$$n = \frac{z^2 * p * q}{e^2} \dots\dots\dots 5$$

Where **n** is the sample size

z is standard variate at any given confidence level

p is the sample proportion

q = 1 – p

e is the given precision rate or acceptable error

Therefore, given $z = 1.96$ (at 95% confidence interval from table), $p = 0.5$; $q = 1 - 0.5 = 0.5$; $e = 0.05$, and substituting in the formula gives:

$$n = \frac{1.96^2 * 0.5 * 0.5}{0.05^2} \cong 385 \dots\dots\dots 6$$

The study used stratified simple random sampling which is a method of sampling that involves the division of a population into smaller groups known as strata. In this technique, the estate was divided into two strata namely: apartments distributed within four villages in Mukuru and low-density houses also distributed within four villages in Mukuru. Additionally, simple random sampling was used to collect respondents in each stratum.

Table 4. 1: Stratification

Stratum	Stratum Sample Size
Embakasi Flats	55
Imara Flats	17
Kware Flats	80
Pipeline Flats	80
Kwa Njenga Lower	50
Kwa Njenga Upper	40
Lower Matopeni	53
Upper Matopeni	46
Total	421

The study collected a random sample of 421 respondents to be interviewed. However, to test for reliability and validity of the questionnaire, 10% of the respondents were used for the pilot study and excluded in the main study. The study incorporated disproportionate stratification since total population of the apartments and low-density houses in the estate were not known.

3.9 Data Issues

3.9.1 Heteroskedasticity

A data set is said to experience heteroscedasticity when a collection of random variables in the population have different variabilities. Variability is quantified by variance or any other measure of dispersion. If its heteroscedasticity is not eliminated, it can lead to an invalid statistical test of significance which assume that modelling errors are uncorrelated and uniform (Pearson et al., 1905).

In probit and logit regression model, test statistics are used to test for heteroscedasticity in the data (Davidson et al., 1984). The assumption made in this test is that heteroscedasticity is a function of Z variables. The Z variables are picked from the independent variables that are included in the model. Lagrange multiplier (LM) is the basic principle of the test statistics. A test statistic is the explained sum of squares from the artificial regression that is constructed from estimate results of the logit or probit model. Chi-square with n-degrees of freedom can be used as the test statistic. There exists heteroscedasticity if Chi-square computed is less than the Chi-square tabulated and the p-value obtained less than significance level of the study (Davidson & MacKinnon et al., 1984).

3.9.2 Multicollinearity

Multicollinearity is a state of intercorrelations among the independent variables. It creates a disturbance in the data, and if present, it causes the statistical inferences from the data to be unreliable (Mansfield et al., 1982). One way to test for multicollinearity in the data is by running a correlation matrix of all the independents variables used in the study. If the correlation between two variables is 0.8 or above, then there exists severe multicollinearity and one of the independent variables will be dropped (Farrar et al., 1967). Alternatively, multicollinearity can also be detected with the help of tolerance and its reciprocal, called variance inflation factor (VIF). If the value of tolerance is less than 0.2 or 0.1 and, simultaneously, the value of VIF 10 and above, then the multicollinearity is problematic. Eliminating multicollinearity ensures the test statistics are reliable and not biasness that was introduced (Farrar & Glauber et al., 1967).

CHAPTER FOUR

DATA ANALYSIS, INTERPRETATION AND DISCUSSION

4.1 Introduction

This chapter provides the results and findings of the study. The chapter is divided into ten sections with section 4.1 being the introduction, section 4.2 presenting the response rate, section 4.3 presenting the descriptive statistics, section 4.4 presenting type of housing, section 4.5 presenting access to health services, section 4.6 presenting house hold living conditions , section 4.7 presenting sanitation, section 4.8 presents the results from diagnostic test, while section 4.9 presents results from correlation matrix and section 4.10 presents regression results.

4.2 Response Rate

The study collected data from 421 respondents representing a response rate of 98 percent. The study distributed 431 questionnaires and managed to get 421 responses back. This is as shown in Table 4.1. The implication is that the response rate of 98% is adequate for the study and is highly representative since it has a nonresponse bias of only 2%. High nonresponse bias can be a major setback to the reliability and validity of the study findings (Fincham, 2008).

Table 4. 2: Response Rate

Response	Frequency	Percent
Returned	421	98
Unreturned	10	2
Total	431	100

4.3 Descriptive Statistics

The descriptive statistics indicates that on average 29% of the respondents in Mukuru Estate were in good health while 71% were in bad health. Thirty seven percent of the respondents had reduced their spending habits to cater for healthcare services. Majority of the respondents had education level that was sufficient to understand health related issues. About 68% of the respondents were married and only 21% had gotten injuries within their dwelling units. The standard deviation among the respondents with postgraduate education was 0.1584 indicating that the data points are spread out over a large range of values.

Table 4. 3: Descriptive Statistics

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
Health Status	389	0.293059	0.455752	0	1
Age	389	0.987147	0.112787	0	1
Gender	389	0.583548	0.493605	0	1
Married	389	0.678663	0.467591	0	1
Primary	389	0.210797	0.4084	0	1
Secondary	389	0.421594	0.49445	0	1
College	389	0.236504	0.425482	0	1
Undergraduate	389	0.095116	0.293753	0	1

Postgraduate	389	0.025707	0.158463	0	1
Employment Status	389	0.395887	0.48967	0	1
Spending Reduction	389	0.365039	0.482061	0	1
Quality of the House	389	0.3008	0.918368	0	1

The analysis of demographic characteristics showed that majority (58.3%) of the respondents were male while 41.7% were female. This implies that both genders were well represented, although the males were slightly more than half of all the respondents. This finding significantly supports interpretations about the representativeness of data (Purdie et al., 2012). The study showed that majority of the respondents (99%) were aged 18 years and above. Only a few (1%) of the respondents were less than 18 years old. It implies that respondents across all age groups were represented in the study. Additionally, the findings show that respondents who had completed secondary school were (42.2%), followed by those who had completed college education (23.7%). About 21.1% of the respondents had completed primary education while 9.5% of the respondents indicated that they had completed undergraduate studies. About 2.6% of the respondents had completed postgraduate studies. However, only 1.0% of the respondents didn't have any sought of formal education. This indicates that majority of the respondents had the education level required to understand health related issues.

Concerning marital status, the study revealed that majority (67.9%) of the respondents were married while slightly greater than a quarter (28.9%) were single. Those who were divorced were about 2.31% while those who were widows and widowers were less than 1%. The study sought to examine the employment status of the respondents. The findings indicated

that majority (60.4%) of the respondents were not employed while 39.6% were employed either in informal or formal sector.

Table 4. 4: Frequencies

	Variables	Frequency	Percent
Gender	Male	227	58.35
	Female	162	41.65
Age	Less Than 18 Years	5	1.29
	18 Years and Above	384	98.71
Education Level	Primary	82	21.08
	Secondary	164	42.16
	College	92	23.65
	Undergraduate	37	9.51
	Postgraduate	10	2.57
	No Education	4	1.03
Marital Status	Married	264	67.87
	Divorced	9	2.31
	Widow	1	0.26
	Widower	3	0.77
	Single	112	28.79
Employment Status	Employed	154	39.59
	Not Employed	235	60.41

4.4 Type of Housing Structure

Pertaining the issue of household units in Mukuru Estate, majority (62.2%) of the units were single room and slightly more than a quarter (29.1%) were self-contained. Notably, only less than 10% of the household units were double rooms. The results are shown in table 4.5.

Table 4. 5: Type of Household Units

Household Unit	Frequency	Percent
Self-Contained	113	29.05
Double Room	34	8.74
Single Room	242	62.21
Total	389	100

The study sought to establish the number of toilets, showers and wash handbasins for the household units in Mukuru Estate. The findings show the minimum number of toilets per floor were 1 while the maximum number of toilets per floor were 8. The maximum number of showers per floor were 7 while some floors did not have showers. Additionally, maximum number of hand wash basins per floor were 5 while some floors did not have hand wash basins. These are shown in Table 4.6.

Table 4. 6: Number of Showers, Toilets and Handbasins

Variable	Mean	Standard Deviation	Minimum	Maximum
Number of Toilets	2.782609	1.365759	1	8
Number of Showers	2.083333	1.319894	0	7
Number of Handbasins	0.40942	0.657089	0	5

Regarding the issue of staircase accessibility, the study indicates that majority (51.2%) of the household units had poor staircase accessibility which measured 3 to 3.5 feet. Additionally, the study established that slightly more than a quarter (28.5%) of the household units had very poor staircase accessibility which was less than three feet. However, 20.3% of the household units had good staircase accessibility which was above four feet.

Table 4. 7: Staircase Accessibility to the Household Unit

Staircase Accessibility	Frequency	Percent
Good (above 4feet)	79	20.31
Poor (3-3.5feet)	199	51.16
Very Poor (less than 3feet)	111	28.53
Total	389	100

The study sought to determine if there were any visible cracks on the wall on each household units. The findings show that majority (76.6%) of the household units had cracks on the wall. Only 24.2% did not have cracks on the wall. Additionally, the study revealed that majority (65.3%) of the household units had cracks on the floor as compared to 34.7% of the household units that did not have cracks on the floor. The findings further indicated that majority (66.1%) of the household units in Mukuru Estate did not have any electrical wires exposed. Only 38.2% of the household units had exposed electrical wires. The findings also indicated that majority of the dwelling units in Mukuru Estate had bedroom windows.

Table 4. 8: Descriptive for Observation Questions

		Frequencies	Percent	Observation
Cracked Walls	No	91	23.39	389
	Yes	298	76.61	
Cracked Floor	No	135	34.7	389
	Yes	254	65.3	
Leaking Walls	Yes	89	22.88	389
	No	300	77.12	
Leaking Floor	Yes	97	24.94	389
	No	292	75.06	
Solid Waste Disposal Provided	No	248	63.75	389
	Yes	141	36.25	
Electrical Wire Exposed	Yes	132	33.93	389
	No	257	66.07	
Building Encroaching the Street	Yes	119	30.59	389
	No	270	69.41	
Bedroom Windows	Yes	313	80.46	389
	No	76	19.54	
Light Switching During Day	Yes	227	58.35	389
	No	162	41.65	

Pertaining the issue of wall material of the household unit, majority (39.1%) of the household unit had wall materials made of stones while 35.2% of the household units had wall materials made of corrugated iron sheets. Additionally, close to a quarter (24.7%) of the household unit had wall materials made of bricks/blocks. However, the study established that only less than 10% of the household units had wall material made of mud and wood.

Table 4. 9: Type of Wall Material

Wall Material	Frequency	Percent
Stone	152	39.07
Brick/Block	96	24.68
Mud	1	0.26
Wood	3	0.77
Corrugated iron sheets	137	35.22
Total	389	100

The study established that majority (66.2%) of the household unit in Mukuru Estate had roof materials of their dwelling unit made of corrugated iron sheets. Additionally, slightly more than a quarter (36.5%) of the household's units had their roof material made of concrete. This mostly occurred in apartments and self-contained units.

Table 4. 10: Type of Roof Material

Roof Material	Frequency	Percent
Corrugated Iron Sheets	242	62.21
Concrete	142	36.5
Tiles	5	1.29
Total	389	100

Concerning the issue of floor material of the household unit, majority (66.8%) of the household units had their floor made of cement sand screed while slightly more than a quarter (29.6%) had tiled floors. Moreover, the less than 10% of the household units had floors made of wood and earth.

Table 4. 11: Type of Floor Material

Floor Material	Frequency	Percent
Wood	5	1.29
Tiles	115	29.56
Cement	260	66.84
Earth	9	2.31
Total	389	100

4.5 Access to Health Services

Regarding the issue of visitation to health facility, the findings indicated that majority (70.7%) of the respondents did not visit a health facility in the last three months while only 29.3% visited a health facility in the last three months. The study established that majority (63.5%) of the respondents reduced their spending habits in order to obtain healthcare services. However, only 36.5% of the respondents did not reduce their spending habits in order to obtain healthcare services. The results indicated that majority (92.0%) of the children did not have rickets or vision impairments. Only 7.9% of the children were found to have rickets or vision impairments.

Table 4. 12: Access to Health Services

		Frequencies	Percent	Observation
Visitation to Health Facility	Yes	114	29.31	389
	No	275	70.69	
Spending Reduction	No	142	36.5	389
	Yes	247	63.5	
Diagnosed with Rickets Among Children	Yes	31	7.97	389
	No	358	92.03	

The study sought to determine the problem which the respondents were diagnosed with when they visited the hospital. The findings indicate that 36.8% and 35.9% of the respondents were diagnosed with water related illness and upper respiratory infection respectively. Less than 15% of the respondents were diagnosed with food poisoning and injuries around their dwelling areas.

Table 4. 13: Problem Diagnosed With

Problem Diagnosed With	Frequency	Percent
Upper Respiratory Infection	41	35.96
Water Related Illness	42	36.84
Food Poisoning	14	12.28
Injuries	17	14.91
Total	114	100

Concerning the difficulty or easiness in the level of obtaining healthcare services, study revealed that 29% of the respondents had a difficult time in obtaining healthcare services. Slightly more than a quarter (27%) indicated it was very difficult to access healthcare services. Only 24.6% indicated that it was easy for them to obtain healthcare services.

Table 4. 14: Easiness of Accessing Healthcare Services

Easiness of Accessing Healthcare Services	Frequency	Percent
Very difficult	31	27.19
Difficult	33	28.95
Moderate	16	14.04
Easy	28	24.56
Very easy	6	5.26
Total	114	100

The results show that 34.5% of the respondents regularly had financial difficulty as compared to 26.2% of the respondents whom sometimes had financial difficulty while obtaining healthcare services. Only 13.4% of the respondents indicated to have never experienced financial difficulty while obtaining healthcare services.

Table 4. 15: Financial Constraints while Accessing Healthcare Services

Financial Constraints while Accessing Healthcare Services	F/requency	Percent
Sometimes	102	26.22
Regularly	134	34.45
Rarely	101	25.96
Never	52	13.37
Total	389	100

4.6 Affordable Quality Housing

The study sought to establish the features of quality affordable housing as understood by the respondents. Majority of the respondents indicated that running water, electrical connection and self-contained house were the prominent features of a quality affordable house. However, proper lighting and ventilation, proper security systems and tiled housing were among the features of quality affordable housing as mentioned by the respondents.

Table 4. 16: Features of a Standard Quality House

Housing Features		Frequencies	Percent	Observation
Self-Contained House	No	110	28.28	389
	Yes	279	71.72	
Proper Lighting & Ventilation	No	126	32.39	389
	Yes	263	67.61	
Tiled House	No	178	45.76	389

	Yes	211	54.24	
Electrical Connection	No	97	24.94	389
	Yes	292	75.06	
Running Water	No	90	23.14	389
	Yes	299	76.86	
Security System	No	174	44.73	389
	Yes	215	55.27	

The results further indicated that majority (88.9%) of the respondents were able to pay their house rent consistently as compared to only 11.1% of the respondents who were unable to pay their rent consistently. Additionally, majority (71.5%) of the respondents indicates that the government or public agents should intervene and regulate house rents unlike 38.5% of the respondents who indicated that house rent should not be regulated by the government or any public agents.

Table 4. 17: Living Conditions of the Respondents

Living Condition		Frequencies	Percent	Observation
Perception on the Quality of the House	Yes	117	30.08	389
	No	272	69.92	
Consistency in Paying House Rent	Yes	104	88.89	117
	No	13	11.11	
Rent Regulation by Government or Public Agents	Yes	278	71.47	389
	No	111	28.53	

4.7 Sanitation

Concerning the issue of main source of drinking water, the study revealed that 37.8% of the respondents sourced water from water vendor while slightly more than a quarter (23.9%) sourced water from a borehole or well. Additionally, 19.8% of the respondents were using water from Nairobi Water which was connected inside their homes. Notably, only less than 10 % of the respondents sourced water from river or pond.

Table 4. 18: Main Source of Water

Water Source	Frequency	Percent
Pond/Dam	40	10.28
River/Storm/Spring	32	8.23
Well/Borehole	93	23.91
Nairobi Water Connected Inside Home	77	19.79
Water vendor	147	37.79
Total	389	100

The study sought to examine if there were water shortage in Mukuru Estate. The findings indicate that majority (57.1%) of the households experienced water shortages. Just a few of the respondents indicated that water shortage was not a problem for them. The findings further indicated that some of the respondents (53.7%) experienced sanitary blockage in their facility as compared to 44.7% of the respondents who never experienced in any sanitary blockage in their dwelling units. The results however indicated that majority of the respondents did not have adequate waste disposal facilities.

Table 4. 19: Summary

		Frequencies	Percent	Observation
Water Shortage	Yes	222	57.07	389
	No	167	42.93	
Sanitary Blockage	Yes	209	53.73	389
	No	180	46.27	
Hand Washing Area	Yes	174	44.73	389
	No	215	55.27	
Adequate Waste Disposal	No	209	53.73	389
	Yes	180	46.27	

Regarding the issue of the time taken to water source, majority (50.4%) of the respondents indicated that it takes only less than twenty minutes to water source. Additionally, 38.6% of the respondents indicated that it only took between twenty-one and thirty minutes to get to the water sources.

Table 4. 20: Duration Water Source

Duration Water Source	Frequency	Percent
0 - 20 Minutes	196	50.39
21 - 30 Minutes	150	38.56
31 - 60 Minutes	25	6.43
Over 1 Hour	18	4.63
Total	389	100

The results show that majority (67.1%) of the respondents indicated that their main waste disposal was main sewer while a quarter of the respondents (22.19) discharged their waste to the river. About 10% of the respondents used septic tanks or bio digester for waste disposal.

Table 4. 21: Main Waste Disposal

Main Waste Disposal	Frequency	Percent
Main Sewer	261	67.1
Septic Tank/Bio Digester	39	10.03
Discharge to the River	89	22.88
Total	389	100

The study sought to understand the main toilet facility for the residents of Mukuru Estate. The findings indicate that majority (57.3%) of the respondents used pit latrines with slab while 33.2% of the respondents used closed pour flush toilets. Additionally, only 3.1% of the respondents used bucket/flying toilets while 6.4% used open defecation as their main toilet facility.

Table 4. 22: Main Type of Toilet Facility

Main Toilet Facility	Frequency	Percent
Use Pit Latrine with Slab	223	57.33
Use Closed Pour Flush Toilet	129	33.16
Bucket/Flying Toilets	12	3.08
Bush/Open Defecation	25	6.43
Total	389	100

4.8 Household Living Conditions

The findings indicate that majority (53.9%) of the household units had poor natural lighting which covered only 10 to 15 percent of the floor area. However, slightly more than a quarter of the household units had good natural lighting which covered 20% of the floor area. Only, 15.7% of the household units had very poor natural lighting which covered only 10% of the floor area. The findings are shown in table 4.23.

Table 4. 23: Natural Lighting of the Household Units

Natural Lighting	Frequency	Percent
Good (20% of floor area)	118	30.33
Poor (10- 15% of floor area)	210	53.98
Very poor (less than 10%)	61	15.68
Total	389	100

The study revealed that 42.4% of the household units in Mukuru Estate had poor ventilation having either permanent vent or openable window while nearly a quarter (22.6%) of these household units had none of the permanent vent or openable windows. However, 34.9% of the household units had good ventilation with proper permanent vent and openable windows.

Table 4. 24: Ventilation of the Household Units

Ventilation	Frequency	Percent
Good (if permanent vent and openable windows)	136	34.96
Poor (if either one)	165	42.42
Very Poor (if none)	88	22.62
Total	389	100

Majority (66.6%) of the respondents indicated that they experienced dizziness while they were cooking. Only 33.4% indicated that they did not experience dizziness while they were cooking. Moreover, the results indicate that majority (79.4%) of the respondents did not get injuries within the households while only 20.6% of the respondents experienced injuries within the building.

Table 4. 25: Living Conditions

Living Conditions		Frequencies	Percent	Observation
Dizziness While Cooking	No	130	33.42	389
	Yes	259	66.58	
Injury Within the Building	Yes	80	20.57	389
	No	309	79.43	

The study revealed that majority (88.9%) of the respondents used electricity as their main mode of lighting. Compared to pressure lamp, lantern and tin lamp, only 7.7% of the respondents indicated that they used pressure lamp for lighting.

Table 4. 26: Main Lighting Mode

Lighting Mode	Frequency	Percent
Electricity	346	88.95
Pressure Lamp	30	7.71
Lantern	7	1.8
Tin Lamp	6	1.54
Total	389	100

The study revealed that majority (57.8%) of the respondents used cooking gas as their main type of cooking fuel. However, slightly more than a quarter (24.9%) of respondents used

kerosene as their main type of cooking fuel. However, 7.2% and 8.7% of the respondents used charcoal and electricity respectively.

Table 4. 27: Main Type of Cooking Fuel

Main Cooking Fuel	Frequency	Percent
Electricity	34	8.74
Gas	225	57.84
Firewood	4	1.03
Kerosene	97	24.94
Biogas	1	0.26
Charcoal	28	7.2
Total	389	100

4.9 Diagnostic Tests

4.9.1 Reliability Test

The reliability of the study was tested using Cronbach's Alpha to measure internal consistency. The results indicated that the Cronbach's Alpha for the measures was 0.7592 which was very close to 1 therefore the instrument was considered reliable. This justifies Greene (2012) contention that for a high reliability estimate, Cronbach Alpha should be as close to 1 as possible.

Table 4. 28: Cronbach Alpha Test

Cronbach's Alpha	Number of Items
0.7592	19

4.9.2 Normality Test

4.9.1.1 Skewness/Kurtosis tests for Normality

Skewness or Kurtosis shows the number of observations (which is 389 here) and the probability of skewness which is 0.3215 implying that skewness is asymptotically normally distributed (p-value of skewness > 0.05). Similarly, probability of Kurtosis indicates that kurtosis is also asymptotically distributed (p-value of kurtosis > 0.05). Finally, chi(2) is 0.304 which is greater than 0.05 implying its significance at 5% level. Consequently, the null hypothesis cannot be rejected. Therefore, according to Skewness test for normality, residuals show normal distribution.

Table 4. 29: Normality Test

Skewness/Kurtosis tests for Normality					
-----joint -----					
Variable	Obs	Pr (Skewness)	Pr (Kurtosis)	adj chi2(2)	Prob>chi2
Health Status	389	0.4321	0.3214	31.84	0.403

4.9.1.2 Shapiro Wilk Test for Normality

The Shapiro-Wilk W is the ratio of the best estimator of the variance to the usual corrected sum of squares estimator of the variance (Shapiro and Wilk 1965). The statistic is positive and less than or equal to one. Being close to one indicates normality.

Table 4. 30: Shapiro Wilk Test for Normality

Variable	Observation	W	V	z	Prob>z
Health Status	389	0.99309	1.855	1.469	0.87092
Age	389	0.61761	102.676	-11.006	0
Gender	389	0.99945	0.147	-4.557	1
Married	389	0.99688	0.837	-0.422	0.66341
Primary	389	0.98528	3.951	3.265	0.00055
Secondary	389	0.99864	0.366	-2.389	0.99155
College	389	0.9883	3.142	2.721	0.00326
Employment status	389	0.99794	0.552	-1.41	0.92079
Double Room	389	0.94945	13.573	6.198	0
Single Room	389	0.99874	0.339	-2.568	0.99488
Spending reduction	389	0.99687	0.841	-0.412	0.6599
Injury in building	389	0.9846	4.136	3.374	0.00037
Dam	389	0.95814	11.24	5.749	0
Borehole	389	0.98856	3.07	2.666	0.00384
Water Inside Home	389	0.9835	4.43	3.537	0.0002
Water shortage	389	0.99961	0.105	-5.345	1
Sanitary blockage	389	0.99983	0.047	-7.272	1
Hand washing area	389	0.99917	0.224	-3.555	0.99981
Inadequate sewage disposal	389	0.99983	0.047	-7.272	1
Bedroom windows	389	0.98684	3.535	3	0.00135
Light switching Off	389	0.99945	0.147	-4.557	1

In this test, the p-value assumes that the distribution is normally distributed. The findings show that the p-value is 0.87092 which is very high and indicates that we do not reject the null hypothesis that health status is normally distributed.

4.9.3 Heteroskedasticity

4.9.3.1 White/Koenker Test for Heteroskedasticity

Heteroskedasticity test(s) using levels of independent variables only

Ho: Disturbance is homoscedastic

White/Koenker nR2 test statistic: 21.886 Chi-sq(20) P-value = 0.3467

This statistic is distributed as chi-squared under the null of no heteroskedasticity, and under the maintained hypothesis that the error of the regression is normally distributed. The degrees of freedom of all these chi-square tests are equal to the number of indicator variables. The relationship between these independent variables was statistically insignificant with Chi-Square ($X^2_{(20)} = 21.886$, $p > 0.05$) indicating that heteroskedasticity was absent.

4.9.3.2 Solution for Heteroskedasticity

Suppose that we found the evidence of existence of heteroscedasticity. If we used the OLS estimator, we will get unbiased but inefficient estimates of the parameters of the model. Also, the estimates of the variances and covariances of the parameter estimates will be biased and inconsistent, and as a result hypothesis tests will not be valid. When there is evidence of heteroscedasticity, we correct by the two methods:

Use OLS estimator to estimate the parameters of the model. Correct the estimates of the variances and covariances of the OLS estimates so that they are consistent. Use an estimator other than the OLS estimator to estimate the parameters of the model.

The first alternative is mostly used. This is because the most serious consequence of using the OLS estimator when there is heteroscedasticity is that the estimates of the variances and covariances of the parameter estimates are biased and inconsistent. This method is consistent in estimating the standard errors.

4.9.4 Multicollinearity Test

4.9.4.1 Variance Inflated Factor

Variance Inflation Factor (VIF) is used to test for multicollinearity. Greene (2012) indicates that a variance which has VIF which is higher than 10 will need to be checked further for multicollinearity. Tolerance which is given by $1/VIF$ depicts the degree of collinearity. The variance inflation factor for all the variables from the table below are less than 10. The tolerance level for all the variables is less than 1. This indicates absence of multicollinearity.

Table 4. 31: Variance Inflated Factor

Variable	VIF	1/VIF
Secondary	2.96	0.338273
Primary	2.86	0.349091
College	2.28	0.438103
Borehole	2.21	0.452928
Single Room	2.2	0.455201
Hand Washing Area	2.04	0.490737
Waste Disposal	1.93	0.517137
Water Shortage	1.64	0.60884
Dam	1.64	0.609521
Sanitary Blockage	1.51	0.662944
Spending Reduction	1.48	0.677727
Water Inside Home	1.47	0.67949
Double Room	1.44	0.693784
Bedroom Windows	1.4	0.711808
Employment Status	1.38	0.722645
Injuring Building	1.19	0.838894
Light Switching Off	1.14	0.876519
Gender	1.13	0.883517
Married	1.11	0.903846
Age	1.07	0.936951
Mean VIF	1.7	

4.10 Correlation Matrix

The results indicated that all the variables were not correlated since their Pearson correlation coefficient were all less than 0.8. This finding supports the argument by Greene (2012) that correlation coefficient greater than or equal to 0.8 indicate presence of severe multicollinearity. The results are shown in Figure 4.1.

	Age	Gender	Married	Primary	Secondary	College	Employment Status	Double Room	Single Room	Spending Reduction	Injury in Building	Dam	Borehole	Water Inside Home	Water Shortage	Sanitary Blockage	Hand Washing Area	Adequate Sewage Disposal	Bedroom Windows	Light Switching Off	
Age	1.0000																				
Gender	0.1742	1.0000																			
Married	0.1364	0.2227	1.0000																		
Primary	-0.5545	0.6554	-0.4423	1.0000																	
Secondary	0.2536	0.4532	-0.3374	-0.4412	1.0000																
College	0.4320	0.6987	0.1742	-0.2876	-0.4752	1.0000															
Employment Status	0.3010	0.4187	0.1364	-0.2895	-0.1269	0.2298	1.0000														
Double Room	0.3680	-0.4352	0.2536	-0.4423	0.3010	0.3680	0.3114	1.0000													
Single Room	0.3114	0.4532	-0.6987	0.2858	0.1178	-0.1776	-0.3665	-0.3971	1.0000												
Spending Reduction	-0.2232	-0.1393	-0.1726	-0.1345	0.2654	0.3622	-0.1425	0.1147	-0.1689	1.0000											
Injury in Building	0.5545	-0.4532	0.4532	0.1269	-0.1425	-0.1364	-0.1388	0.5623	0.3377	-0.1216	1.0000										
Dam	0.6554	-0.6987	0.6987	-0.1335	0.2287	0.2536	0.1067	-0.1478	-0.1376	0.4113	-0.1304	1.0000									
Borehole	0.4423	-0.4187	0.4187	-0.1863	-0.1246	0.1845	0.2364	-0.3478	-0.2965	-0.1871	-0.2365	-0.1898	1.0000								
Water Inside Home	0.5113	-0.3447	-0.1733	-0.4532	0.6987	0.4187	0.1633	0.1432	0.4432	-0.1087	0.2741	-0.1682	-0.2785	1.0000							
Water Shortage	-0.4573	0.1364	-0.3416	0.1427	0.6987	-0.1895	-0.1687	0.2710	0.1381	0.1722	0.2229	0.2081	-0.4514	-0.1166	1.0000						
Sanitary Blockage	-0.1059	-0.3010	-0.3680	0.1636	0.3010	-0.1387	-0.1132	0.5545	0.6554	0.2860	0.1916	0.2802	-0.3018	-0.1471	0.4450	1.0000					
Hand Washing Area	0.4532	0.2365	0.2536	-0.3128	0.3680	0.1563	0.3395	0.6987	-0.5251	0.1985	-0.1124	0.2572	0.2958	0.4532	-0.1807	-0.0673	1.0000				
Adequate Sewage Disposal	0.6987	-0.2741	0.1742	-0.3926	0.3114	0.2375	0.1925	0.6987	-0.3937	0.2753	-0.2294	0.3142	0.2422	0.6987	-0.1591	-0.2774	0.5549	1.0000			
Bedroom Windows	-0.4187	0.2967	-0.1147	0.1116	-0.3447	-0.1726	-0.4532	0.4187	0.1107	-0.3401	0.6987	-0.4095	0.2458	0.4187	-0.1392	-0.2492	-0.1435	-0.1842	1.0000		
Light Switching Off	0.6554	0.1742	0.1364	0.2536	0.5545	0.6554	-0.4423	-0.3010	0.3680	0.3114	-0.4187	0.2002	-0.1256	-0.1169	0.1207	0.1175	0.3418	0.1468	-0.1532	1.0000	

Figure 4. 1: Correlation Matrix

4.11 Regression Results

The study estimated probit model for health status and found the chi square for likelihood ratio test was significant suggesting that the independent variables jointly influenced health status of individuals in Mukuru Estate. Table below shows the coefficients, standard errors and the significance of the variables. The coefficients of age, employment status, sanitary blockage, inadequate waste disposal, dam and water shortage are negatively associated with health status. The variables that are statistically significant are age, gender, married, primary, secondary, college, double room, single room, borehole, water shortage, bedroom windows and lights switching off at 1%, 5%, and 10% respectively. Even though the other variables are not statistically significant, they tend to affect health status in one way or the other.

Table 4. 32: Probit Binary Model

Variables	Coefficients	Standard Errors
Age	-0.4233*	-0.722
Gender	0.0503**	-0.1487
Married	0.1330**	-0.1545
Primary	0.2112**	-0.2855
Secondary	0.1399**	-0.2352
College	0.2427*	-0.2379
Employment status	-0.0918	-0.1643
Double Room	0.4638*	-0.2803
Single Room	-0.3754*	-0.2105
Spending reduction	0.0476	-0.1724
Injury in building	-0.0981	-0.1843
Dam	-0.119	-0.2952

Borehole	0.1174**	-0.2373
Water Inside Home	0.1733	-0.2091
Water shortage	-0.1453**	-0.181
Sanitary blockage	-0.0116	-0.1683
Hand washing area	-0.0165	-0.1968
Inadequate sewage disposal	-0.0257	-0.1897
Bedroom windows	0.4046*	-0.2137
Light switching Off	0.0892*	-0.1496
Constant	-1.2038	-0.8154
Observations	389	

Standard errors in parentheses

*** p<0.01 (The coefficients are statistically significant at 1%), ** p<0.05 (The coefficients are statistically significant at 5%), * p<0.1 (The coefficients are statistically significant at 10%)

Probit regression **Number of obs = 389**

LR chi2(20) = 30.08

Prob > chi2 = 0.0685

Log likelihood = -220.25212 Pseudo R2 = 0.0639

4.11.1 Marginal Effects among the Variables

The marginal effect of variables in this study is shown in table 4.31 by the partial derivative of the dependent variable (health status) with respect to the independent variables.

Table 4. 33: Marginal Effects using Delta-Method

Variables	dy/dx	Std. Err.	z	P>z
Age	-0.135789	0.231283	0.59	0.557
Gender	0.016136	0.0477	0.34	0.735
Married	-0.04267	0.04941	-0.86	0.388
Primary	0.06776	0.09144	-0.74	0.459
Secondary	0.16448	0.075357	-0.6	0.551
College	0.34785	0.076008	1.02	0.306
Employment Status	-0.22944	0.052631	-0.56	0.576
Double Room	0.14877	0.088963	1.67	0.094
Single Room	-0.12044	0.06669	-1.81	0.071
Spending Reduction	0.115267	0.055293	0.28	0.782
Injury in Building	-0.031471	0.059058	0.53	0.594
Dam	-0.338187	0.09465	0.4	0.687
Borehole	0.137656	0.076068	0.5	0.621
Water Inside Home	0.25561	0.066952	0.83	0.406
Water shortage	-0.146602	0.057944	0.8	0.421
Sanitary Blockage	-0.10373	0.053983	-0.07	0.945
Handwash	0.22528	0.063131	-0.08	0.933
Inadequate Waste Disposal	-0.16824	0.060847	-0.14	0.892
Bedroom Windows	0.129808	0.067841	1.91	0.056
Lights Switching Off	0.02862	0.047927	0.6	0.55

4.11.2 Discussion of Results

The table shows the marginal effect, standard errors and the z-value. The findings show that an increase of 1% in age lowers the probability of being in good health by 13.6%. This is because an increase in age as one approach old age makes one's body vulnerable to

sickness. This finding is in agreement with Lorem (2017) who conducted a study in Peru where the ordinary least square regression results indicated that age had negative effect on the health status of tenant. This indicates that as one ages, there's a deterioration in their health status. The finding show that education level was statistically significant which had a positive effect on health status. Additionally, increase by 1% of individuals with primary education increased the probability of being in good health by 6.7% while an increase by 1% of individuals with secondary education increased the probability of being in good health by 16.4% and an increase by 1% of individuals with college education increased the probability of being in good health by 34.8%. This finding is in agreement with the findings of a study conducted by Rana (2009) in Bangladesh which showed that probability of good health status increased as the education level of the tenant also increased. This implies that tenants with higher education understands the importance of good health and hence seeks better medical behaviours.

The findings showed that an increase by 1% of employment status lowered the probability of being in good health by 22.9%. This result shows that as individual work for long hours, their chances of being in good health reduces. This finding is in agreement with the findings of Kaleta (2008) who established that self-rated health for household members who worked in weekly long hours, occupational groups, shift work, and tenure were different across all the characteristics of the subjects depending on employment status.

An increase by 1% of injuries occurred within the building lowered the probability of being in good health by 3.1%. Consequently, an increase by 1% in spending reduction lowered the probability of being in good health by 11.5%. The results are in accordance with the

results of a study conducted by DiGiuseppi (2010) which showed that physical injuries which occurred within the building could have been influenced by poor lighting, poor staircase accessibility, uncarpeted or concrete floors, missing or damaged window locks or catches, structural defects, inadequate spacing and height of steps and railings among others. His findings were statistically significant implying that it had an effect on health status of individuals.

An increase of 1% in sourcing water from a dam lowered the probability of being in good health by 33.8% while an increase of 1% in sourcing water from a borehole increased the probability of being in good health by 13.8% while an increase of 1% in house connected with water increased the probability of being in good health by 25.6%. Consequently, an increase of 1% in water shortage lowered the probability of being in good health by 14.6%. This result showed similarities from a study conducted by Hunter (2010) which showed that poor water supply impacts health by causing acute infectious diarrhoea, repeat or chronic diarrhoea episodes, and non-diarrhoeal disease, which can arise from chemical species such as arsenic and fluoride. It can also affect health by limiting productivity and the maintenance of personal hygiene. Hunters (2010) further showed that strenuous efforts must be made to improve access to safe and sustainable water supplies in developing countries, and, given the health burden on the public and the costs to the health system, health professionals should join with others in demanding accelerated progress towards global access to safe water.

An increase of 1% in sanitary blockage and inadequate waste disposal reduced the probability of being in good health by 10.3% and 16.8% respectively. Additionally, an

increase of 1% in hand washing areas increased the probability of being in good health by 22.5%. These findings are in accordance with the results of Blom (2015) who found that drainage systems and its maintenance, if neglected, could pose a threat in both community and healthcare causing infections as well as emergence of multi-resistant bacteria that could cause unpredictable clinical manifestations. He further showed that adequate sanitation is fundamental and a prerequisite for safe life and productivity.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

5.0 Introduction

This chapter entails the summary of the study, the conclusion of the research, the recommendations drawn from the study findings, contribution of the study to theory or existing knowledge and areas of further research.

5.1 Summary of Findings

The study collected data from 421 respondents representing a response rate of 98 percent. The study distributed 431 questionnaires and managed to get 421 responses back. The descriptive statistics indicates that on average 29% of the respondents in Mukuru Estate were in good health while 71% were in bad health. The analysis of demographic characteristics showed that majority (58.3%) of the respondents were male while 41.7% were female with the majority being of 18 years and above. The findings show that respondents who had completed secondary school were (42.2%), followed by those who had completed college education (23.7%). About 21.1% of the respondents had completed primary education while 9.5% of the respondents had completed undergraduate studies. About 2.6% of the respondents had completed postgraduate studies. Only 1.0% of the respondents didn't have any sought of formal education. This showed that majority of the respondents had the education level required to understand health related issues.

Majority (62.2%) of the units were single room and slightly more than a quarter (29.1%) were self-contained. Notably, only less than 10% of the household units were double

rooms. Forty two percent of the household units had poor ventilation having either permanent vent or openable window while nearly a quarter (22.6%) of these household units had none of the permanent vent or openable windows. Thirty-nine of the household units had good ventilation with proper permanent vent and openable windows. Majority (51.2%) of the household units had poor staircase accessibility which measured 3 to 3.5 feet. Additionally, the study established that slightly more than a quarter (28.5%) of the household units had very poor staircase accessibility which was less than three feet. However, 20.3% of the household units had good staircase accessibility which was above four feet.

Majority of the respondents indicated that running water, electrical connection and self-contained house were the prominent features of a quality affordable house. However, proper lighting and ventilation, proper security systems and tiled housing were among the features of quality affordable housing. Fifty seven percent of the respondents used cooking gas as their main type of cooking fuel. However, slightly more than a quarter (24.9%) of respondents used kerosene as their main type of cooking fuel. Thirty seven percent of the respondents sourced water from water vendor while slightly more than a quarter (23.9%) sourced water from a borehole or well. Additionally, 19.8% of the respondents were using water from Nairobi Water which was connected inside their homes. Sixty seven percent of the respondents indicated that their main waste disposal was main sewer while a quarter of the respondents (25.2%) discharged their waste to the river. About 10% of the respondents used septic tanks or bio digester for waste disposal. Fifty seven percent of the respondents used closed pour flush toilets while 33.2% of the respondents used pit latrines with slab.

Additionally, only 3% of the respondents used buckets while 6.4% used bush as their main toilet facility.

In conclusion, all the factors above contributed to health status but at different degrees. Hence the results have showed that there is a relationship between the substandard housing and the health status in Mukuru Estate

5.2 Conclusion

The study has shown that majority of the respondents lived in low-density houses which comprised of single rooms and double rooms. These dwelling units had walls made of corrugated iron sheets and bricks. Their roofing material were made of corrugated iron sheets and had floors made of cements. Notably, the natural lighting, staircase accessibility and ventilation on these dwelling units was poor. Therefore, the study concluded that there is laxity in implementing public health standards, good architectural permanent designs and proper planning to provide better housing for residents of Mukuru Estate.

The study has shown that majority of the respondents who had visited a health facility in the last three months and were diagnosed with upper respiratory infection as well as water related illness. Also, some were diagnosed with food poisoning and injuries which occurred within their dwelling units. Only a few were found to have rickets. Majority of the respondents indicated that it was difficult to obtain health services. While majority cut off their spending habits in order to obtaining health care services. Majority of the respondents experienced financial difficulty while obtaining health services. Therefore, the study

concluded that accessing healthcare services for the residents of Mukuru Estate was a challenge.

The research has revealed that majority of the respondents considered that a house with running water, electrical connection and self-contained were the top most qualities of an affordable quality house. Majority of the respondents were able to pay for their house rent consistently. Concerning main mode of lighting and cooking fuels, majority of the dwelling units had electrical connection and respondents used cooking gas as their main cooking fuel. Majority of the respondents indicated that the government or public agents should regulate rents. This study concluded that majority of the respondents could afford basic needs such as electricity and affordable cooking fuels.

The study showed that majority of the respondents sourced water from water vendors while slightly a few of the dwelling units had water connected inside their homes. It only took less than twenty minutes to get to a water source as indicated by majority of the respondents. Moreover, majority of the respondents used toilets which had closed pour flush while only a few used the bush as their toilet facility. The number of households accessing a toilet facility were slightly more than one household. These findings led to the conclusion that majority of the respondents were not satisfied with the sanitation services provided by their local authority as well as the landlords and housing agents who are in charge of providing these services.

5.3 Recommendation

On the basis of all the findings presented in this report, it can be recommended that for efficient actions in the future, particular attention should be paid to the following points:

Due to the fact that social determinant of health in the Mukuru Estate can be described by multiple deprivations (such as housing structure, sanitation, household living conditions), an efficient intervention in any individual area requires a highly complex and integrated approach. This means that strategies are needed which address housing within the context of policies targeting these deprivations. This should not be applied only for the Mukuru Estate, but also for other vulnerable places throughout the country.

Policy measures aiming at reducing health inequalities should be sensitive to those specificities that characterize not only the objective health status of the Mukuru Estate (and other vulnerable places) but also their perceptions about this. Health mediators can play an important role in this area. Mobilization of the citizens to adopt the National Hospital Insurance Fund (NHIF) in order to reduce the out of pocket spending towards health care could be one channel to improved health status.

Public health standards, good architectural permanent designs and proper planning to provide better housing for residents of Mukuru Estate should be adopted and implemented. Better wall materials to be constructed to ensure comfort in cold days. Proper lighting and ventilation to be applied in order to reduce the rate at which rickets and respiratory infections are reported. This includes constructing or expanding sewerage disposal sections

in order to avoid discharge of this waste to the river. This in return improves on sanitation and hygiene.

5.4 Contribution of the Study to Theory/Existing Knowledge

The study developed a conceptual framework which outlines the correlation between the social determinants of health and health status. The objectives that were related to the originally developed conceptual framework were successfully established and the results provide basis for development of other related conceptual frameworks. The study also contributed to the existing knowledge by showing the relationships between different dimensions of health status as measured by different social determinant of health.

5.5 Areas of Further Research

The dimensions of substandard housing and social determinants of health were found to significantly influence health status. The results obtained from this study are informative and shed light when it comes to substandard housing but it can however offer limited guidance for policy makers and other government authorities in Kenya. Findings described in this report confirm that more research is needed on identifying the impacts of housing on health, in order to understand the relationship more accurately. This could inform policy on how to prioritise certain aspects. Researchers can widen the scope of the study in the future studies by assessing social determinants of substandard housing on tenants' health all over Kenya in order to make the study findings as representative as possible.

REFERENCES

- Alemu, A. M. (2017). To what extent does access to improved sanitation explain the observed differences in infant mortality in Africa? *African journal of primary health care & family medicine*, 9(1), 1-9.
- Amendah DD, Buigut S, Mohamed S (2014) Coping Strategies among Urban Poor: Evidence from Nairobi, Kenya. *PLOS ONE* 9(1): e83428
- Bakhtyar, B., Zaharim, A., Sopian, K., Saadatian, O., & Abdulateef, J. (2012). Affordable Quality Housing for Urban Low-Income Earners in Malaysia.
- Barnes, M., Butt, S., & Tomaszewski, W. (2011). The duration of bad housing and children's well-being in Britain. *Housing Studies*, 26(1), 155-176.
- Barnett, K., Mercer, S. W., Norbury, M., Watt, G., Wyke, S., & Guthrie, B. (2012). Epidemiology of multimorbidity and implications for health care, research, and medical education: a cross-sectional study. *The Lancet*, 380(9836), 37-43.
- Blackwell, D. L., Lucas, J. W., & Clarke, T. C. (2014). Summary health statistics for US adults: national health interview survey, 2012. *Vital and health statistics. Series 10, Data from the National Health Survey*, (260), 1-161.
- Blom, K. (2015). Drainage systems, an occluded source of sanitation related outbreaks. *Archives of Public Health*, 73(1), 8.
- Burgard, S. A., Seefeldt, K. S., & Zelner, S. (2012). Housing instability and health: findings from the Michigan Recession and Recovery Study. *Social science & medicine*, 75(12), 2215-2224.
- Castañeda, H., Holmes, S. M., Madrigal, D. S., Young, M. E. D., Beyeler, N., & Quesada, J. (2015). Immigration as a social determinant of health. *Annual review of public health*, 36, 375-392.
- Chapman R, Howden-Chapman P, Viggers H. Retrofitting houses with insulation: a cost benefit analysis of a randomised community trial. *J Epidemiol Community Health* 2009; 63:271e7.

- Conron, K. J., Mimiaga, M. J., & Landers, S. J. (2010). A population-based study of sexual orientation identity and gender differences in adult health. *American journal of public health, 100*(10), 1953-1960.
- Davidson, R., & MacKinnon, J. G. (1984). Convenient specification tests for logit and probit models. *Journal of Econometrics, 25*(3), 241-262.
- DiGuseppi, C., Jacobs, D. E., Phelan, K. J., Mickalide, A., & Ormandy, D. (2010). Housing interventions and control of injury-related structural deficiencies: a review of the evidence. *Journal of public health management and practice: JPHMP, 16*(5 Suppl), S34.
- Dreyer, R. P., van Zitteren, M., Beltrame, J. F., Fitridge, R., Denollet, J., Vriens, P. W., ... & Smolderen, K. G. (2015). Gender differences in health status and adverse outcomes among patients with peripheral arterial disease. *Journal of the American Heart Association, 4*(1), e000863.
- Durand, M. (2015). The OECD better life initiative: How's life? and the measurement of well-being. *Review of Income and Wealth, 61*(1), 4-17.
- Easterlow, D., Smith, S. J., & Mallinson, S. (2000). Housing for health: the role of owner occupation. *Housing Studies, 15*(3), 367-386.
- Faragher, E. B., Cass, M., & Cooper, C. L. (2013). The relationship between job satisfaction and health: a meta-analysis. In *from Stress to Wellbeing Volume 1* (pp. 254-271). Palgrave Macmillan, London.
- Farrar, D. E., & Glauber, R. R. (1967). Multicollinearity in regression analysis: the problem revisited. *The Review of Economic and Statistics, 92*-107.
- Fincham, J. E. (2008). Response rates and responsiveness for surveys, standards, and the Journal. *American journal of pharmaceutical education, 72*(2), 43.
- Gan, W. Q., Sanderson, W. T., Browning, S. R., & Mannino, D. M. (2017). Different types of housing and respiratory health outcomes. *Preventive medicine reports, 7*, 124-129.
- Han, K. T., Park, E. C., Kim, J. H., Kim, S. J., & Park, S. (2014). Is marital status associated with quality of life? *Health and quality of life outcomes, 12*(1), 109.

- Howden-Chapman, P., Pierse, N., Nicholls, S., Gillespie-Bennett, J., Viggers, H., Cunningham, M., ... & Chapman, R. (2008). Effects of improved home heating on asthma in community dwelling children: randomised controlled trial. *Bmj*, *337*, a1411.
- Hunter, P. R., MacDonald, A. M., & Carter, R. C. (2010). Water supply and health. *PLoS medicine*, *7*(11), e1000361.
- Ineichen, B. (2003). *Homes and Health: How housing and health interact*. Routledge.
- Iwarsson, S., Haak, M., & Slaug, B. (2012). Current developments of the Housing Enabler methodology. *British Journal of Occupational Therapy*, *75*(11), 517-521.
- Jacobs, B., Bigdeli, M., Annear, P. L., & Van Damme, W. (2011). Addressing access barriers to health services: an analytical framework for selecting appropriate interventions in low-income Asian countries. *Health policy and planning*, *27*(4), 288-300.
- Jamoom, E. W., Horner-Johnson, W., Suzuki, R., Andresen, E. M., & Campbell, V. A. (2008). Age at disability onset and self-reported health status. *BMC Public Health*, *8*(1), 10.
- Joung, I. M. (1997). The relationship between marital status and health. *Nederlands tijdschrift voor geneeskunde*, *141*(6), 277-282.
- Kaleta, D., Makowiec-Dąbrowska, T., & Jegier, A. (2008). Employment status and self-rated health. *International Journal of Occupational Medicine and Environmental Health*, *21*(3), 227-236.
- Kimani, J. K., Ettarh, R., Kyobutungi, C., Mberu, B., & Muindi, K. (2012). Determinants for participation in a public health insurance program among residents of urban slums in Nairobi, Kenya: results from a cross-sectional survey. *BMC health services research*, *12*(1), 66.
- Kothari, C. R. (2004). *Research methodology: Methods and techniques*. New Age International.
- Krieger, J., & Higgins, D. L. (2012). Housing and health: time again for public health action. *American journal of public health*, *92*(5), 758-768.

- Kwon, K., Park, J. B., Lee, K. J., & Cho, Y. S. (2016). Association between employment status and self-rated health: Korean working conditions survey. *Annals of occupational and environmental medicine*, 28(1), 43.
- Lakshminarayanan, S. (2011). Role of government in public health: Current scenario in India and future scope. *Journal of Family and Community Medicine*, 18(1), 26.
- Lawrence, E. M., Rogers, R. G., Zajacova, A., & Wadsworth, T. (2018). Marital Happiness, Marital Status, Health, and Longevity. *Journal of Happiness Studies*, 1-23.
- Loem, G. F., Schirmer, H., Wang, C. E., & Emaus, N. (2017). Ageing and mental health: changes in self-reported health due to physical illness and mental health status with consecutive cross-sectional analyses. *BMJ open*, 7(1), e013629.
- Luo, Y., & Waite, L. J. (2014). The impact of childhood and adult SES on physical, mental, and cognitive well-being in later life. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, 60(2), S93-S101.
- Mansfield, E. R., & Helms, B. P. (1982). Detecting multicollinearity. *The American Statistician*, 36(3a), 158-160.
- Maqbool, N., Ault, M., & Viveiros, J. (2015). *The impacts of affordable housing on health: A research summary*. Center for Housing Policy.
- Mara, D., Lane, J., Scott, B., & Trouba, D. (2010). Sanitation and health. *PLoS medicine*, 7(11), e1000363.
- Matte, T. D., & Jacobs, D. E. (2000). Housing and health—current issues and implications for research and programs. *Journal of Urban Health*, 77(1), 7-25.
- Muchukuri, E., & Grenier, F. R. (2009). Social determinants of health and health inequities in Nakuru (Kenya). *International journal for equity in health*, 8(1), 16.
- Mwaura, J. W., & Pongpanich, S. (2012). Access to health care: the role of a community-based health insurance in Kenya. *Pan African Medical Journal*, 12(1).
- Northridge, J., Ramirez, O. F., Stingone, J. A., & Claudio, L. (2010). The role of housing type and housing quality in urban children with asthma. *Journal of Urban Health*, 87(2), 211-224.

- Ogundahunsi, D. S., & Adejuwon, S. A. (2014). Housing condition and health relationships in ijeda-ijesa and iloko-ijesa, Osun State, Nigeria. *Global Journal of Human-Social Science Research*.
- Olivier, J., Tsimpo, C., Gemignani, R., Shojo, M., Coulombe, H., Dimmock, F., ... & Haakenstad, A. (2015). Understanding the roles of faith-based health-care providers in Africa: review of the evidence with a focus on magnitude, reach, cost, and satisfaction. *The Lancet*, 386(10005), 1765-1775.
- Page, C. P., & Spina, D. (2012). Selective PDE inhibitors as novel treatments for respiratory diseases. *Current opinion in pharmacology*, 12(3), 275-286.
- Pearson, K. (1905). *On the general theory of skew correlation and non-linear regression* (No. 14). Dulau and Company.
- Pollack, C., Sadegh-Nobari, T., Dekker, M., Egerter, S., & Braveman, P. (2008). Where we live matters for our health: the links between housing and health.
- Power, A. (2008). Does demolition or refurbishment of old and inefficient homes help to increase our environmental, social and economic viability? *Energy Policy*, 36(12), 4487-4501.
- Prior, P. M., & Hayes, B. C. (2003). The relationship between marital status and health: An empirical investigation of differences in bed occupancy within health and social care facilities in Britain, 1921-1991. *Journal of family Issues*, 24(1), 124-148.
- Prüss-Ustün, A., Bartram, J., Clasen, T., Colford Jr, J. M., Cumming, O., Curtis, V., ... & Freeman, M. C. (2014). Burden of disease from inadequate water, sanitation and hygiene in low-and middle-income settings: a retrospective analysis of data from 145 countries. *Tropical Medicine & International Health*, 19(8), 894-905.
- Purdie, D. M., Dunne, M. P., Boyle, F. M., Cook, M. D., & Najman, J. M. (2002). Health and demographic characteristics of respondents in an Australian national sexuality survey: comparison with population norms. *Journal of Epidemiology & Community Health*, 56(10), 748-753.
- Rah, J. H., Cronin, A. A., Badgaiyan, B., Aguayo, V. M., Coates, S., & Ahmed, S. (2015). Household sanitation and personal hygiene practices are associated with child

- stunting in rural India: a cross-sectional analysis of surveys. *BMJ open*, 5(2), e005180.
- Rana, A. M., Wahlin, Å., Lundborg, C. S., & Kabir, Z. N. (2009). Impact of health education on health-related quality of life among elderly persons: results from a community-based intervention study in rural Bangladesh. *Health promotion international*, 24(1), 36-45.
- Republic of Kenya (2007), Housing Sector Incentives and Market Re – Engineering Measures, *Ministry of Housing*
- Robroek, S. J., Schuring, M., Croezen, S., Stattin, M., & Burdorf, A. (2013). Poor health, unhealthy behaviors, and unfavorable work characteristics influence pathways of exit from paid employment among older workers in Europe: a four-year follow-up study. *Scandinavian journal of work, environment & health*, 125-133.
- Rourke, S. B., Bekele, T., Tucker, R., Greene, S., Sobota, M., Koornstra, J., ... & Watson, J. (2012). Housing characteristics and their influence on health-related quality of life in persons living with HIV in Ontario, Canada: results from the positive spaces, healthy places study. *AIDS and Behavior*, 16(8), 2361-2373.
- Roys, M., Davidson, M., Nicol, S., Ormandy, D., & Ambrose, P. (2010). *The real cost of poor housing*. Bre Press.
- Saikia, N., & Bora, J. K. (2016). Gender difference in health-care expenditure: evidence from India human development survey. *PloS one*, 11(7), e0158332.
- Shapiro, S. S., & Wilk, M. B. (1965). An analysis of variance test for normality (complete samples). *Biometrika*, 52(3/4), 591-611.
- Taylor, L. A., Tan, A. X., Coyle, C. E., Ndumele, C., Rogan, E., Canavan, M., ... & Bradley, E. H. (2016). Leveraging the social determinants of health: what works? *PLoS One*, 11(8), e0160217.
- Thomas, O., Brenda., Laura Atukunda, Sarah Lebu, Samira Nuru (2018) MUKURU SPECIAL PLANNING AREA RAPID HEALTH IMPACT ASSESSMENT
- Thomson, H., & Thomas, S. (2015). Developing empirically supported theories of change for housing investment and health. *Social Science & Medicine*, 124, 205-214.

- Tran, B. X., Nguyen, L. H., Nong, V. M., & Nguyen, C. T. (2016). Health status and health service utilization in remote and mountainous areas in Vietnam. *Health and quality of life outcomes*, 14(1), 85.
- Van der Heide, I., Wang, J., Droomers, M., Spreeuwenberg, P., Rademakers, J., & Ueters, E. (2013). The relationship between health, education, and health literacy: results from the Dutch Adult Literacy and Life Skills Survey. *Journal of health communication*, 18(sup1), 172-184.
- Vlassoff, C. (2007). Gender differences in determinants and consequences of health and illness. *Journal of health, population, and nutrition*, 25(1), 47.
- Wang, Y. P., & Murie, A. (2011). The new affordable and social housing provision system in China: implications for comparative housing studies. *International Journal of Housing Policy*, 11(3), 237-254.
- Water and Sanitation in Urban Malawi: *can the Millennium Development Goals be Met? A Study of Informal Settlements in Three Cities – Mtafu A. Zeleza Manda* (2010).
- World Health Organization (2017). Include a social determinants of health approach to reduce health inequities. *Public Health Reports*, 125(4_suppl), 6-7.
- World Health Organization. (2014). *Social determinants of mental health*. World Health Organization.

APPENDICES

Appendix I: Questionnaire

SURVEY QUESTIONNAIRE **(SUBSTANDARD HOUSING ON TENANTS' HEALTH STATUS IN MUKURU** **ESTATE; A SOCIAL DETERMINANT OF HEALTH PERSPECTIVE)**

Introduction

Hello, my name is Alex Mwangi Mucheru a Student at the University of Nairobi investigating substandard housing on tenant's health status in Mukuru Estate; a social determinant of health perspective. You have been chosen at random to be in a study about how substandard housing impact the health of tenants. This study involves research whose purpose is to understand your knowledge on substandard housing and other social determinant of health. This will take fifteen minutes of your time. There are no foreseeable risks or benefits to you for participating in this study. There is no cost or payment to you. If you have questions while taking part, please stop me and ask. We will do our best to keep your information confidential but we cannot guarantee absolute confidentiality. If you have questions about this research study you may contact principal investigator- Alex Mucheru at phone number 0722462798. If you feel as if you were not treated well during this study, or have questions concerning your rights as a research participant call The Secretary/Chairperson KNH-UoN ERC on Tel. No. 2726300 Ext 44102. Your participation in this research is voluntary, and you will not be penalized or lose benefits if you refuse to participate or decide to stop. May I continue?

Household Number		
No	Questions	Please indicate your option
1.	<u>OBSERVATION (Question 1 – 10)</u> Type of house hold unit 1. Self-contained 2. Double room 3. Single room	
2.	If single room/double room what is the number of sanitary facilities per floor 1. Number of toilets..... 2. Number of showers... 3. Number of wash hand basins...	

3.	Cracks (visible) a. Walls 1. Yes 2. No b. Floor 1. Yes 2. No	
4.	Signs of leakage/dampness a. Wall 1. Yes 2. No a. Floor 1. Yes 2. No	
5.	Natural lighting 1. Good (20% of floor area) 2. Poor (10- 15% of floor area) 3. Very poor (less than 10%)	
6.	Ventilation 1. Good (if permanent vent and openable windows) 2. Poor (if either one) 3. Very poor (if none)	
7.	Stair case accessibility 1. Good (above 4feet) 2. Poor (3-3.5feet) 3. Very poor (less than 3feet)	
8.	Solid waste disposal (garbage) space provided 1. Yes 2. No	

9.	<p>Electrical wired exposed</p> <ol style="list-style-type: none"> 1. Yes 2. No 	
10	<p>Is the building encroaching the street?</p> <ol style="list-style-type: none"> 1. Yes 2. No 	
11	<p>What is the wall material of your dwelling unit?</p> <ol style="list-style-type: none"> 1. Stone 2. Brick/Block 3. Mud 4. Wood 5. Corrugated iron sheets 6. Grass/Reeds 	
12	<p>What is the roof material of your dwelling unit?</p> <ol style="list-style-type: none"> 1. Makuti 2. Corrugated iron sheets 3. Concrete 4. Tiles 	
13	<p>What is the floor material of your dwelling unit?</p> <ol style="list-style-type: none"> 1. Wood 2. Tiles 3. Cement 4. Earth 	
14	<p>Have you or any household member of your family visited the health facility in the last 3 months</p> <ol style="list-style-type: none"> 1. Yes 2. No 	
15	<p>If yes what was diagnosed as the problem</p> <ol style="list-style-type: none"> 1. Upper respiratory infection 2. Water related illness 3. Food poisoning 4. Injuries 5. Others 	

16	<p>Have your child/children ever diagnosed with vision impairment or rickets?</p> <ol style="list-style-type: none"> 1. Yes 2. No 	
17	<p>How difficult or easy was it to obtain the healthcare services you needed within the past three months?</p> <ol style="list-style-type: none"> 1. Very difficult 2. Difficult 3. Moderate 4. Easy 5. Very easy 	
18	<p>Do you experience financial difficulties as a result of spending on healthcare?</p> <ol style="list-style-type: none"> 1. Never 2. Rarely 3. Sometimes 4. Regularly 5. Always 	
19	<p>In the past 3 months, did you reduce your spending on essential needs, such as food or clothing, to be able to cover healthcare costs?</p> <ol style="list-style-type: none"> 1. Yes 2. No 	
20	<p>What do you think are the features of quality affordable standard housing?</p> <ul style="list-style-type: none"> <input type="checkbox"/> Self-contained house <input type="checkbox"/> Proper lighting and ventilation <input type="checkbox"/> Tiled housing <input type="checkbox"/> House with electricity connection <input type="checkbox"/> House with running water <input type="checkbox"/> House with proper security systems 	
21	<p>Do you think the house you are living in is of quality standard material?</p> <ol style="list-style-type: none"> 1. Yes 2. No 	

22	<p>If yes, Are you able to pay this rent consistently?</p> <ol style="list-style-type: none"> 1. Yes 2. No 	
23	<p>What is your main source of water for drinking and for other uses? (if more than one reasons, rank them in order of priority)</p> <ol style="list-style-type: none"> 1. Pond/Dam 2. River/Stream/Spring 3. Well/Borehole 4. Nairobi Water connected inside home 5. Water vendor 6. Rain/Harvested 	
24	<p>Do you experience frequent water shortages?</p> <ol style="list-style-type: none"> 1. Yes 2. No 	
25	<p>What is the time taken to get to the water source?</p> <ol style="list-style-type: none"> 1. 0 – 20 minutes 2. 21 – 30 minutes 3. 31 -60 minutes 4. Over 1 hour 	
26	<p>Do you experience constant blockage in your sanitary facility?</p> <ol style="list-style-type: none"> 1. Yes 2. No 	
27	<p>What is your main domestic waste water disposal?</p> <ol style="list-style-type: none"> 1. Main Sewer 2. Septic tank/Bio digester 3. Conservancy tank 4. Discharge to the river 	
28	<p>What is the main toilet facility for this household?</p> <ol style="list-style-type: none"> 1. Use closed pour flush toilet 2. Use pit latrine with slab 3. Bucket 	

	<ul style="list-style-type: none"> 4. Bush 5. Flying toilet 	
29	<p>How many households use this toilet facility?</p> <ul style="list-style-type: none"> 1. One household 2. Two households 3. Three households 4. Over three households 	
30	<p>Is there a set place to wash hand after visiting the toilet?</p> <ul style="list-style-type: none"> 1. Yes 2. No 	
31	<p>Are you satisfied with sewerage services provided by your local authority?</p> <ul style="list-style-type: none"> 1. Yes 2. No 	
32	<p>Do you think there is adequate sewage disposal in the estate?</p> <ul style="list-style-type: none"> 1. Yes 2. No 	
33	<p>What is your main mode of lighting?</p> <ul style="list-style-type: none"> 1. Electricity 2. Pressure lamp 3. Lantern 4. Tin lamp 5. Gas lamp 6. Firewood 7. Solar 8. Natural lighting 	
34	<p>Do you switch on the light during daytime?</p> <ul style="list-style-type: none"> 1. Yes 2. No 	
35	<p>Does your sleeping area/bedroom have any window?</p> <ul style="list-style-type: none"> 1. Yes 	

	2. No	
36	<p>Have you ever had any injury within the building?</p> <ol style="list-style-type: none"> 1. Yes 2. No 	
37	<p>What is your main type of cooking fuel?</p> <ol style="list-style-type: none"> 1. Electricity 2. Gas 3. Firewood 4. Kerosene 5. Biogas 6. Charcoal 	
38	<p>Do you experience dizziness when cooking fuel is on?</p> <ol style="list-style-type: none"> 1. Yes 2. No 	
39	<p>In your own opinion, should the government or public agencies regulate house rents?</p> <ol style="list-style-type: none"> 1. Yes 2. No 	
40	<p>What is your age?</p> <ol style="list-style-type: none"> 1. Less than 18 years 2. 18 years and above 	
41	<p>What is your marital status?</p> <ol style="list-style-type: none"> 1. Married 2. Divorced 3. Widow 4. Widower 5. Single 	
42	<p>What is your highest education level?</p> <ol style="list-style-type: none"> 1. Primary 2. Secondary 3. College 4. Undergraduate 5. Postgraduate 6. No education 	

43	What is your employment status? 1. Employed 2. Not employed	
44	Gender of the household head 1. Male 2. Female	

The END!!!

Thank you for Participating in the Survey!!

Appendix II: Consent form

Hello, my name is Alex Mwangi Mucheru a Student at the University of Nairobi investigating substandard housing on tenant's health status in Mukuru Estate; a social determinant of health perspective. You have been chosen at random to be in a study about how substandard housing impact the health of tenants. This study involves research whose purpose is to understand your knowledge on substandard housing and other social determinant of health. This will take fifteen minutes of your time. There are no foreseeable risks or benefits to you for participating in this study. There is no cost or payment to you. If you have questions while taking part, please stop me and ask. We will do our best to keep your information confidential but we cannot guarantee absolute confidentiality. If you have questions about this research study you may contact principal investigator- Alex Mucheru at phone number 0722462798. If you feel as if you were not treated well during this study, or have questions concerning your rights as a research participant call The Secretary/Chairperson KNH-UoN ERC on Tel. No. 2726300 Ext 44102. Your participation in this research is voluntary, and you will not be penalized or lose benefits if you refuse to participate or decide to stop. May I continue?

I certify that I have consented the participant (code no.) _____

Researcher's name: _____

Signature: _____

Date: _____

Appendix III: KNH-UON Ethics and Research Committee Approval Letter



UNIVERSITY OF NAIROBI
COLLEGE OF HEALTH SCIENCES
P O BOX 19676 Code 00202
Telegrams: varsity
Tel:(254-020) 2726300 Ext 44355

KNH-UON ERC
Email: uonknh_erc@uonbi.ac.ke
Website: <http://www.erc.uonbi.ac.ke>
Facebook: <https://www.facebook.com/uonknh.erc>
Twitter: @UONKNH_ERC https://twitter.com/UONKNH_ERC



KENYATTA NATIONAL HOSPITAL
P O BOX 20723 Code 00202
Tel: 726300-9
Fax: 725272
Telegrams: MEDSUP, Nairobi

Ref: KNH-ERC/A/296

1st August, 2019

Alex Mwangi Mucheru
Reg. No.X53/6506/2017
School of Economics
College of Humanities and Social Sciences
University of Nairobi



Dear Alex

RESEARCH PROPOSAL: SUBSTANDARD HOUSING ON TENANTS' HEALTH STATUS IN MUKURU ESTATE; A SOCIAL DETERMINANT OF HEALTH PERSPECTIVE (P443/06/2019)

This is to inform you that the KNH- UoN Ethics & Research Committee (KNH- UoN ERC) has reviewed and **approved** your above research proposal. The approval period is 1st August 2019 – 31st July 2020.

This approval is subject to compliance with the following requirements:

- a. Only approved documents (informed consents, study instruments, advertising materials etc) will be used.
- b. All changes (amendments, deviations, violations etc.) are submitted for review and approval by KNH-UoN ERC before implementation.
- c. Death and life threatening problems and serious adverse events (SAEs) or unexpected adverse events whether related or unrelated to the study must be reported to the KNH-UoN ERC within 72 hours of notification.
- d. Any changes, anticipated or otherwise that may increase the risks or affect safety or welfare of study participants and others or affect the integrity of the research must be reported to KNH- UoN ERC within 72 hours.
- e. Clearance for export of biological specimens must be obtained from KNH- UoN ERC for each batch of shipment.
- f. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. (*Attach a comprehensive progress report to support the renewal*).
- g. Submission of an *executive summary* report within 90 days upon completion of the study. This information will form part of the data base that will be consulted in future when processing related research studies so as to minimize chances of study duplication and/ or plagiarism.

Protect to discover

Appendix IV: Research Authorization Letter from Nairobi City County

NAIROBI CITY COUNTY

Telephone: +254 20 2221349
Web: www.nairobi.go.ke



City Hall
P .o. box 30075-00100
Nairobi
Kenya

DEPARTMENT OF HUMAN RESOURCES DEVELOPMENT

Ref: NCC/HRD/HRM/2/684/2019

Date: 6th June 2019

Mr. Alex Mwangi Mucheru Reg No. X53/6506/2017
University Of Nairobi
P.O.BOX 30197-00100 G.P.O
Nairobi

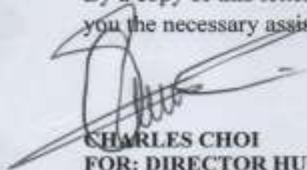
RE: RESEARCH AUTHORIZATION

Reference is hereby made to your application letter dated 6TH June 2019, on the above subject matter;

The Nairobi City County has approved your request subject to the following;

1. The period of research will be One (1) month with effects from 10th June 2019 ending July 2019.
2. You will be allowed to information in specific areas of study at Mukuru.
3. That during your research, there will be no costs developing on the County.
4. The research will be used for academic purposes only.
5. That you undertake to indemnify the County against any claim that may arise from your research study.
6. You are not authorized to release any information without vetting and authority from this office.
7. You are expected to submit to undersigned copy of the final research document for the county's retention (within one week after research).

By a copy of this letter, the **Chief Administrative Officer** Health services is requested to accord you the necessary assistance.



CHARLES CHOI
FOR: DIRECTOR HUMAN RESOURCE DEVELOPMENT

Appendix V: Budget

No.	Items /activities	Amount (Kshs.)
1	Stationery (pens, Reams of paper, Printing toner, photocopy, etc.)	70,000.00
2	Transport	30,000.00
3	Lunch	10,000.00
4	Data Collection and Co-ordination and communication Expenses	15,000.00
5	Fee for Ethics and Review Committee	10,000.00
6	10% contingency	8,000.00
	TOTAL	143,000.00

Appendix VI: Letter from University of Nairobi



UNIVERSITY OF NAIROBI SCHOOL OF ECONOMICS

Telephone: +254-020-3118262 Ext.28122
Telephone: +254-20-4913206
Email: economics@uonbi.ac.ke
Website: economics.uonbi.ac.ke

P.O. Box 30197-00100 GPO
04 Herry Thuku Road
Gandhi Wing, Room GIV 210
NAIROBI, KENYA

23/05/2019

TO WHOM IT MAY CONCERN

Dear Sir/Madam,

RE : ALEX MWANGI MUCHERU - REG. NO, X53/6506/2017

This is to confirm that the above named is a Master of Science in Health Economics and Policy student in the School of Economics, University of Nairobi.

We also wish to confirm that the student has completed his coursework and he is currently working on the research paper entitled "Substandard Housing on Tenants Health Status in Mukuru; Social Determinants of Health Perspective" He will require data for the project to be satisfactorily completed.

In light of this information, we request your kind consideration in providing him with any assistance that he may require.

