INCLUSIVE DESIGN TO SUPPORT INDEPENDENT LIVING OF ELDERLY CITIZENS IN SAUDI ARABIA

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Globally, the elderly suffer an increased number of falls in their homes. Notably, the Kingdom of Saudi Arabia has a high percentage of elderly falls due to inadequate home interior design for independent living. However, the Ministry of Housing is currently unable to fulfil these housing requirements. In this study, the researcher aimed to document best practices in interior design that support independent living for the elderly. The study looks into the current challenges that elderly people face in interior home design. Accordingly, the study develops and formulates building codes that support independent living for the elderly to reduce falls among this population. A qualitative method based on a case-study approach was employed, whereby a total of 12 informants, including 10 elderly and two professionals from Saudi Building Codes, were purposefully and snowball-identified. Data are collected through thematic review, in-depth semi-structured interviews, and physical observations of the interior design of existing elderly homes. The data obtained from the review and interview were analysed based on a thematic analysis matrix using Atlas.ti software. The thematic review revealed that the integration of inclusive principles in interior

design plays a crucial role in promoting independent living for elderly citizens. It is understood that accessibility, flexibility, safety, environmental comfort, and social interaction have been considered and incorporated as requirements in interior design houses in most countries across the globe. The result further revealed that most of the elderly faced obstacles related to the lack of an elevator for easier movement in the building, and the main challenges that increased the risk of falling and leading to serious injury among the elderly in their independent living in Saudi homes were due to slippery floors and physical barriers. The findings suggest some important changes to the existing residential codes for future practice to reduce the high rate of falls among the elderly. First, the codes formulated, which include flexibility 1029.14.1, social interaction 1029.5, and accessibility codes 1105.1.8, should be considered by the Saudi Building Code Committee, the Saudi Council of Engineers, and the Ministry of Housing in providing homes to the elderly. The findings of the study will therefore be helpful to policymakers in understanding the issues of poor housing that affect elderly independent living. Therefore, the findings of the study contribute to improved knowledge of the framework of best practices for interior design that provide an inclusive strategy to support independent living for the elderly.

Keywords: Elderly Resident, Inclusive Design, Saudi Arabia Homes, Independent Living, Interior Design

SDG: GOAL 3: Good Health and Well-Being, GOAL 10: Reduced Inequalities, GOAL 11: Sustainable Cities and Communities

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REKA BENTUK TERANGKUM DALAM REKA BENTUK DALAMAN BAGI MENGGUBAL KOD BANGUNAN RUMAH UNTUK MENYOKONG KEHIDUPAN MANDIRI WARGA TUA DI ARAB SAUDI

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Warga tua di seluruh dunia mengalami peningkatan jumlah kejatuhan di rumah mereka. Kerajaan Arab Saudi mempunyai peratusan jatuh yang tinggi di kalangan warga emas berbanding banyak negara lain disebabkan reka bentuk dalaman rumah yang tidak mencukupi. Bagaimanapun, Kementerian Perumahan pada masa ini tidak dapat memenuhi keperluan perumahan ini. Dalam kajian ini, pengkaji bertujuan untuk mendokumentasikan amalan terbaik dalam reka bentuk dalaman yang menyokong kehidupan berdikari untuk warga tua. Kajian itu melihat kepada cabaran semasa yang dihadapi oleh warga emas dalam reka bentuk rumah dalaman. Kajian itu membangunkan dan merumuskan kod bangunan yang menyokong kehidupan berdikari untuk warga tua untuk mengurangkan kejatuhan dalam kalangan penduduk ini. Kaedah kualitatif berdasarkan pendekatan kajian kes telah digunakan.. Seramai 12 pemberi maklumat, termasuk 10 warga emas dan dua profesional dari Kod Bangunan Saudi, sengaja dan dikenal pasti dengan bola salji. Data dikumpul melalui semakan tematik, temu bual separa berstruktur yang mendalam, dan pemerhatian fizikal reka

bentuk dalaman rumah warga emas sedia ada. Data yang diperolehi daripada semakan dan temu bual dianalisis berdasarkan matriks analisis tematik menggunakan perisian Atlas.ti. Kajian bertema mendedahkan bahawa penyepaduan prinsip inklusif dalam reka bentuk dalaman memainkan peranan penting dalam mempromosikan kehidupan berdikari untuk warga emas. Difahamkan bahawa kebolehcapaian, fleksibiliti, keselamatan, keselesaan persekitaran dan interaksi sosial telah dipertimbangkan dan digabungkan sebagai keperluan dalam rumah reka bentuk dalaman di kebanyakan negara di seluruh dunia. Hasilnya selanjutnya mendedahkan bahawa kebanyakan warga emas menghadapi halangan yang berkaitan dengan kekurangan lif untuk pergerakan lebih mudah di dalam bangunan, dan cabaran utama yang meningkatkan risiko terjatuh dan membawa kepada kecederaan serius di kalangan warga tua dalam kehidupan bebas mereka di rumah Saudi. adalah lantai licin dan halangan fizikal. Penemuan mencadangkan beberapa perubahan penting kepada kod kediaman sedia ada untuk amalan masa depan bagi mengurangkan kadar kejatuhan yang tinggi di kalangan warga tua. Pertama, kod yang dirumuskan, termasuk fleksibiliti 1029–14.1, interaksi sosial 1029.5 dan kod kebolehaksesan mudah didatangi 1105.1.8, harus dipertimbangkan oleh Jawatankuasa Kod Bangunan Saudi, Majlis Jurutera Saudi dan Kementerian Perumahan dalam menyediakan rumah kepada warga tua. Oleh itu, dapatan kajian akan membantu penggubal dasar dalam memahami isu perumahan miskin yang menjejaskan kehidupan bebas warga tua. Oleh itu, dapatan kajian menyumbang kepada peningkatan pengetahuan tentang rangka kerja amalan terbaik untuk reka bentuk dalaman yang menyediakan strategi inklusif untuk menyokong kehidupan berdikari untuk warga tua.

Kata Kunci: Penduduk Tua, Reka Bentuk Inklusif, Rumah Arab Saudi, Hidup Merdeka, Reka Bentuk Dalaman

SDG: MATLAMAT 3: Kesihatan dan Kesejahteraan yang Baik, MATLAMAT 10: Ketidaksamaan Berkurang, MATLAMAT 11: Bandaraya dan Komuniti Lestari

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LIST OF ABBREVIATIONS

APD	Authority for Welfare of People with limited Income
HRSD	Ministry of Human Resources and Social Development
KSA	Kingdom of Saudi Arabia
MOH	Ministry of Housing
SBC	Saudi Building Code
SBCC	Saudi Building Code Committee
WHO	World Health Organisation

CHAPTER 1

INTRODUCTION

1.1 Introduction

This chapter presents the study's context and the setting of elderly citizens'house design issues in the Kingdom of Saudi Arabia. The problem statements, research goal, and study objective are presented. Lastly, the study justification, scope and limitations, definition of terms, and thesis organisation are detailed.

1.2 Background

The terms 'home'or 'housing'refer to a place of shelter in which a person lives; therefore, this home concept is linked with human emotions and consciousness. Based on the aforementioned definition, humans need homes or houses, specifically homes that meet elderly adults'needs for advanced care, safety, and security. The World Health Organisation (WHO) Housing and Health Guidelines report states that "Poor housing conditions are one of the mechanisms through which social and environmental inequality translate into health inequality, which further affects the quality of life and well-being" (World Health Organisation, 2018).

Correspondingly, some of the features of poor housing which affect the quality of life and well-being include unsuitable interior designs such as ramps, railings, low toilets, and spacious bathrooms. The compound of the housing blocks may also lack safe pedestrian walkways and easy access to much-needed facilities.

It was further reported that in developing countries such as Saudi Arabia, the majority of individuals living in poor housing or 'unsuitable housing'are people with disabilities, the elderly, the elderly with functional disabilities, women, minorities, indigenous people, single-parent households, and those with the lowest income. Poor housing features render these individuals more vulnerable to inequity and inequality. Thus, given the significant housing issues that an ageing society faces, it is necessary to better understand and accommodate the varied housing needs of elderly individuals to support their independent living (Jonsson et al., 2021).

Due to the poor housing conditions in Saudi Arabia, many elderlies face several challenges in their homes such as slippery floors and unsuitable interior space, which affect their independent living. These issues are related to a lack of requirements or standards for inclusive interior design in houses that are provided for elderly citizens in the country. As a result, one of the priorities of the Saudi Vision 2030 framework is to provide adequate and suitable housing that can improve the well-being of the citizens. Citizens of all ages must have equal opportunities to live in houses that are designed to serve them throughout all life stages: houses that meet the inhabitants'needs and are designed to allow safe, independent, and comfortable living at different ages will undoubtedly improve life quality Designing an inclusive and cost-effective house is crucial for accommodating people's needs and preventing unnecessary expenses related to home interior modifications (Zallio & Clarkson, 2023).

In this regard, the inclusive design approach entails understanding elderly diversity and taking this diversity into account while making decisions that are related to home

development to meet their needs. In other words, it refers to designing homes that can be used by the elderly irrespective of their age or disability (Fallah, et al., 2021). Inclusive design entails that regardless of the elderly physical abilities, they can safely and effectively use all the facilities at home without facing any challenges that can cause injury. This is because, studies in Saudi have shown that the elderly prefer to spend most of their time at home, where they have lived for many years. Therefore, the home environment plays a key role in the autonomy, health status, and independence of the elderly. However, the home design in Saudi is meant to serve young people, and since the home environment is designed based on the needs and abilities of young people, it cannot meet the needs of the elderly (Fallah, et al., 2021).

Several reports and studies have indicated that by the year 2030, Saudi will be an ageing society. Therefore, there is a need to refocus on home design to ensure that the elderly needs for independent living are met. However, due to combined longer life expectancies and decreasing fertility rates, the Saudi percentage of people aged > 60 years old is increasing more rapidly than that of any other age group (Heylighen, Van Der Linden & Steenwinkel, 2017). Nevertheless, people of all ages should live together to benefit from each other, specifically the older and younger generations. Hence, appropriate housing that is designed based on the local cultural context and that accommodates the elderly Saudi citizens'requirements is needed. Accordingly, designing housing spaces to accommodate elderly adults is crucial for their meaningful integration into Saudi society.

A study of Al-Shaqi et al. (2016) showed that the majority of the elderly in Saudi were more concerned about the loss of independence (49%) than dying (29%) as they aged.

Although the DLF survey was conducted during challenging financial conditions, the findings suggested that elderly people were more concerned about the loss of independence or becoming reliant on others rather than their financial status. The majority of elderly people living with neurological disorders prioritised living autonomously in their homes despite relying on others for daily life management (Moilanen et al., 2021). Therefore, the home is a point of focus to safeguard socially inclusive, healthy, and independent living. Accordingly, the appropriate infrastructure should be designed and implemented to support and provide the services that older people may require (Abdi et al., 2020).

In response to ageing trends, the Saudi government are developing and applying healthy ageing strategies to promote and improve life quality for the older population. Typically, ageing adults desire independence, government assistance, and reduced healthcare costs (Altamimi, 2016). Altamimi's study supported the claim by Al-Shaqi, Mourshed and Rezgui (2016) that subjective understanding of the older Saudi population should be considered to improve their life quality.

As populations age, the number of dependent older people is also likely to increase. In Saudi Arabia, there is a growing ageing population, and the percentage of elderly Saudi citizens within the population is constantly increasing. To date, while family members assume the active role of caretakers, however, as family structure patterns change the Saudi government must accept more responsibility for elderly citizen care. A possible cost-saving approach is to promote independence and a high living standard for older adults and to support them in their choice to remain in their homes and stay in society.

Furthermore, experts in the built environment must increase their involvement in their research on older citizens'housing needs to contribute to the significant factors (dwelling size, the feeling of independence, and feeling of security or fear, etcetera) in home decisions and depict how these factors can be improved more comprehensively and accurately. The gap in this research also emphasises the significance of urban planning and architecture training for researchers. Producing research that informs policy and meaningfully influences elderly adults'life quality requires a transdisciplinary methodology. Nevertheless, such research remains infrequent and challenging to fund (Roy et al., 2018). Another study has recommended additional research on elderly people's life quality in Saudi Arabia to reduce the risk of falls that result in loss of independent living (Abdalagleel Alsaif & Ahmed Alsenany, 2018).

From the above examination, the Saudi elderly's home design is critical as it is anticipated that the kingdom will be an ageing nation by 2055, where approximately 27.8% of the total Saudi population will be > 60 years old (Alsulami & Atkins, 2016). These changes in demography present challenges that are related to the elderly citizens'life quality due to shifting house design requirements. Therefore, this thesis focuses on housing-inclusive interior design to aid in the sustainable resolution of diverse challenges in the country.

1.2.1 An Overview of the Need for Inclusive Interior Design

In Saudi, the home design does not meet the requirements to support the independent living of the elderly. This is because the Saudi building codes do not have the standards or requirements for elderly homes. Many authors have related the issues to the lack of

awareness of the best features of inclusive design by the SBC professionals on the importance of homes to the elderly's health, independence, and quality of life. Ramsamy-Iranah et al. (2021) confirmed that "designers have not integrated issues of inclusive design that would be beneficial to all age groups". Inclusive design facilitates fair, safe, and independent involvement in daily activities. It approaches and offers novel perceptions of how individuals interact with the built environment. Such a design increases inventiveness and problem-solving opportunities. As the population ages, inclusive design will become a necessity rather than a choice. Consequently, designers must create homes that accommodate elderly people's requirements, encourage their daily activities, and enrich their autonomous and active involvement in all aspects of society (Yasemin Afacan, 2019)

The best features of an inclusive or universal home serve as the foundation for international ageing frameworks and policies, which serve as standards for healthy old age (Borelli et al., 2019; Herssens et al., 2014). Nevertheless, inclusivity-emphasising design methods are contradictory, which indicate that a single design cannot meet everyone's needs. Consequently, it might be challenging for designers and architects to create designs that are inclusive of elderly citizens and appropriate for them. Despite various studies on home accessibility, there are limited methodologies to evaluate accessible home characteristics or analyse the connections between the most significant and satisfactory characteristics that establish a good fit between homes and the elderly (Bianchin & Heylighen, 2018). The lack of appropriate housing options that enable the elderly to age in the proper location and preserve their independence and autonomy is the result of the growing elderly population and the inadequacy of the interior design of existing homes (Luciano et al., 2020). Designers should

emphasise new inclusive home or interior designs to accommodate the needs of all age groups and support personal autonomy in the home (Katunský et al., 2020). Thus, this study anticipates that inclusive interior design can encourage the elderly to live independently at home.

1.3 Research Motivation

1.3.1 Population Increase

Increased human lifespan was one of the most significant 20th-century events. Population ageing and its effects are evident worldwide, which includes the Eastern Mediterranean Region. The United Nations and the WHO estimated that the global population of people aged > 60 years old will amount to 1.2 billion by 2025 and 2 billion (22% of the population) by 2050. Among this population, 80% will live in developing countries, where 4% of people are anticipated to be > 80 years old (WHO, 2022).

Saudi demographic trends are shifting and following the global trend as its ageing population increases. The increased ageing population is mainly due to improved life expectancy, elevated birth rates in the last 40 years, and a recent decrease in fertility rates. Moreover, Between the 1980s and the 2000s, Saudi Arabia's life expectancy increased from 64.4 to 74.3 years (Aleban, 2021; Word Bank, 2014). Saudi Arabia recorded a population expansion between 1980 and 2000 due to an elevated birth rate, nationwide growth, and maternal and child health improvements (Khoja et al., 2018). Thus, the elderly population, which comprises residents aged 60 and above, is expected to grow from 3.5% in 2010 to 9.5% and 18.4% in 2035 and 2050, respectively (Abusaaq, 2015). The reasons for choosing an elderly category of the

community are due to the increased number of elderly citizens in Saudi Arabia, who are also considered a vulnerable group who face challenges in living independently in their homes.

Unlike the gradual population ageing in developed countries that follows constant socio-economic growth over generations and decades, population ageing in developing countries, such as in Saudi, is accelerating rapidly. These demographic changes are linked to substantially altered family structures and roles, migration, and labour patterns. Therefore, the economic, social, and health needs of this ever-increasing population could overwhelm most civil society institutions. Therefore, policymakers must hasten efforts to achieve the aim of successful ageing globally (World Health Organisation, 2022).

Currently, one million elderly people live in Saudi Arabia (approximately 4% of the population). The elderly population is constantly increasing and is expected to reach 2.5 million by 2020 (approximately 7% of the population) (Abdalagleel Alsaif & Ahmed Alsenany, 2018). However, a report submitted to the Saudi Arabian Monetary Agency has reported that health expenditures are expected to increase during 2015 and 2050 due to the increase in the elderly rate from 5.4 percent (1.6 million) to 25 percent (10 million) but the public expenses on education will drop in the same period as the youth dependency ratio decreases from 41 percent to 24 percent. Increased health expenditures and a reduction in public expenses on education are expected to offset each other (Abusaaq, 2015). This means that the population of the elderly in Saudi will increase more than the youth population in 2050.

As a result, growing populations are a significant political concern since they put financial pressure on governments to provide elderly citizens with adequate housing and services. Providing an environment that meets the requirements, preferences, and habits of the elderly is essential to providing a high quality of life, as older people are more likely to be housebound and to be negatively impacted by unsuitable housing (Ismail et al., 2020). Moreover, because extended families have transitioned to nuclear families, both the developed and developing countries have older adults who are single, such as couples or people who are receiving senior care (Ramsamy-Iranah et al., 2021).

With meagre resources, which include the lack of skilled human capital and poor comprehension of ageing, caring for older Saudi adults presents several challenges. One of the main challenges to developing Saudi's elderly health is the substantial scientific literature gap on elderly citizens'health statuses, characteristics, and requirements. During this study, the estimated elderly Saudi population was 859,421 (5.2% of the Saudi population). Saudi population ageing is a well-established and highly predictable trend that is expected to continue (Khoja et al., 2018). Figure 1.1. depicts the Saudi population's ageing over the past 50 years and the projected increase in numbers of elderly citizens.

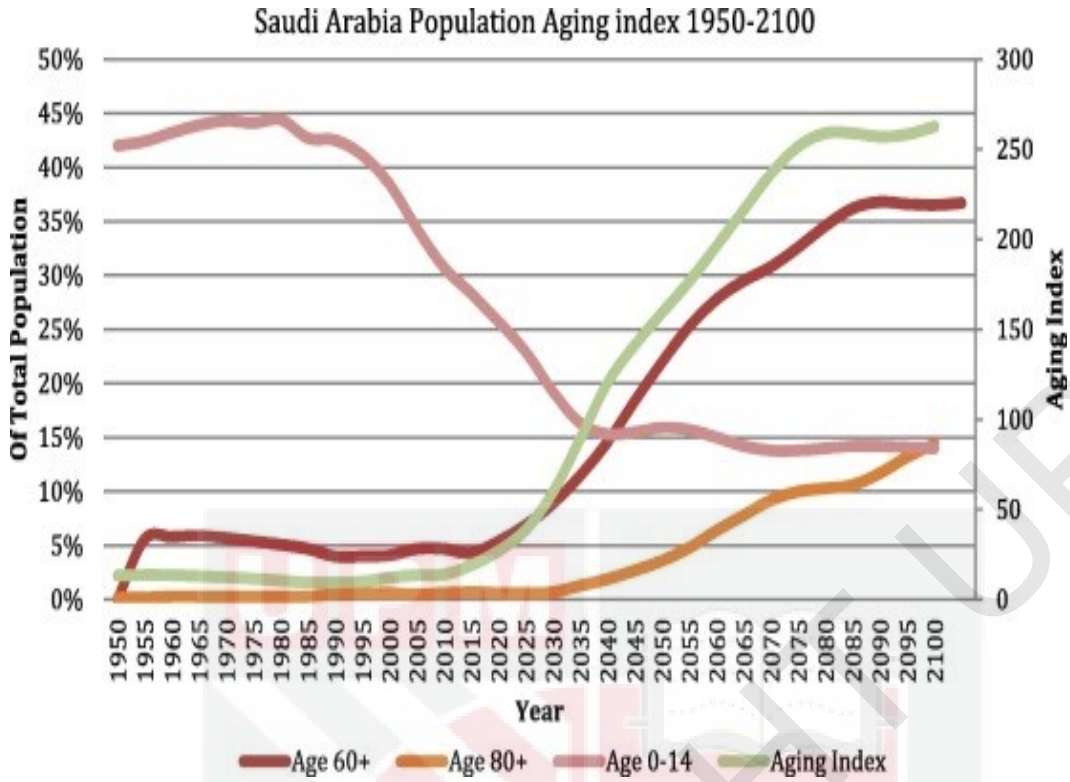

Figure 1.1 : Saudi Population Ageing Index and the Proportions of Extreme Age Groups (Khoja et al., 2018b)

1.3.1.1 Falls Incidents

Falls incidents among the elderly are common worldwide, with various factors contributing to their increased prevalence. Falls are typically caused by a diverse and broad set of risk factors (WHO, 2021)(French et al., 2007). Falls incidents in Saudi are recorded by approximately 28–35% of people aged ≥ 65 years old each year (Almegbel et al., 2018). The result further shows that indoor falling (slippery floors) accounted for 84% of falling incidents. The resulting injuries are viewed as a key public health issue. More than 50% of injury-linked hospitalisations among the elderly are attributed to falls. Additionally, falls may result in physical injuries, subsequent independence loss, and even death.

Few studies discuss gerontology issues in the Middle East, specifically falls incident. For instance, in Saudi, Almegbel et al. (2018) conducted the first known study on falls incident among elderly Saudis. The authors reported a fall prevalence of 49.9%, which was significantly higher than the prevalence rates described in many other countries. For example, the fall prevalence among elderly people was 28% in England, 34% in Canada, 37.4% in Ecuador, and 22% in the USA. Interestingly, Asian countries reported much lower prevalence rates: 11% in China, 19% in Hong Kong, 16% in Japan, and only 4% in Malaysia (Uy et al., 2016). Falls occurred most frequently indoors (83%), which corresponded to the findings of Uy et al. (2016), see Figure 1.2.

Variable	Category	Total n (%)
Experience any falls within last 12 months	Yes	590 (49.9)
	No	592(50.1)
Number of fall(s) per person	1	312 (52.9)
	2	179 (30.3)
	3	73 (12.4)
	4	17 (2.9)
	5+	9 (1.5)
Fracture site	Hip	21 (21)
	Arm	21 (21)
	Rib	8 (8)
	Spine	9 (9)
	Leg	39 (39)
	Others	2 (2)
Place of falling	In own house	762 (77)
	In someone else's house/hotel/rest house	62 (6)
	Public place (mosques, mall, street, park)	146 (15)
	Other/Not specified	17(2)
Place of falling in a house	Stairs	140 (17)
	Kitchen	64 (9)
	Front door step	168 (20)
	Bathroom	250 (35)
	Bedroom	116 (14)
	Other/Not specified	89 (11)

Figure 1.2 : Fall Prevalence over a 12-Month Period and Fall-Related Characteristics (Almegbel et al., 2018)

Almegbel et al (2018) reported a high fall prevalence among elderly Saudis in Riyadh, Saudi Arabia, where falls among the elderly were more common in Saudi Arabia than in other countries. Housing ownership, education level, caregiver's presence, number of medications, walking aid use, and stress affected fall risk among the elderly (Almegbel et al., 2018). Yoo, Kim, Yim and Jeon (2016) stated that preventive

measures should be implemented for people who are at risk of falling, which included awareness of possible risk factors (polypharmacy, architectural barriers, and lack of caregiver support).

Abdalagleel Alsaif and Ahmed Alsenany (2018) stated that one-third of elderly Saudicitizens had risk factors that increased their fall risk, which corresponded to the worldwide data on falls among older populations. Therefore, Saudi's societal authorities and designers should establish fall prevention strategies. Furthermore, future studies should focus on the associated risk factors and fear of falling among elderly Saudi citizens.

The innovative Ambient Assisted Living (AAL) monitoring improves elderly citizens'life quality and supports their daily activities. Ambient Assisted Living (AAL) refers to "the use of information and communication technologies (ICT) in a person's daily life to enable them to stay active longer, remain socially connected, and live independently into old age" (Vimarlund, et al., 2021). The AAL enables independent living by the elderly in their selected surroundings and maintains their connections with their relatives, families, and friends (Alsulami et al., 2017). Although most previous studies stated that home design issues were the main reason for falls among elderly people, the studies did not suggest architectural home design recommendations to decrease the fall risk.

Alsulami et al.'s (2017) research aim is to measure fall prevalence among elderly Riyadh citizens over a one-year period and describe the most common fall risk factors and resulting injuries. Up to 74% of the participants who fell had post-fall injuries.

Among these participants, falls were associated with a lack of education and middle school certification. Furthermore, participants who resided in rented houses also had a higher fall risk. Identifying the fall risk factors added to the existing knowledge on the topic, increased awareness, and presented suggestions to aid in the reduction of the number of falls among elderly people and thereby increase their life quality. Examining and resolving the fall contributory risk factors in elderly Saudi citizens may also aid in the reduction of elderly morbidity, mortality, hospital admissions, and decreased functionality.

1.3.1.2 Quality of Life and Physical Function

A low life quality is related to economic, social and environment reduces physical function and healthcare access. A study in Saudi indicated that perceived health, particularly psychological well-being, chronic diseases, and functional status such as fall risk, are the primary components of health status which occasionally occur in unsuitable homes of elderly people (Al Senany & Al Saif, 2015). Therefore, these aforementioned factors should be studied alongside housing, well-being, and long-term care when examining elderly independent living (Karlin et al., 2016).

1.3.1.3 The Saudi Building Code (SBC)

Architecture is typically pursued as a response to human needs, which include the need for shelter, security, and fellowship. Over the last two decades, architecture has been criticised as being detached from humanity. Some researchers alleged that architecture alienated humans from life (Putra & Lukito, 2018). In their book “Inclusive Design: Design for the Whole Population”, Clarkson and Keates suggested that designs were becoming less authentic as architects frequently preferred to work more rapidly using

standard reference data, such as that from Time-saver Standards for Architectural Design Data, and may have consequently neglected the humans who would use the building in the future. Inclusive design is important to provide design for all and can aid architects in creating designs for the entire population, which would provide affordable houses and improve the citizens'life quality (Clarkson & Keates, 2003).

The Saudi Building Codes (SBC) refers to construction- and building-related terms and requirements that ensure public health and safety. The SBC contains different requirements in sustainability- and energy saving-related categories. This thesis involves the SBC architectural code, which establishes the requirements that are related to architectural work, use quality, and building construction systems. Furthermore, the architectural code includes detailed requirements based on usage and work, building areas and heights, interior finishes, emergency access requirements, hotel and public recreational buildings, special needs requirements, internal environments, external walls, and rooftop constructions.

The Saudi Building Code (SBC) was officially established in 2007. It was developed to enhance building safety and ensure compliance with modern construction standards in Saudi Arabia. The Saudi Building Code (SBC) was developed to standardise construction practices in Saudi Arabia and enhance the safety, sustainability, and efficiency of buildings. Its origins can be traced back to several key factors such as Safety Standards, International Standards and Environmental Considerations (Saudi Building Codes, 2024).

Recently, the SBC has presented several changes to the International Code Council to ensure that its regulations would be more effectively suited to the Saudi environment. The SBC 1101 architecture-related code was established to meet local weather, material, construction, and regulatory requirements. The code was applied to Saudi residential buildings beginning in June 2021. Most residential building regulations and requirements focus on general architectural factors, such as the floor number, building exterior colour, window size, or exterior wall design (Saudi Building Code, 2018). Therefore, the SBC housing requirements do not consider the citizens'needs in the design process or spacing in design regulations. These considerations are vital to understanding the issues underlying housing shortages in the kingdom. Some of these aforementioned challenges are interior design issues and are the reasons citizens reject specific housing units. Furthermore, Saudi Arabia still does not have guidelines to promote elderly independent living, decrease falls among the elderly, or use architectural structures to improve life quality. Thus, the guidelines are necessary as most falls occur at home.

1.4 Research Problem

The World Health Organisation (WHO) (2018) states in the Housing and Health Guidelines Report that poor housing conditions are one of the mechanisms through which social and environmental inequality translates into health inequality. This further affects the quality of life and well-being. The majority of people living in unsuitable housing are low-income individuals, women, people of colour, single-parent households, older people with functional impairments, and those on minimum wages, all of whom are vulnerable to inequity and inequality. The majority of elderly population with or without functional impairment have several housing-related issues.

There is an urgent need for greater knowledge of and support for the different housing needs of elderly adults (Jonsson et al., 2021).

The problem of providing enough housing that will enable the elderly to age in the appropriate place and preserve their autonomy and independence is brought on by the growing number of elderly people and the unsuitable interior design of existing homes (Luciano et al., 2020). Though a lot of research has been done on the subject of home accessibility, not much has been done to assess the effectiveness of inclusive design features or examine the connection between the most important and fulfilling features and how often elderly residents use them (Bianchin & Heylighen, 2018).

Probably due to the lack of understanding or unclear of best global practices in inclusive interior design, the architects and designers in Saudi unable to implement designs that are inclusive of the elderly and that are acceptable. These further demonstrate that the houses produced by the architecture and the Ministry of Housing in Saudi are unsuitable for the elderly and will not guarantee ageing in place. According to Fallah et al. (2021), the majority of an older individual's lifespan is spent at home. The problem is that many homes in today's society are not suitable for the elderly or those with disabilities. Consequently, it is difficult for them to perform simple everyday tasks at home.

Notably, the lack of inclusive interior design leads to unsuitable housing where elderly citizens in Saudi Arabia are facing serious challenges to their independent living, and one of these challenges is the issue of falling resulting in serious injury (Alabdullgader & Rabbani, 2021; Alshammari et al., 2018). Previous studies in Saudi have reported

that annually approximately 28% to 35% of people who are aged 65 and over suffer a fall. It was found that nearly half of the elderly population in Saudi Arabia (49.9%) experienced at least one fall in the previous year. The studies indicated that indoor falls were the most common type of falls (83%) (Almegbel et al., 2018). However, the specific factors contributing to indoor falls among elderly individuals in Saudi Arabian homes were not identified (Alabdullgader & Rabbani, 2021; Alshammari et al., 2018; Almegbel et al., 2018).

For example, previous studies by Maswadi et al. (2022) focused on achieving independent living by using technology, while Alsulami and Atkins (2016) examined technology and the house as major risk factors for increased falls among the elderly. A review of the SBC housing construction requirements revealed that the codes covered safety and health factors in exterior architecture and building materials (Saudi Building Code, 2022). Based on this, Yoo, Kim, Yim and Jeon (2016) recommend architectural barriers that can prevent elderly people from falling. Moreover, Abdalagleel Alsaif and Ahmed Alsenany (2018) reported that Saudi societal authorities and designers should establish fall prevention strategies. One of the strategies for preventing the elderly from falling is suitable interior design. Another issue of concern is the lack of building codes or requirements in the SBC that support elderly citizens'independent living in their homes in Saudi Arabia. The review of the SBC indicated that the requirement for elderly homes is not considered and specified. The houses given to the elderly were normal houses given to all people and the features of the houses do not support elderly independent living, as such these become an unending challenge to the elderly's wellbeing. Therefore, the SBC and the Ministry of Housing should consider formulating building codes and requirements that can

improve the quality of life as well as support the independent living of the elderly in Saudi.

From the foregoing, therefore, this current study attempts to fill the gap of previous studies especially on the interior design of elderly people's homes in Saudi Arabia which has not been studied. Furthermore, interior design requirements in Saudi Arabia do not include a specific code that can promote elderly life quality.

1.5 Objective

This study aims to clarify the elderly Saudi citizens' housing issues. The design best practices and physical design factors that support elderly citizens' independent living were investigated. The study was performed to identify the challenges and possibilities of reformulating the SBC to improve residential design for Saudi elderly citizens. Thus, the study objectives were defined as follows:

1. To investigate the best global practices of interior design that can support independent living for elderly adults in their homes.
2. To analyse current obstacles to elderly Saudi citizens' independence in their homes.
3. To develop an inclusive interior building code to support independent living for elderly Saudi citizens in their homes.

1.6 Research Question (RQ)

Previous studies examined the financial and social benefits of integrating design qualities into private single-family homes during the construction design stage. Additionally, these studies promoted inclusive design use to enable independent living

for the elderly for improved life quality (Hall, 2015). The Saudi housing sector is challenged by a lack of appropriate housing for different citizen groups (Ministry of Housing, 2016).

In this study, the term 'inclusive design' refers to a design method that seeks to provide suitable housing units that may succeed more effectively in meeting the citizens' needs and enhancing their life quality. The study focused on elderly citizens, the main recipients of the current affordable housing units provided by the Saudi Ministry of Housing in 2017. This study examined inclusive interior design for elderly Saudi citizens' homes and explored how this design theory could be incorporated into the SBC to ensure independent living for elderly citizens in their homes. Furthermore, pertinent theories, methodologies, and empirical work are presented. The main RQ was structured as follows: how can inclusive design be integrated into interior design and SBC formulation to support independent living for elderly Saudi citizens in their homes? The main RQ was accompanied by the following sub-RQs:

Sub RQ1: What are the best global practices of interior design that support elderly adults' independent living in their homes?

Sub RQ2: What are the current obstacles to the elderly Saudi citizens' independence in their homes?

Sub RQ3: How can inclusive design principles be integrated into interior design in the building code formulation to support the elderly Saudi citizens' independence in their homes?

Table 1 summarises the research framework (RQs, objectives, and methods) adapted from Zairul (2017):

Table 1.1 : Research Overview Summary

GAP	SRQ	Objective	Deductive
Lack of inclusive interior design	SRQ1: What are the best global practices of interior design that support elderly adults' independent living in their homes?	To investigate the best global practices of interior design that support independent living by the elderly in their homes.	Best practices of interior design that support independent living for the elderly in their homes.
Inadequate information about the challenges faced by the elderly in their homes.	SRQ2: What are the current obstacles to elderly Saudi citizens' independence in their homes?	To analyse the current issue of elderly Saudi citizens' independence in their homes.	- Elderly citizens' preferences for their home environment - Current issues encountered by the elderly.
Absence of interior design codes in SBC standards to support independent living for the elderly.	SRQ3: How can inclusive design principles be integrated into interior design to formulate an SBC that supports elderly Saudi citizens' independence in their homes?	To develop an inclusive interior building code to support elderly Saudi citizens' independent living in their homes.	- Inclusive interior design best practice. - Building code criteria in interior design.

1.7 Study Justification

The importance of this research is based on several studies that highlighted the necessity of considering the issues of an increased ageing population. Additionally, suitable housing should be provided to enable elderly independent living as recommended by the United Nations (Nation, 2022). The United Nations report states that almost all countries have an increased proportion and number of the aged population. The ≥ 65-year-old age group is increasing more rapidly than all other age groups. Generally, an ageing society faces significant housing challenges, where suitable housing will substantially challenge many governments in the future (Investment, 2020). The shortage of suitable housing that supports independent living by the elderly has financially pressured healthcare provision in many countries.

Furthermore, an ageing population is a significant political concern because it puts financial pressure on governments to provide senior housing and services that are appropriate.

Saudi Arabia is currently experiencing an accelerated increase in its elderly population and is facing housing design issues (Almegbel et al., 2018). Therefore, this proactive study is significant as it supports suitable elderly housing requirements. Significantly, proper understanding and provisions for elderly people's diverse home requirements are needed (Jonsson et al., 2021). The inclusive design supports lifelong independent living for all age groups, in addition to the elderly in their preferred environments. Designing houses to be inclusive and cost-effective is a crucial requirement in modifying house designs according to oldness and day-to-day demands. This type of approach is vital in accommodating people and avoiding the issue of home interior alteration-related spending (Mnea & Zairul, 2023). Therefore, this research is crucial and significant in fulfilling existing and future housing demands. Additionally, the findings would aid the establishment of an SBC that supports elderly independent living instead of waiting for the issue to arise later.

1.8 Study Limitations

Given the rising percentage of elderly citizens losing their ability to live independently and suffering falls in their homes, the study focused on the inclusive interior design of elderly citizens' homes in Saudi Arabia. It is necessary to employ inclusive design in the interior design of Saudi homes to enable independent living for older adults and improve their quality of life. This study aimed to contribute to best practices in design that meet the elderly citizens' needs; however, the housing issues that affect the elderly

citizens in all regions of Saudi Arabia were not explored. For research in this area to progress, researchers must understand the issues encountered by such citizens. Expanding this understanding to all Saudi cities will facilitate the establishment of general interior design regulations to provide homes that clearly meet citizens' needs.

Another limitation of this current study is the review of current SBC and formulation of building codes. SBCs are a set of requirements and standards of building codes for public and private buildings. It is expected that the SBC should outline the home features for the elderly or elderly with functional disabilities homes. Yet this was missing in the SBC. Therefore, this study provides and formulates building codes that can support the independent living of the elderly. This formulation can provide awareness and guide the policymakers in understanding the importance of providing accessible homes with special features that can improve the quality of life as well as enhance the independent living of the elderly and elderly with functional disability.

The elderly and elderly with functional disabilities require accessible homes or housing to live independently. This can be achieved through architectural design, and by including accessible elements inside the house, such as a non-slip floors, adapted electronics, bookshelves, and cabinets, or furniture. Access is usually described as the area that people with disability using a wheelchair can reach mostly with their arms and with little to no movement of their legs or body. Due to the architectural design in Saudi, many elderly and elderly with functional disabilities are having challenges to modify their homes to meet their needs. Therefore, there is a need for the SBC and professionals to consider accessibility and flexibility in the future design of homes in Saudi.

Finally, the qualitative case study is another limitation of this current study. Yin (1984) asked, “How can you generalise from a single case?” Case studies provide a limited methodological basis for scientific generalisation as they are based on a low number of participants. For example, some case studies involved only one participant. In this research, the case study approach presented inherent limitations due to the limited number of participants that could be included in the study. Despite these limitations, the study presents opportunities to gain a deeper understanding and consideration of the participants’ lived experiences.

The author is cognisant of the complexity of the current Saudi interior housing regulations. Based on this awareness, the author expects that current laws can adapt to changes that incorporate inclusive design best practices and formulate SBC rules and regulations to govern the interior design of elderly Saudi citizens’ homes more effectively.

1.9 Thesis Organisation

This study is structured into six chapters, which are summarised as follows:

Chapter 1: Introduction: The research, the study background, the research objective, RQ, the study's significance and benefit, knowledge contribution, anticipated results, and definitions of terms are introduced.

Chapter 2: Literature Review: the LR is conducted using international and local journals, newsletters, and books are presented. The LR focuses on the following three aforementioned sub-RQs. The research gaps identified in the review and how the author’s research aims to address the literature gaps are highlighted.

Chapter 3: Methodology: The methodology used in this thesis is presented and the reason specific approaches selected is clarified. The reasons the case study approach is used rather than other possible approaches are discussed. The reason that the case study method was the most appropriate research methodology and the rationale for using a case study approach is stated. Lastly, the research design, sample analysis, interview technique and strategies, and data collection are described.

Chapter 4: Findings and Data Analysis [Thematic Analysis Matrix (TAM) (Zairul, 2021)]: The analysis findings from 10 elderly citizens' qualitative interviews are presented. The interviews examined the issues encountered by elderly adults who lived independently in their homes, the observations, and LR documentation by Atlas.ti. Themes were identified using TAM (Zairul, 2021) with Atlas.ti 8 computer-assisted qualitative data analysis software.

Chapter 5: Discussion: The discussions of the main findings is discussed in the chapter. The findings of the study are compared with the literature and theory to examine the consistencies of the data.

Chapter 6: Conclusion, Implication and Recommendations: The chapter presents the conclusion part of the study. The conclusion drawn from the main findings is presented in the chapter, and the implication of the study including implications on practical and theory, and body of knowledge contributions are discussed. The recommendations including recommendations to policy making, SBC and Ministry of Housing, architects and designers, and elderly people and recommendations for further research are presented in the chapter.

1.10 Summary

The number of elderly adults in Saudi Arabia is increasing. The growing ageing population has played a key role in the increase in general policies that promote independence for this population. Notably, elderly Saudi adults encountered several obstacles to independent living. In correspondence, the RQ and objectives guiding the thesis were introduced and a thesis overview was presented. The following chapter presents an LR that investigates the current issues encountered by elderly adults as they seek to live independently in their homes, the best practices for integrating inclusive design into interior design to support elderly adults, and recommendations for adapting the SBC for home design to accommodate elderly independent living and improve life quality.

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