

**FACTORS AFFECTING ROOF GARDEN DESIGN IN
THE PLANNING AND DESIGN OF HOSPITAL
BUILDING**

BY

NOURA RAMADAN ELASNAEI IBRAHIM

**A thesis submitted in fulfilment of the requirement for the
degree of Master of Science (Built Environment)**

**Kulliyyah of Architecture and Environmental Design
International Islamic University Malaysia**

FEBRUARY 2020

ABSTRACT

This research focuses the factors affecting the implementation of roof gardens in the processes of planning and design of hospital building that would contribute to the quality improvement of future design of roof gardens. The premise of study is to review, identify and establish the significant relationships between the roof gardens and the healing environment in hospital buildings. At the outset, an overview of hospital development, principles of design and ways to achieve hospital roof gardens design that would enhance healing in hospital patients were reviewed. The physical factors affecting the planning and design of roof gardens in creating a healing environment of hospital buildings were identified and classified into three categories: design, climate and construction. The impacts and significance of roof gardens on the environment, economics, and humans (staff and patients) in hospital buildings were also discussed. The methodology employed in this study includes both qualitative and quantitative approaches. A questionnaire survey was developed and distributed to 86 respondents (patients and medical staff) randomly selected from Serdang Hospital to measure the visibility, accessibility, availability, and satisfaction of hospital roof gardens and its relation to the healing process. Field observations were also conducted in the study. The study successfully identified the key factors to be addressed and considered to enhance the design and planning for future hospital roof gardens that include (1) location, accessibility and visibility, (2) comfortability and familiarity, (3) safety and security, (4) senses stimulation, and (5) service and maintenance. The preliminary findings conclude that there is a significant positive relationship between hospital roof gardens and the patients' healing process. The study highlighted that the need for future healthcare designers to collaborate with multi-disciplinary teams in the integration of roof gardens in the planning and design of hospital building in order to improve the quality of healing environment.

خلاصة البحث

يركز هذا البحث على العوامل التي تؤثر على تنفيذ حدائق الأسقف في عمليات تخطيط وتصميم مبنى المستشفى والتي من شأنها أن تسهم في تحسين جودة التصميم المستقبلي للحدائق على الأسطح. إن أساس الدراسة هو مراجعة وتحديد وإقامة العلاقات الهامة بين حدائق السطح والبيئة العلاجية في المستشفيات. في البداية، تم استعراض لمحة عامة عن تطوير المستشفى، ومبادئ التصميم وطرق تحقيق تصميم حدائق الأسقف التي من شأنها تعزيز الشفاء للمرضى في المستشفيات. تم تحديد العوامل التي تؤثر على تخطيط وتصميم حدائق الأسقف في خلق بيئة علاجية في المستشفيات وتصنيفها إلى ثلاث فئات: التصميم والمناخ والبناء. كما تمت مناقشة تأثير وأهمية حدائق الأسقف على البيئة والاقتصاد والبشر (الموظفين والمرضى) في المستشفيات. المنهجية المستخدمة في هذه الدراسة تشمل كلا النهج النوعي والكمي. تم إعداد استبيان تم توزيعه على 86 مستجيب (مرضى وموظفين طبيين) تم اختيارهم عشوائياً من مستشفى سيردانغ لقياس إمكانية الرؤية، وإمكانية الوصول، والتوافر، ورضاء حدائق السطح بالمشفى محل الدراسة وعلاقتها بعملية الشفاء. وقد أجريت أيضاً ملاحظات ميدانية في الدراسة. وقد نجحت الدراسة في تحديد العوامل الرئيسية التي ينبغي معالجتها والنظر فيها لتعزيز تصميم وتخطيط حدائق أسقف المستشفيات المستقبلية التي تشمل (1) الموقع وإمكانية الوصول والرؤية، (2) سهولة الاستخدام، (3) السلامة والأمن، (4) يستشعر التحفيز، و (5) الخدمة والصيانة. وتخلص النتائج الأولية إلى وجود علاقة إيجابية كبيرة بين حدائق أسطح المستشفيات وعملية الشفاء لدى المرضى. وأبرزت الدراسة أن الحاجة إلى مصممي الرعاية الصحية في المستقبل للتعاون مع فرق متعددة التخصصات في دمج حدائق السطح في تخطيط وتصميم مبنى المستشفى من أجل تحسين نوعية بيئة الشفاء.

APPROVAL PAGE

I certify that I have supervised and read this study and that in my opinion, it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a thesis for the degree of Master of Science (Built Environment)

.....
Srazali Aripin
Supervisor

.....
Norwina Mohd Nawawi
Co-Supervisor

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a thesis for the degree of Master of Science (Built Environment)

.....
Fadzidah Abdullah
Internal Examiner

.....
Hasanuddin Bin Lamit
External Examiner

This thesis was submitted to the Department of Architecture and is accepted as a fulfilment of the requirement for the degree of Master of Science (Built Environment)

.....
Srazali Aripin
Head, Department of Architecture

This thesis was submitted to the Kulliyah of Architecture and Environmental Design and is accepted as a fulfilment of the requirement for the degree of Master of Science (Built Environment)

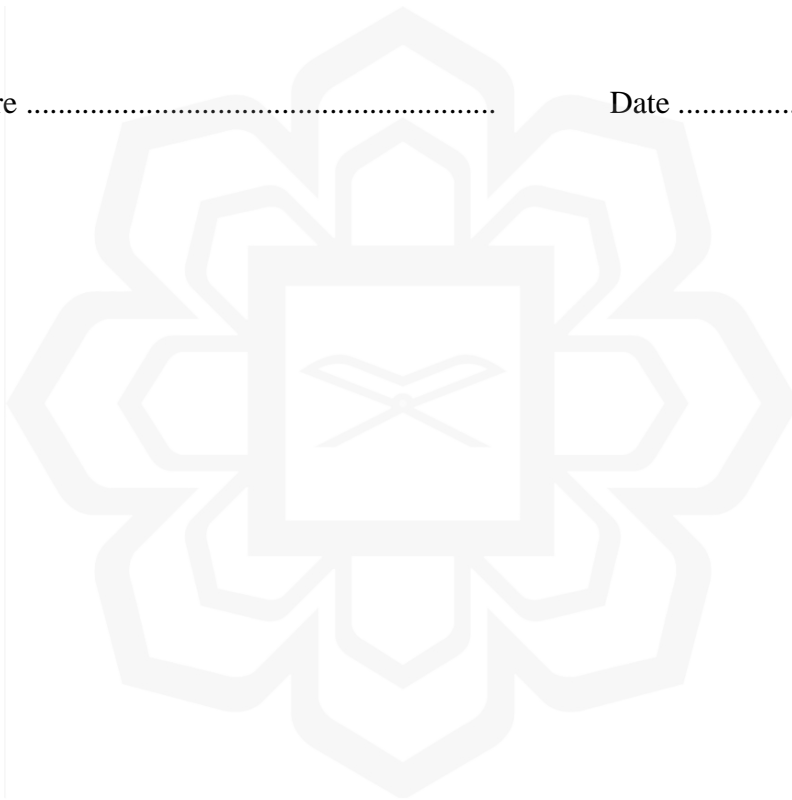
.....
Abdul Razak Sapin
Dean, Kulliyah of Architecture
and Environmental Design

DECLARATION

I hereby declare that this thesis is the result of my own investigations, except where otherwise stated. I also declare that it has not been previously or concurrently submitted as a whole for any other degrees at IIUM or other institutions.

Noura Ramadan Elasmaei Ibrahim

Signature Date



INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA

**DECLARATION OF COPYRIGHT AND AFFIRMATION OF
FAIR USE OF UNPUBLISHED RESEARCH**

**FACTORS AFFECTING ROOF GARDEN DESIGN IN THE
PLANNING AND DESIGN OF HOSPITAL BUILDING**

I declare that the copyright holders of this thesis are jointly owned by the student and IIUM.

Copyright © 2020 Noura Ramadan and International Islamic University Malaysia. All rights reserved.

No part of this unpublished research may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording or otherwise without prior written permission of the copyright holder except as provided below

1. Any material contained in or derived from this unpublished research may be used by others in their writing with due acknowledgement.
2. IIUM or its library will have the right to make and transmit copies (print or electronic) for institutional and academic purposes.
3. The IIUM library will have the right to make, store in a retrieved system and supply copies of this unpublished research if requested by other universities and research libraries.

By signing this form, I acknowledged that I have read and understand the IIUM Intellectual Property Right and Commercialization policy.

Affirmed by Noura Ramadan

.....
Signature

.....
Date

ACKNOWLEDGEMENTS

Firstly, it is my utmost pleasure to dedicate this work to my dear parents and my family, who granted me the gift of their unwavering belief in my ability to accomplish this goal: thank you for your support and patience.

I wish to express my appreciation and thanks to those who provided their time, effort and support for me and this project. To the members of my dissertation committee, thank you for sticking with me.

Finally, a special thanks to Asst. Prof. Ar. Dr. Srazali Aripin for his continuous support, encouragement, and leadership, and for that, I will be forever grateful.



TABLE OF CONTENTS

Abstract.....	ii
Abstract in Arabic.....	iii
Approval Page.....	iv
Declaration.....	v
Copyright Page.....	vi
Acknowledgements.....	vii
List of Tables.....	xii
List of Figures.....	xvi
CHAPTER ONE: INTRODUCTION.....	1
1.1 Introduction.....	1
1.2 Research Background.....	2
1.3 Statement of the Problem.....	4
1.4 Research Aim and Objectives.....	4
1.5 Research Questions.....	5
1.6 Literature Review.....	6
1.7 Significance of The Study.....	6
1.8 Scope of The Research.....	7
1.9 Methodology.....	7
1.9.1 Research Framework.....	8
1.9.2 Literature Review.....	9
1.9.3 Research Techniques and Field Study.....	10
1.9.3.1 Observation and Case Study.....	10
1.9.3.2 Questionnaire Survey.....	10
1.9.4 Results and Analyses.....	10
1.10 Organization of The Research.....	11
1.11 Summary.....	11
CHAPTER TWO: OVERVIEW ON THE DEVELOPMENT OF HOSPITAL DESIGN AND SUSTAINABILITY.....	12
2.1 Introduction.....	12
2.2 Healing Environment in Hospital Design.....	13
2.3 Historical Evolution of Hospital Designs.....	14
2.3.1 Hospitals in The Old Civilization.....	14
2.3.2 Hospital in Middle Ages and Medieval Monastic.....	18
2.3.2.1 In Europe.....	18
2.3.2.2 In The Middle East.....	18
2.3.3 The Renaissance.....	24
2.3.4 Hospital in The Modern Period.....	24
2.3.4.1 The Nightingale Movement.....	24
2.3.4.2 The Modern Hospital Until Now.....	25
2.4 Evolution of Hospital Designs in Malaysia.....	27
2.5 Sustainability in Hospital Designs.....	30
2.6 Summary.....	32

CHAPTER THREE: RESEARCH METHODOLOGY	34
3.1 Introduction	34
3.2 Understanding Healing Gardens and Its Design Characteristics	36
3.3 Types of Outdoor Spaces in Hospitals.....	37
3.3.1 Landscaped Grounds.....	37
3.3.2 Landscaped Setbacks	37
3.3.3 Front Porches.....	37
3.3.4 Entry Gardens.....	37
3.3.5 Courtyards	38
3.3.6 Plaza.....	38
3.3.7 Viewing Gardens	38
3.3.8 The Viewing/Walk-in Garden.....	38
3.3.9 Roof Garden and Terrace Garden.....	38
3.4 Roof Garden Design in Hospital Building	39
3.5 Healing Garden Design Principles and Considerations	39
3.5.1 Unity, Simplicity, Rhythm and Repetition.....	39
3.5.2 Balance and Harmony and Contrast	40
3.5.3 Quiet & Comfort.....	41
3.5.4 Familiarity and Security.....	42
3.5.5 Privacy and Social Interaction.....	42
3.5.6 Form and Line Characteristic	43
3.5.7 Visibility, Accessibility, and Location	43
3.5.8 Senses Stimulation.....	44
3.6 Roof Garden in Hospitals and Its Types	45
3.7 The Impacts and Significance of Roof Garden in Hospital Building	48
3.7.1 Benefits of Roof Gardens in Buildings and Environment	49
3.7.2 Benefits for Staff	49
3.7.3 Benefits for Patients and Visitors	50
3.7.3.1 For Visitors.....	50
3.7.3.2 For patients.....	51
3.8 Summary	53
CHAPTER FOUR: FACTORS AFFECTING ROOF GARDEN PLANNING AND DESIGN	54
4.1 Introduction	54
4.2 Construction factors.....	55
4.2.1 Location	55
4.2.2 Building Height	56
4.2.3 Size and Area.....	56
4.2.4 Roof Deck	57
4.2.5 Load Requirement	57
4.2.6 Slope	59
4.2.7 Drainage	60
4.2.8 Waterproofing	65
4.2.9 Protection Layers.....	67
4.3 Climatic Factors.....	69
4.3.1 Wind.....	70
4.3.2 Rainfall and Irrigation.....	74
4.3.3 Solar Radiation	75

4.3.4 Shade.....	77
4.3.5 Microclimate	79
4.3.6 Temperature	79
4.4 Designing Factors	81
4.4.1 Location	81
4.4.2 Accessibility	82
4.4.3 Visibility.....	83
4.4.4 Safety	83
4.4.5 Maintenance	84
CHAPTER FIVE: RESEARCH METHODOLOGY	87
5.1 Introduction	87
5.2 Research Framework.....	89
5.3 Research Methodology.....	91
5.3.1 Methodological Approach.....	91
5.3.2 Methodologies by Other Researchers	93
5.3.3 Methodological Approach of The Study.....	93
5.4 The Secondary Data and Literature Review.....	94
5.5 the Primary Data	95
5.5.1 Case Study	95
5.5.2 Observation	96
5.6 The Quantitate Method	97
5.6.1 Staff Survey	98
5.6.1.1 Survey Structure	98
5.6.2 Patient Survey.....	100
5.6.2.1 Survey Structure	101
5.7 Reliability of The Surveys.....	102
5.8 Approach To Data Analysis	102
5.8.1 Data Analysis	103
5.9 Limitation	103
5.10 Summary	104
CHAPTER SIX: ROOF GARDEN DESIGN IN HOSPITAL BUILDING: A CASE STUDY	105
6.1 Introduction	105
6.2 A Case Study	105
6.3 The Case Study Data Collection Procedure	106
6.3.1 Location	106
6.4 Serdang Hospital Users	107
6.5 Serdang Hospital History and Design	108
6.6 Design Defects and Maintenances	109
6.7 Serdang Therapeutic Roof Garden	110
6.8 Vegetation	114
6.9 Lighting.....	115
CHAPTER SEVEN: RESULT AND ANALYSIS: THE QUESTIONNAIRE SURVEY AND THE OBSERVATION	117
7.1 Introduction	117
7.2 Aims and Objectives	118

7.3 Survey Methodology.....	118
7.4 Target Group and Sampling Criteria.....	120
7.5 The Survey Preparation.....	120
7.6 The Pilot Study	121
7.7 The Survey Distribution and The Responding Rates.....	122
7.8 Method of Analysis s	123
7.9 The Staff Survey	123
7.10 The Patient Survey	142
7.11 Observation.....	167
7.12 Result and Discussion of The Observation	167
7.12.1 Location and Visibility.....	167
7.12.2 Accessibility	168
7.12.3 Comfortability and Familiarity.....	168
7.12.4 Senses Stimulation.....	172
7.12.5 Security and Safety	173
7.12.6 Offering Different Spaces and Activity	174
7.12.7 Services and Maintenance	175
CHAPTER EIGHT: DISCUSSIONS AND CONCLUSIONS	177
8.1 Discussion on The Finding.....	177
8.1.1 Location, Accessibility, & Visibility	178
8.1.2 Comfortability and Familiarity.....	179
8.1.3 Safety and Security	180
8.1.4 Senses Stimulation.....	180
8.1.5 Service and Maintenance	181
8.2 Conclusion.....	182
8.3 Recommendation	183
REFERENCES	186
APPENDIX A: QUESTIONNAIRE FOR THE PATIENT.....	210
APPENDIX B: QUESTIONNAIRE FOR THE HOSPITAL STAFF.....	213

LIST OF TABLES

Table 3.1	Comparison of the three types of roof garden methods	47
Table 4.1	Drainage System Types	64
Table 5.1	The Methods Types Used to Achieve Each of The Research Objectives	92
Table 5.2	The Cronbach's Alpha and Internal Consistency of The Statistical Reliability	102
Table 7.1	Staff Working Pattern	124
Table 7.2	Frequency Analysis of Gender Distribution of Hospital Staff	124
Table 7.3	Respondents' Age Group	125
Table 7.4	Hospital Staff Highest Qualification	125
Table 7.5	Hospital Staff Medical Service Level	126
Table 7.6	Average of Time Spend in The Hospital on A Working Day By The Staff.	126
Table 7.7	Respondents Agreement on Whether Garden Should Be Within The Hospital Building or Not	127
Table 7.8	Reason for Having Garden Within The Hospital Building By The Staff	128
Table 7.9	The Awareness of The Availability of Garden in Serdang Hospital	128
Table 7.10	Time to Spend in The Garden in A Day By The Hospital Staffs	129
Table 7.11	Relationship Between The Hospital Staff and Degree of Staying at The Garden Daily	130
Table 7.12	Hospital Staffs' Opinion on Where A Garden to Be Located in The Hospital Building	130
Table 7.13	Order of Priority of The Hospital Garden Planning and Design Attributes for Malaysian Medical Staffs at Serdang Hospital	132
Table 7.14	Level of Satisfaction with The Statement, Garden in Hospital is Important Factor for Patient's Healing By The Hospital Staffs	133

Table 7.15	Apart From Medicine, Garden in Hospital Influences Patients' Recovery	133
Table 7.16	Relationship Between Staff and Level of Satisfaction with The Statement, Garden in Hospital is Important Factor for Healing	134
Table 7.17	Level of Satisfaction with The Statement, Garden Should Be Closed to Patient's Ward	135
Table 7.18	Level of Satisfaction with The Statement, Location of Garden in A Hospital Should Be Accessible to All	135
Table 7.19	Relationship Between Staff and Level of Satisfaction with The Statement, Garden Should Be Closed to Patient's Ward	136
Table 7.20	Level of Satisfaction with The Statement, Thematic Garden is Good for End-Users in The Hospital	137
Table 7.21	Level of Satisfaction with The Statement, Garden in The Working Environment Would Contribute to Better Work Performance	137
Table 7.22	Level of Satisfaction with The Statement, Access to An Outside View is Important in The Ward Environment	138
Table 7.23	Level of Satisfaction on Whether There Should Be Enough Outside View in The Wards	138
Table 7.24	Hospital Staffs' Level of Satisfaction on Whether Access to A View will Contribute to Better Work Performance in The Participant Present Working Conditions.	139
Table 7.25	Hospital Staffs' Level of Satisfaction on Whether A View is Beneficial for Patients	139
Table 7.26	Relationship Between Staff and Level of Satisfaction with The Statement, A View is Beneficial for Patients	140
Table 7.27	Criticisms with Regards to The Physical Environment By The Hospital Staffs	141
Table 7.28	List of The Staff Suggestions for Improving The Hospital	141
Table 7.29	Frequency Analysis of Gender Distribution of Hospital Patients	143
Table 7.30	Respondents' Age Group	143
Table 7.31	Relationship Between Patients' Age Group and Degree of Staying at The Garden Daily	145

Table 7.32	Hospital Patients' Being in The Hospital for The First Time	145
Table 7.33	Time of Being Admitted in Serdang Hospital	146
Table 7.34	Patients' Length of Stay at Serdang Hospital Ward	146
Table 7.35	Patients' Expected Time of Release	147
Table 7.36	Patients' Awareness of Their Type of Illness	147
Table 7.37	Patients' Awareness of Their Type of Illness	148
Table 7.38	Patients' Opportunity to Move Around The Hospital	149
Table 7.39	Respondents Agreement on Whether Garden Should Be Within The Hospital Building or Not	149
Table 7.40	Reason for Having Garden Within The Hospital Building By The Hospital Patients'	150
Table 7.41	Availability of Garden in This Hospital	151
Table 7.42	Time to Spend in The Garden in a Day By The Hospital Staffs	151
Table 7.43	Relationship Between Gender and Degree of Staying at the Garden Daily	152
Table 7.44	Order of priority of The Hospital Garden Planning and Design Attributes for Malaysian Patients at Serdang Hospital	153
Table 7.45	Negative Experiences By Malaysian Patients in The Hospital Garden Planning and Design	153
Table 7.46	Level of Satisfaction with The Statement "Garden in Hospital is Important Factor for Healing By The Hospital Patients"	154
Table 7.47	Level of Satisfaction with The Statement "Garden Should Be Closed to The Patient's Ward By The Hospital Patients"	155
Table 7.48	The Relationship Between The Degree of Staying at The Garden Daily and Level of Satisfaction with The Statement, Garden Should be Closed to Patient's Ward	155
Table 7.49	Level of Satisfaction By Serdang Hospital Patients with The Statement "Location of Garden in A Hospital Should Be Accessible to All"	156
Table 7.50	The Relationship Between Degree of Staying at The Garden Daily and Level of Satisfaction with The statement "Location of Garden in A Hospital Should Be Accessible to All"	157

Table 7.51	Level of Agreement By Serdang Hospital Patients with The Statement “Thematic Garden is Good for End-Users in The Hospital”	158
Table 7.52	The Relationship Between The Degree of Staying at The Garden Daily and Level of Satisfaction with The Statement “Thematic Garden is Good for End-Users in The Hospital”	159
Table 7.53	The Mean of Overall Level of Satisfaction By The Patients	160
Table 7.54	Patients’ Opinion on Where A Garden to Be Located Within The Hospital Building	161
Table 7.55	Availability of Outside View From The Patients’ Bed at The Ward	162
Table 7.56	Level of Satisfaction with The View By Serdang Hospital From Their Ward	162
Table 7.57	Type of View That Can Be Seen From The Bed Location By The Patients	163
Table 7.58	Investigation of Whether The Patients are Happy with A ward with no Window	164
Table 7.59	Level of Satisfaction with The Present Window at Their Ward	164
Table 7.60	Investigation of The Patients’ Opinion on Access to A View	165
Table 7.61	Relationship Between Gender and Happy with a Ward with No Window	165
Table 7.62	Criticisms Regarding to The Physical Environment By Serdang Hospital Patients	166

LIST OF FIGURES

Figure 1.1	The Research Framework	8
Figure 2.1	Ancient Egyptian Healing God	15
Figure 2.2	Plan of The Temple of Asklepios	16
Figure 2.3	Temple of Asklepios, Hieron	17
Figure 2.4	Al-Arghuni Bimaristan in Damascus	20
Figure 2.5	Bimaristan AlNuri, Damascus	22
Figure 2.6	Mansuri Hospital	23
Figure 2.7	Florence Nightingale	25
Figure 2.8	Tomas hospital terrace, London, 1871	25
Figure 2.9	The Institute for Medical Research (IMR)	28
Figure 2.10	Klinik Desa (LAMA) at Selangor; Malaysia	29
Figure 2.11	Hospital Pusat Kesihatan, Malaysia	29
Figure 2.12	Bahru Hospital, Malaysia and Prince Court Hospital, Malaysia	30
Figure 4.1	Different Types of Roof Drain	61
Figure 4.2	Retrofit Drain system	65
Figure 4.3	The Plants Stolons and Rhizomes	67
Figure 4.4	Climate in Kuala Lumpur	70
Figure 4.5	Wind Speed	71
Figure 4.6	Wind Rose, Kuala Lumpur, Malaysia	72
Figure 4.7	An Average of Monthly Hours of The Sunshine Over The Year	76
Figure 4.8	Cloudy, Sunny, and Precipitation Days	78
Figure 4.9	Maximum Temperature	80

Figure 4.10	Average Minimum and Maximum Temperature Over The Year	80
Figure 5.1	The Chapter Diagram	88
Figure 5.2	The Study Framework	89
Figure 5.3	The Triangulation Design of This Study	92
Figure 5.4	Location Map for Serdang Hospital	96
Figure 6.1	Location of Hospital Serdang	106
Figure 6.2	A Drawing Map That Highlights Area Around Serdang hospital	107
Figure 6.3	Serdang Hospital Location	107
Figure 6.4	An Eagle-eye Photo for Serdang Hospital and University Putra	107
Figure 6.5	An Eagle-eye Photo for Serdang Hospital	108
Figure 6.6	A Patient Waiting Area for Registration at Serdang Hospital	108
Figure 6.7	Ceiling Fullier at Serdang Hospital	109
Figure 6.8	Level 2 Plan of Serdang Hospital	111
Figure 6.9	Level 3 Plan of Serdang Hospital	111
Figure 6.10	Level 4 Plan of Serdang Hospital	112
Figure 6.11	Level 6 Plan of Serdang Hospital	112
Figure 6.12	Level 7 Plan of Serdang Hospital	113
Figure 6.13	Level 5 Plan of Serdang Hospital	113
Figure 6.14	Figure 6.14 Elevation View of The Hospital Shows The Gardens at Multi-Levels	114
Figure 6.15	View of Serdang Hospital Roof Gardens at Multi-Roof Levels	114
Figure 6.16	Serdang Hospital at Sunset Time	115
Figure 6.17	The Roof Garden at A Higher Level at Sunset time	115
Figure 6.18	Serdang Hospital Roof Garden at Night	116

Figure 7.1	The Survey Framework for Field-Work	119
Figure 7.2	Rating Scale Question With 7 Points	121
Figure 7.3	Question 3.5a From The Staff Survey	131
Figure 7.4	View of The Roof Garden at Different Levels of Serdang Hospital	168
Figure 7.5	Serdang Hospital Roof Garden at Level 6	169
Figure 7.6	Picture A & B Shows The View of The Covered Seating at Level 5	170
Figure 7.7	The View of The Two Open Seating Provided at The Hospital Roofs Gardens, source: taken by the author at level 2	170
Figure 7.8	Shows The Dramatically Changing at The path Wide Size	171
Figure 7.9	The Path Curve Line at One of The Serdang Hospital Roof Gardens	171
Figure 7.10	Shows The Path Ramp at Level 2 of Serdang Hospital Garden	171
Figure 7.11	Picture A & B Above Shows The Variation of A Texter and Material Usage at One of The Roof Gardens at Serdang Hospital; Source: Taken By The Author	172
Figure 7.12	Picture A & B Views The Lack of Color Availability in The Design	173
Figure 7.13	Picture A, & B Above Views The Usage of Bright Color	173
Figure 7.14	Picture A & B Above Shows The Cement Borders of The Roof Gardens; Source: Taken By The Author	174
Figure 7.15	Picture A & B Above Shows The Hierarchy Concept for The Roof Gardens; Source: Taken By The Author	174
Figure 7.16	The kids' playground at Level 2	175
Figure 7.17	Picture A, & B above Illustrate That Some of The Gardens were Used as A Storage Area; Source: Taken By The Author	176
Figure 7.18	Picture A, & B Above Indicate Some of The Maintenance Neglection	176

CHAPTER ONE

INTRODUCTION

1.1 INTRODUCTION

The quality of the buildings, in terms of physical planning and design, has significant influence, contributing to the quality of human life and well-being (Madanipour, 2010). Historically, gardens were recognized as meditation spots and healing hubs. Being around plants, in a garden has been intrinsically recognized to have good effect to human well-being (Barmelgy, 2013). With the ever-growing demand of population in the cities, a decline in green areas has been visible leading to negative effects on the environment. As a result, the benefits of being around the gardens and green areas are undeniable.

Gardens and paradises are often described as sacred and beautiful places in the teachings of many religions. From the Islamic perspective, running water, shade and exquisite greenery are mentioned in the Holy Quran as the main elements for physical and spiritual refreshment. In the Holy Quran, the word garden is referred to paradise as Jannat. Janata Firdaus is mentioned more than 120 times in the Holy Quran as an indication of relaxing, blissful and everlasting place also; it is viewed as a retreat, a refuge or a comfortable sanctuary for khalwa (Clark, 2011). In the Quran, a phrase that translates to “a garden with running rivers flowing underneath it” or jannatun Tajiri men tahtiha Aalanihar was used in the Holy Quran several times. On a deeper level, it symbolizes the purification of the soul with ever-flowing “waters” of the spirit. The use of water as a symbol of purification is used in several sacred traditions (Gilli, 2002).

An architectural example of that is the use of water in Alhambra palaces in Spain (Bennis, 2006). Built during the Islamic Andalusian era, the architecture responsible for designing the palace, used water to represent the gardens of paradise by building the Palace in a manner that would allow it to be reflected in the water fountain positioned opposite of it to symbolize the eternal hereafter. This palace is considered to be one of the most prominent representations of the gardens of paradise in the world.

The design and planning of hospital buildings dating to the Islamic civilizations had been contributed greatly to promote the concept of healing in healthcare facilities. The Islamic civilization stands out with its concern for the wellbeing of ones' body and soul. Both aspects of humans are considered equally important. The well-being of the body was viewed as necessary to elevate ones' quality of life. Prophet Mohammad, (peace be upon him) says in a hadith; "Your body has a right on you" (Bukhari, n.d.). In Islam, Muslims are required to fight the spread of disease and are urged to seek medical help when needed. Furthermore, the health system in the Islamic civilization is built on strong foundations (Ali, 2013).

Nowadays, approaches in research methodologies are being directed to the findings on health and the well-being of individuals. Researches in the field of built environment have been focusing on the impacts of gardens on human health and well-being. Therefore, there is growing research documenting the health benefits associated with gardens. These include reducing stress and improved health outcomes by having access to the garden or even having a view of the garden. Most researches in the field of healing environment have agreed that gardens and horticultural therapy are viable factors for healing (Schweitzer, Gilpin, & Frampton, 2004). Healing landscapes have become increasingly viable fields of research. Gardens in hospital designs appear to be

an appropriate strategy to achieve healing environments for patients, staff and visitors. Roof garden is considered as one of the practical ways for the implementation of gardens in hospital.

Thus, this study tends to focus on the integrations of roof garden design in the design and planning of hospital buildings in Malaysian context. What would be the factors affecting the integrations of roof gardens in the development of hospital buildings in Malaysia.

1.2 RESEARCH BACKGROUND

In the past, gardens used to be considered as an integral part of the healthcare facility. The gardens are used as a place for meditation and healing (Barmelgy, 2013). However, due to economic constraints, having gardens in the design of hospital buildings during the early 20th Century, were given less priority resulting the inability of patients to experience the benefits of being close to nature (Nedu & Krklješ, 2010). Until mid of the 20th-century researchers in quantifying, tried to understand and document the health effects of plants and highlighted the natural health service became especially important around healthcare and considered outdoor spaces as part of the healing facilities (Relf, 2005).

The integrated and developed design and planning of healthcare buildings are now more focused on patients' needs and satisfactions concerning the effects of the built environment, treatments and services on their health outcomes (Petros, 2011). This would shift the focus of hospital design and planning from a sterile to an environment that promotes healing. As a result, creating a healing environment should be the aim in the design and planning of hospital building with the attention providing the end-users (patients, staff and visitors) access to gardens. That is a paradigm shift

of attitudes towards a comprehensive approach of patients' health and well-being resulted in a considerable rise in interest of facilities (Nizarudin, 2012).

Hospitals are considered as a complex integral part of the healthcare industry. This complexity due to the variation of services that the hospital provides for its users, where patients seek out medical treatment and staff deliver continuous support (Aripin, 2006). Quality interventions have given new insight and scope for improvements, not only the services of the hospitals but also to make the great structure. Most healthcare designers accept the fact that hospital design is a complex task: functional and psychological alike (Hussain & Babalghith, 2014).

Thus, the aspects of healing environment in hospital design are primarily important and relevant within the context of sustainability in healthcare facilities to conceive the link and benefit of sustainability in contributing to the patients' health outcomes. The physical aspects such as daylighting, window design, and thermal conditions and etcetera, should be cleverly designed to achieve the balance and the principles of economic, social and ecological sustainability without compromising the functionality of hospital building so as to make the patient and employee friendly (Aripin, 2007).

Now with the cities becoming bigger and green areas have been eroding, most hospitals share limited land areas which opens the door for the healthcare designer creativity to obtain the best usability for the area design (El Barmelgy, 2013). As a result, designing rooftop gardens to be as part of hospitals facilities and to have a therapeutic function to give awareness of the positive influences of outdoor environment on patients' healing process have been presented in hospital design (Said, 2003a).

However, the application of green roofs in Malaysia is still infrequent whereby only a few buildings in Malaysia have adopted green roofs. Malaysian construction industry has realized that besides being aesthetically pleasing, application of green roofs provides numerous environmental, technical and owner benefits (Zahir, Raman, Mohamed, Jamiland, & Nopiah, 2014). For instance, green roofs mitigate Urban Heat Island by cooling and humidifying the surrounding air, creating a microclimate which has beneficial effects within the immediate area (Ismail, Aziz, Nasir, & Taib, 2012). For the technical benefit, green roofs also reduce stormwater run, improve the thermal resistance of the roof throughout the year and reduce noise levels especially for buildings near airports, factories or busy freeways (Hashemi, Mahmud, & Ashraf, 2015).

1.3 STATEMENT OF THE PROBLEM

The research problem identified in this research remains in the scarce of applying the roof gardens in hospital building in Malaysia. The preliminary finding indicates that there is a limited roof garden being adopted in the design and planning of hospital buildings in Malaysia.

As noted by Anna, Heylighen, Susanna and Marie (2017), Architecture to promote health and well-being is now considered as an important part of creating a health service of high quality. Developments in methodology put high demands on the design quality of care environments (Bromley, 2012) coupled with increasing expectations and demands from patients and staff that the environments should be person centered, welcoming, and accessible while also supporting privacy and security (Vischer, 2008; Volker, Lauche, Heintz, and de Jonge, 2008).

In addition, there are demands that decisions about the design of the hospital building be based on the best available information from credible research and evaluations of existing building projects (Ulrich, Berry, Quan, and Parish, 2010). Evidence-based design is now an established concept as an approach for quality improvements in the design process of new hospital building (Anna, Heylighen, Susanna and Marie, 2017). Consequently, it is essential to develop a clear conceptual framework to enable communication and operationalization of what good design stands for and how it can contribute to results in hospital, rather than relying solely on subjective values about quality. Hence, the concept of design quality has never been so important to emphasize as today. In this study, the concept of design quality in relation to hospital building was explored. Also, this study presents a taxonomy based on a scoping review that illustrates the wide range of terms used in connection with design quality of hospital environments.

Previous research has implicitly indicated what good design is and how it can be measured. High-quality physical environments can be a therapeutic resource for promoting health and well-being (Gesler, Bell, Curtis, Hubbard, and Francis, 2004) and as support for the care and treatment of patients (Bromley, 2012; Huisman, Morales, van Hoof, and Kort, 2012; Janssen et al., 2014). A well-designed environment with a higher degree of exposure to daylight was found to reduce depression and the treatment time for depressed patients (Benedetti, Colombo, Barbini, Campori, & Smeraldi, 2001). Patients visually exposed to actual or simulated nature may experience relief from pain and have a lower intake of pain-reducing drugs (Malenbaum, Keefe, Williams, Ulrich, and Somers, 2008).

Currently, the physical environment is also considered as an integral part of person-centered care defined as thermal comfort, acoustic comfort, and visual