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# The Effect of Housing on Health and Challenges of Demographic Changes

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# The Effect of Housing on Health and Challenges of Demographic Changes

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**Abstract-** There is overwhelming evidence on the robust relationship between housing and health, and the effect of poor housing conditions on health risks and outcomes. Although adequate housing is a fundamental human right and an essential social determinant of health, global prevalence of poor housing conditions is a key public health issue. Identification of the factors of housing associated with health and wellbeing, and investigation of health risks and outcomes attributed to housing conditions are essential preventive measures to ensure enhancement of both housing conditions and overall health. On the other hand, demographic changes and current trends of population growth indicate increased pressure on housing and health sectors globally. Current demographic trends suggest rapid growth of ageing population and increased urbanisation as the major challenges. It is vital to examine if the existing housing conditions would be sufficient to cater to the future needs, and address any issues arising due to the projected demographic changes. This review aims to examine existing literature focusing on the effect of housing on health and the challenges arising due to demographic changes. The findings presented in this review may provide valuable insights on the effects of housing on health and inform housing and health sectors on the future directives to be undertaken.

**Keywords:** health outcomes, housing conditions, demographic change, ageing population.

## I. INTRODUCTION

Globally, the robust relationship between housing and health has been a key subject of interest across diverse disciplines. The effect of built environment, especially housing, on general health and well-being has been well understood for over a century (1). In developed countries, people generally spend over 90% of their time indoors, at home or work(2, 3). Especially due to the COVID-19 pandemic, people have been spending even more time in their homes either due to lockdown or working from home as a social distancing measure (4). Similarly, vulnerable population sub-groups such as older adults, young children, and those with chronic illness or disability spend most of their time at home, and are more susceptible to the health risks associated with housing conditions(5, 6). Given the increasing amount of time spent in buildings

and the influence of the housing on health, adequate housing conditions are vital.

The World Health Organization (WHO) defines healthy housing as a shelter that supports a state of complete physical, mental, and social well-being(7). It integrates- the feeling of 'home' related to the sense of security and belonging; the physical structure of the residence associated with physical health; the immediate housing environment in relation to the access to essential services and protection from diverse factors; and social characteristics of the local community that facilitate health and well-being. Adequate housing is a fundamental human right and an important social determinant of health (8, 9). Nonetheless, there is a wide prevalence of poor housing conditions, globally. In the United States, the prevalence of inadequate housing was 5.2%, with moderate or severe physical defects in heating or plumbing (10). Similarly, 19% of the total homes in England did not meet the decent homes standard, which was defined as a home in a reasonable state of repair, with reasonable modern facilities and services, and providing a reasonable degree of thermal comfort (11). Moreover, 20% and 13% of the European population reported that their residence did not protect against excessive heat in summer, and was not comfortably warm during winter, respectively (12).

Considering the numerous health risks associated with poor housing and the resulting health burden due to health conditions attributed to housing, substandard housing is a major public health issue (7, 13). The commonly associated health conditions with poor housing conditions include injuries, respiratory illness, asthma, cardiovascular disease, obesity, and mental health among others(13-15). Household air pollution due to solid cooking fuels caused 3.8 million global deaths in 2016 (16). Exposure to damp housing and gas stove emissions was associated with 7.9% and 12.3% of the total asthma burden in Australian children, respectively (17). In New Zealand, about 10% of hospital admissions occur every year due to household crowding (18). Although each individual is equally exposed to the health risks attributed to poor housing, vulnerable and ethnic minority population subgroups and those with lower income are more likely to reside in substandard housing or experience homelessness, resulting in enormous health inequalities (19, 20).

On the other hand, analysing the current trends and demographic changes, adequate housing is

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expected to become increasingly vital (7). Globally, it is estimated that people aged 60 years and above will double by 2050 (21), and this population sub-group spend a significant proportion of their time at home, and may require improved housing conditions. The global demographic trends by 2050 also suggest increased urbanisation which could increase housing demand in major urban centres, thus having an impact on housing affordability (22). It is therefore essential to investigate is the current housing conditions will cater to the future needs with regards to demographic projections and changes. The purpose of this review is to examine existing literature focusing on the effect of housing on health and the challenges arising due to demographic changes. Given the limited number of current articles addressing the aforementioned issues, the need to investigate the interrelation of housing, health, and demographic projections is exemplified.

## II. THE RELATIONSHIP BETWEEN HOUSING AND HEALTH

Because of the complex and multifactorial interrelationship between housing and health, it becomes challenging to formulate a methodology especially in the housing environment to ensure precise measurement of health benefits and associated cost savings of the proposed interventions (23). However, it is essential to identify the factors of housing associated with overall health, and to investigate the health risks and outcomes arising due to poor housing conditions, such that effective interventions and preventive measures can be carried out early on. This strategy may help ensure that the negative health outcomes are mitigated, and housing conditions are improved along with the upliftment of overall health and wellbeing.

Numerous studies have investigated and established the relationship between housing and health. Table 1 outlines the association of health risks and outcomes with cause attributed to housing conditions. A study by Evci et al. (24) identified the association of characteristics of residences of elderly with the incidence of home accidents such as falls, cuts, hits, electricity accidents, and poisoning. Higher occurrence of home accidents was observed in elderly living on third floor or higher, and dwellings with less than four rooms. Moreover, higher frequency of home accidents occurred in dwellings at poor safety level, which was calculated by evaluation of seven housing characteristics- ventilation system, grabbing bar, ground coating, indoor steps or staircases, handrails, damaged staircase, and height differences in staircases.

Gustafson et al. (25) investigated the association of skin conditions with housing conditions among 371 Latino migrant farm workers in North Carolina. Pruritus was associated with absence of air conditioning, which was reported in 36.2% of

participants living in dwellings without air conditioning. Scaling of the skin was mostly reported by participants with bedroom in thermal discomfort range. A significant association of rash with humid indoor environment as a result of damp and humid housing was observed. However, the authors did not find a significant association of housing conditions with the prevalence of other skin conditions such as blisters and ingrown nails.

In a study by Jin et al. (26), the role of household ventilation in decreasing the impact of indoor air pollutants on the risk of lung cancer was assessed. The authors found that a good ventilation in kitchen and bedroom was inversely associated with the risk of lung cancer, which could be due to the significant reduction in the exposure to indoor air pollutants arising from second hand smoke, high-temperature cooking oil fumes, coal used for cooking, and solid fuels used for heating. It was concluded that ventilation along with the cessation of tobacco may be a preventive measure for lung cancer. Similarly, Pramitha et al. (27) established a positive association was found between indoor particulate matter size 2.5 micrometers (PM<sub>2.5</sub>) concentration and lung function impairment. Additionally, indoor humidity outside the ideal range of 40-70%, and inadequate house ventilation were associated with lung function impairment.

Chum et al. (28) investigated the association of exposures in a residential environment with cardiovascular diseases including myocardial infarction, angina, coronary heart disease, stroke, and congestive heart failure. Environmental noise, proximity to a major road, and exposure to violent crimes were independently associated with higher odds of cardiovascular diseases. Other factors such as reduced access to parks/ recreation, food stores, and increased access to fast food restaurants were associated with higher odds of cardiovascular diseases. Similarly, a study by Rohde et al. (29) examined the association of residence floor level and cardiovascular disease and found a positive association. The prevalence of all three health outcomes- stroke, venous thromboembolism, and intermittent claudication increased by increase in floor level. The authors discuss that this could be attributed to various factors including poor psychosocial environment, atmospheric electrical parameters, and association of building height with socioeconomic status.

The association between household factors and incidence of malaria in Uganda's highly endemic region was explored by Snyman et al. (30). The authors found that as compared to residing in a traditional house, residing in a modern house with non-earth floors, non-thatched roofs, and non-mud walls was associated with roughly half the incidence of malaria. Moreover, various factors were related to the lower incidence of malaria including residing in a town rather than in a rural setting; bedroom with openings such as windows, eaves, and

airbricks to the outside; and presence of an educated and older primary caregiver.

Shah et al. (31) analysed the association of housing quality and mental health, particularly in context of pest infestation and depressive symptoms. The authors found that residents in housing with cockroach infestation had nearly three times the risk of experiencing high depressive symptoms as compared to those housing without infestation. Moreover, both cockroach and mouse infestation were associated with more than five times the risk of depressive symptoms. Another study by Pevalin et al. (32) also assessed the impact of persistent poor housing conditions on mental health. Factors directly related to poor housing conditions included- lack of adequate light, absence of adequate heating, condensation, leaky roof, damp walls or roof, and rot in the walls or floor. The authors

concluded that the increase in the persistence of housing problems had a deteriorating effect on mental health.

Amerio et al. (33) explored the association of poor housing with increased risk of depressive symptoms in Italy during the lockdown period due to COVID-19 outbreak. Factors associated with the risk of moderate to severe depressive symptoms included residing in apartments less than 60 m<sup>2</sup>, with poor-quality views, with unusable balcony, and scarce indoor quality. Moreover, participants who reported worsened working performance from home were more likely to report depression. Overall, the reviewed studies indicate a strong relationship between housing conditions and health outcomes; and further accentuates the measures to be undertaken to prevent the adverse health outcomes associated with poor housing.

*Table 1:* Association of health risks and outcomes with cause attributed to housing conditions

Author	Year	Country	Study Design	Participants (N)	Cause Attributed to Housing Conditions	Health Risk/Outcome
Evcı et al. (24)	2006	Turkey	Cross-sectional study	3277	Floor level, room count, and home characteristics-ventilation system, grabbing bar, ground coating, indoor steps or staircases, handrails, damaged staircase, and height differences in staircases	Home accidents- falls, cuts, hits, electricity accidents, and poisoning
Gustafson et al. (25)	2013	United States	Cross-sectional study	371	Indoor thermal environment	Skin conditions such as pruritus, rash, and scaling
Jin et al. (26)	2014	China	Case-control study	1424	Household ventilation	Prevention of lung cancer
Chum et al. (28)	2015	Canada	Cross-sectional study	2411	Environmental noise, proximity to major roads, and exposure to violent crimes, access to parks/ recreation, food stores, and fast food restaurants	Cardiovascular diseases including myocardial infarction, angina, coronary heart disease, stroke, and congestive heart failure
Snyman et al. (30)	2015	Uganda	Cohort Study	515	House construction (traditional/modern), location of household (rural/town), openings to outside	Incidence of malaria
Rohde et al. (29)	2016	Norway	Cross-sectional study	11169	Floor level	Stroke, venous thromboembolism, intermittent claudication
Pevalin et al. (32)	2017	Britain	Cross-sectional study	16234	Housing conditions such as adequate lighting, heating, condensation, leaky roof, damp walls or roof, and rot in walls or floor	Measurement of mental health
Shah et al. (31)	2018	United States	Cross-sectional study	461	Household cockroach and mouse infestation	Moderate and severe depressive symptoms
Pramitha et al. (27)	2019	Indonesia	Cross-sectional study	109	PM <sub>2.5</sub> concentration, indoor humidity, house ventilation	Lung function impairment
Amerio et al. (33)	2020	Italy	Cross-sectional study	8177	Housing dimension, accessibility of balcony, quality of view from apartment, quality of indoor area, and worsening of working performance.	Moderate and severe depressive symptoms

### III. CHALLENGES OF DEMOGRAPHIC CHANGES ON HOUSING AND HEALTH

In 2019, the global population was 7.7 billion, and the United Nations (UN) has projected a world population of 9.7 billion in 2050 and more than 11 billion in 2100 (34, 35). The UN report (35) emphasizes that the ageing population is rising as a result of declining fertility levels, increasing life expectancy, and majority of

countries facing reduction in population size. Moreover, 78.5% of the 3.86 billion projected increased population from 2015 to 2100, will arise from poorest regions of the world, primarily due to the slowly declining fertility (34). This enormous increment in the global population will certainly have a massive impact on the housing as well as health sector.

a) *Rapid growth of ageing population*

The age distribution of world population from 1950 to 2018 and projection until 2100 is illustrated in Figure 1. The projections indicate an increasing share of ageing population with the improvement in global health and declining mortality (36). In 2019, 1 in 11 (9%) people were over 65 years of age, which is projected to become 1 in 6 (16%) people by 2050 (35). Moreover, 1 in 4 Europeans and North Americans could be 65 years of age or over by 2050. The population group of 80 years

of age or over is projected to triple from 143 million (2019) to 426 million (2050). The most appropriate population subgroup to best explain the association of poor housing and ill health is older people. This is because the highest prevalence of chronic illnesses is seen in older people, they are likely to spend most of their time at home, they are most vulnerable to ill effects of poor housing conditions, and they are most likely to live in poor housing conditions (23, 37).

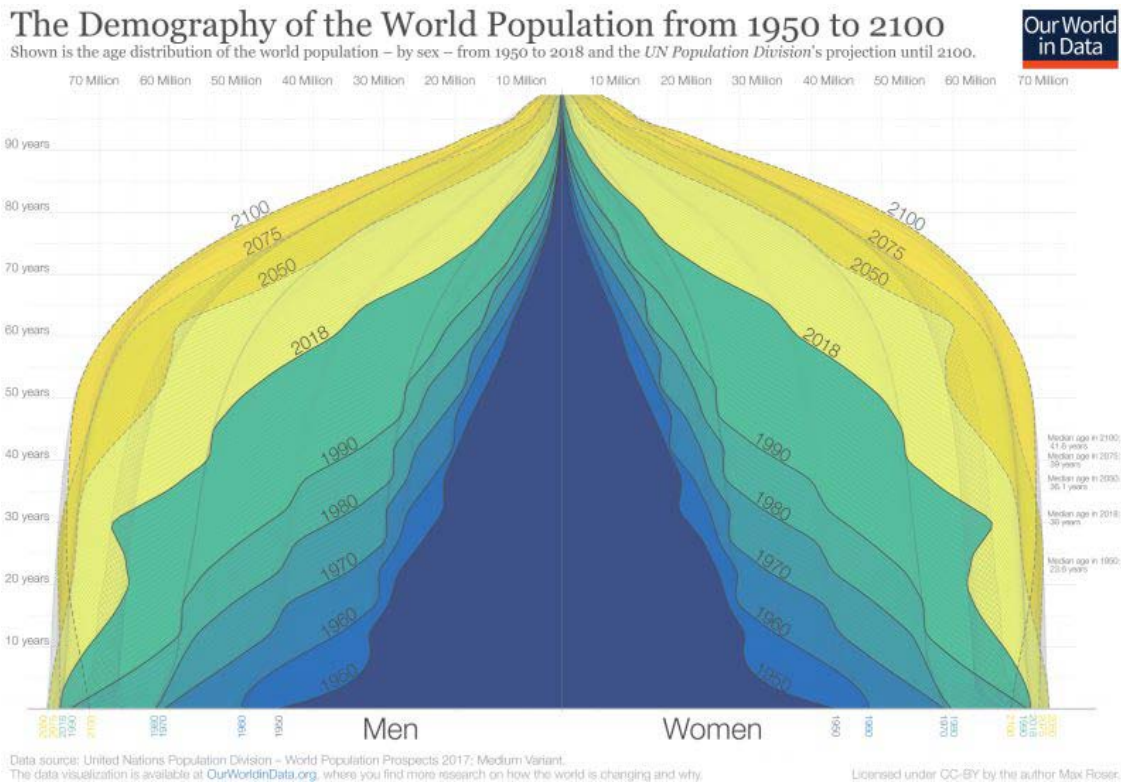


Figure 1: Age distribution of world population from 1950 to 2018 and projection until 2100 (36)

Particularly for older adults, specific housing related interventions may be beneficial. Hazard reduction interventions can be successful in reducing injuries as a result of falls which is common in older adults (38). Home hazard assessment can also be a useful educational strategy for fall reduction along with installation of safety devices including nonslip stripping on steps, double sided tape for mats and rugs, and grab rails (39). However, as structural modifications can be both difficult and expensive, these should be considered in the earlier design stage when developing housing for older adults. Similarly, residential design addressing older adults with dementia can help them live an independent life (23). The major areas of concern include- easy access to outside spaces, ease in way finding, individualisation of personal and communal spaces, appropriate use of colour and contrast, and lighting and opportunities to engage with the environment(40). Similarly, interventions such as wheelchair access and installation of grab rail should be

adopted early in the residential design phase for older adults with disability and mobility issues to prevent any health issues arising due to fall related injuries(41).

Addressing the ageing population, research is being conducted globally into the effects of housing on health. A qualitative study conducted by Somrongthong et al. (42) assessed the impact of housing and older people's living experience in rural Thailand. The authors found that the design of the houses did not entirely support the older people's individual daily activities, nor did it cater for health care equipment. Inadequate housing was a cause of several accidents and health risks were attributed to unsafe and insufficient lighting, furniture and floor surfaces, and beds and toilets with incompatible height for older people. A study conducted in South Australia (43) examined the effects of ageing on housing and urban development. The current and future housing necessities was dissimilar within as well as between some groups, which was associated with the older South Australian's age, location of residence,

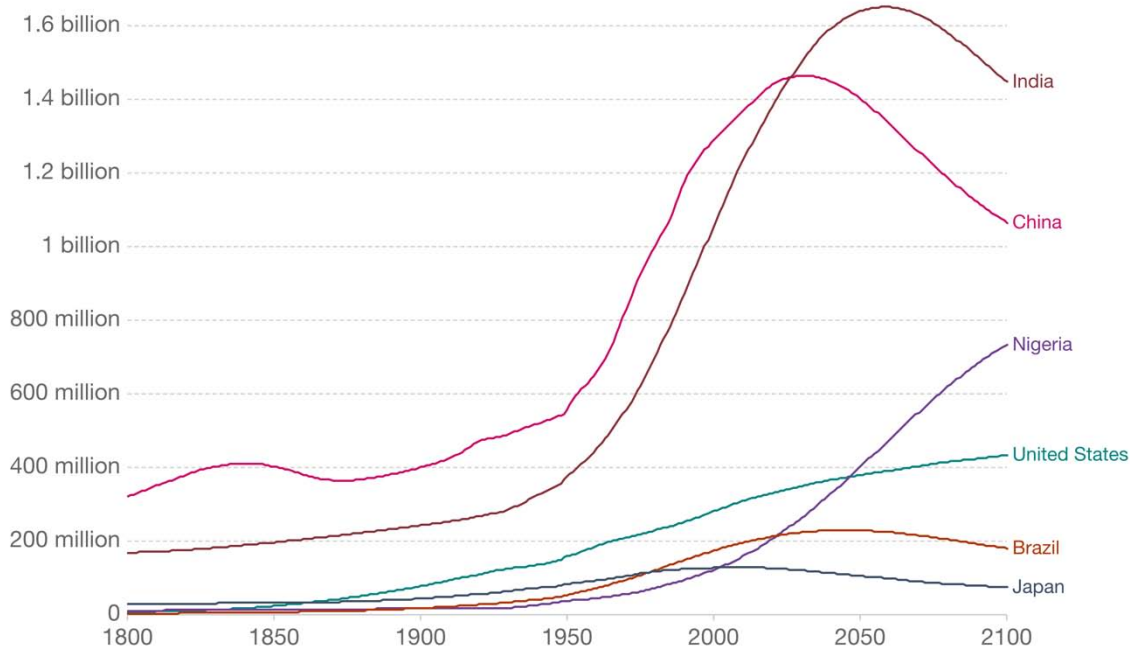
socio-economic status, and the assets that they hold. The study highlighted the need of support for ageing in place, an appropriate house design, and options for affordable and adequate accommodation in proper locations. Fox et al. (44) explored the housing needs of older adults in Ireland, and found that those in standard housing were less likely to undertake adjustments that enabled ageing in place, while those in sheltered housing reported positive outcomes and were content with the home design. Moreover, older adults in standard housing felt less safe at home, reported more illness and disability, and were worried about the future. The study highlighted the need of flexible and adaptable social housing designs to address the needs of older people over time. Overall, regardless of the country of origin, there is overwhelming evidence on the need of adequate and appropriate housing that cater to the ageing population.

#### b) Changing distribution of the world population

The population growth by country from 1800 to 2017 and projection until 2100 is shown in Figure 2.

### Population, 1800 to 2100

Historical estimates of population, combined with the projected population to 2100 based on the UN's medium variant scenario.



Source: Gapminder & UN Population Revision (2017) Medium Scenario  
Note: Historical country data is shown based on today's geographical borders.

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Figure 2: Population growth by country from 1800 to 2017 and projection until 2100 (36)

The demographic shift due to fastest growing population in the low-income countries will put a major burden on the housing as well as health sector. Along with the rising housing demand in Africa, the housing structure is also being transformed from mud walls to concrete and brick walls, and thatch roofs to corrugated

metal roofs(45), which presents a decent prospect to improve health and wellbeing of the at-risk population(46). A study conducted by Tusting et al. (47) indicated that the incidence of improved housing, which was defined as housing with durable construction, sufficient living area, and improved water and sanitation,

doubled from 2000 to 2015. However, it was found that almost half of African population in urban areas still reside in unimproved housing conditions. This was moderately because of unimproved sanitation, which emphasises the need of urgent improvement of water and sanitation infrastructure. Moreover, housing design plays an essential role as it is associated with diverse health outcomes such as soil-transmitted helminths, malaria, mental health, respiratory disease, diarrhoeal disease, and leishmaniasis (47). Housing improvements could also combat the poor growth outcomes as well as childhood infectious diseases and lead to improved child health in sub-Saharan Africa (48).

On the other hand, the growing population in developing countries will also bring new challenges as a result of urbanisation and unprecedented growth of slums. The global population living in urban areas is projected to increase from 30% in 1950 to 66% by 2050 (49). Of the total projected increase in the global urban population from 2014 to 2050, 37% is anticipated to arise from India, China, and Nigeria. The chief reasons for migration from rural to urban areas include poverty, unemployment, and absence of adequate medical and educational amenities, which further increase the pressure on prevailing urban infrastructure (50). The unaffordability of urban housing causes the migrants to reside in slums and squatter settlements. Slums continue to increase along with the rising migrant population, and also because of the limitations of planning practices to address residents' needs. Approximately 1 billion people reside in slums and these slums are a major threat to human health (7). For those residing in slums, the health risks associated with housing include those from poor sanitation, unvented cooking amenities, hazardous electrical connections, overcrowding, structurally defective dwellings, inadequate housing amenities, unsafe infrastructure, and toxic building materials. In India, approximately 1 in 6 city residents presently live in an urban slum having unsanitary conditions unsuitable for human habitation (50). As India is projected to become the world's most populous country by 2027 (35), this demographic change will certainly have a negative impact on both housing conditions and overall health. It is therefore vital to address the issues arising due to the changing distribution of the world population.

#### IV. CONCLUSIONS

The interrelationship between housing and health is complex and multifactorial. Given the increasing amount of time people spend at homes, adequate housing conditions are essential. Nevertheless, poor housing conditions is a major public health issue due to its global prevalence and the consequential health burden. Additionally, the current demographic changes indicate that adequate housing

will become increasingly important. The rapidly increasing ageing population and increased urbanisation are some of the challenges arising due to demographic changes, which could have a negative impact on both housing conditions and health outcomes. This review summarised the evidence from existing literature on the effect of housing on health and the challenges arising due to demographic changes. Various health risks and outcomes attributed to poor housing conditions were identified including home accidents in elderly, skin conditions, respiratory diseases, cardiovascular diseases, malaria, and mental health. On the other hand, two major challenges arising due to demographic change- rapid growth of ageing population and changing distribution of the world population were identified, which would significantly increase the pressure on both housing and health sectors. Research emphasise the need of adequate and suitable housing that cater to the increasing ageing population. Similarly, the unprecedented population growth in low income countries and rapid urbanisation globally indicate the need of urgent action to curb the negative consequences on both housing and health. Future research on the relationship between housing and health should consider the wide implications of demographic changes so as to provide credible information and encourage housing and health sectors to implement effective interventions.

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