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Towards Safe Cities & Resilient Communities

13 & 14 SEPTEMBER 2018
IMPIANA HOTEL, IPOH, PERAK

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SAFE PLACE BY DESIGN: THE IMPACT OF THE PHYSICAL ENVIRONMENT ON HEALTH

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Abstract - Recent research examining the effect of neighbourhoods on health and well-being has often focused on neighbourhood physical environment. Good living environment is thought to improve health and fear of crime is recognised to be a mediator of the relationship between physical environment and health. Because few studies have investigated this relationship, this study aims to examine the impact of the house quality on fear of crime and health. A total of 230 households from a residential neighbourhood in Malaysia participated in the study. Using structural equation modelling, the findings indicate that housing quality and fear of crime can account for a proportion of the variance in residents' self-rated health. However, there is no significant relationship between housing quality and fear of crime. Results also show that fear of crime does not mediate the relationship between housing quality and health in the study area. This study suggests that the environment-fear relationship should be re-examined theoretically.

Keywords - *house quality, fear of crime, health, Malaysia, SEM.*

1   INTRODUCTION

During the last decade, there has been an increasing interest in the impact of neighbourhood attributes on health. The World Health Organisation (WHO, 1948, p.100) defined human health as "a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity". Based on this definition, health has three interrelated dimensions including physical, mental and social. Although these three dimensions are interrelated and influence each other greatly, however, one can examine the impact of other variables on each dimension, separately. Although physical health is important, mental health is one of the key dimensions of health that forms personal and social relationships.

Neighbourhood social and physical conditions have long been believed to have a direct influence on personal health (Garner & Raudenbush, 1991). Evidence suggests that living in disadvantaged neighbourhoods has negative impacts on mental and physical health (Bissonnette et al., 2012; Park et al., 2015; Wallace, 2012). Stemming largely from the previous work on fear of crime and urban environment, it is clear that the physical characteristics of the living environment could be related to perceive safety and security among residents (Armitage et al., 2011; Greenberg et al., 1982; Hedayati-Marzbali et al., 2012). The neighbourhood is one of several spaces that provide social and physical space for interactions between residents, which leads to greater sense of community. Studies using large samples have generally concluded that the built environment does affect health over and above the impact of the area composition (Kawachi et al., 1997).

The recent increase in research on the effect of neighbourhood conditions on health indicates a rediscovery of the indirect manners in which neighbourhoods may have affected an individual's health. Moreover, certain characteristics of residents and the physical characteristics of an environment can affect neighbourhood problems, which suggest that both the social and physical conditions of the neighbourhood may affect the residents' perceptions and attitudes (Austin et al., 2002).It is proposed that

a person's health is influenced by a number of factors including the built environment and perceived neighbourhood safety (Lorenc et al., 2012).Dirt, decay and graffiti are signs of neglect of the environment that are seen as drivers of fear (Cozens et al., 2003; Waters et al., 2007). While neighbourhoods are regarded by policy makers as important social determinants of health (Browne-Yung et al., 2016), the mechanisms linking neighbourhoods to health outcomes remain unclear. Despite the growth in neighbourhood-health studies, the impact of neighbourhood environmental quality on health related factors has received relatively little empirical research, especially in developing countries like Malaysia. While there are many factors that can influence personal health, this study focussed on the effects associated with visual signs in the neighbourhood environment.

It is obvious that the influential factors on personal health, as a human phenomenon, can be referred not only in various economic, social, cultural and environmental factors, but also at different levels such as individual, household and community levels. The current study examines the effective factors on personal health at the household level. The relationship between the characteristics of neighbourhood environment and individual well-being has long been recognised in Western literature (Shaw & McKay, 1969). In recent years we have witnessed an increasing interest in examining the contextual impact of neighbourhood environment on individual health outcomes using sophisticated multilevel statistical methods (Maass et al., 2016). However, studies of neighbourhood effects on health outcomes are predominantly Western settings, and are rarely done in developing countries (Hedayati-Marzbali et al., 2016a).

The purpose of this study was to examine the impact of house quality, as a neighbourhood environmental attribute, on neighbourhood health. Furthermore, the current study sought to determine the mediating effect of fear of crime on the relationship between house quality and self-rated health. The study addressed the extent in which the relationship between house quality and self-rated health varies based on perceived fear of crime. It emphasises on how residents perceive neighbourhood visual quality and consequently, the positive impacts of high quality on residents' health and well-being are triggered.

2   LITERATURE REVIEW

The modern era of environmental health was first articulated by Rachel Carson in 1962. In her classic work, she warned of human health effects (Carson, 1962). Since then, at least two paradigm shifts have revolutionised the field: first shift referred to civil rights, forming the environmental justice movement, and second, which occurred in recent years, referred to a broad range from chemical environment to the built environment (Frumkin, 2005). Architectural changes following the oil shocks of the 1970s were the most important reason to this shift. The term built environment refers to images of places including buildings, neighbourhoods and parks (Frumkin, 2005). Afterwards, there is an increasing recognition that the built environment may affect individual's health and well-being.

There is increasing recognition that the built environment may affect individual's health. The broken windows theory as originated by Wilson and Kelling in 1982, offers insight to public health (Frumkin, 2005). Wilson and Kelling (1982) pointed out the possibility of a specific neighbourhood having more unpleasant appearances created by signs of incivilities compared with other neighbourhoods. They suggested that the environment sends direct messages to its users that regulate individual behaviour. They further proposed that healthy places need to be well-designed, well-built and functional. Broken windows are a signal that no one cares (Wilson & Kelling, 1982). The relationships between the study variables are explained in the following subsections.

2.1   House Quality and Health

The quality of the home environment has a pervasive effect on the individual's quality of life (Garcia, 2000). The surrounding environment of the home is also a vital indicator for people's health and their meaningful interaction within the environment. Austin et al. (2002) found that housing quality has

positive and significant relationship with resident's perception of safety, while there is a negative relationship between victimisation and housing quality. The underlying assumption is the existence of positive impact of housing quality on residents' perception of safety. Research further indicated that neighbourhood disorder is negatively associated with negative health outcomes (Hill et al., 2005). Even though Hill et al. (2005) examined the effect of disorder on health, the operationalisation of disorder scale is exclusively derived from items that reference social disorder and could do a better job of indicating physical disorder. Therefore, these approaches may not always be appropriate in explaining health and well-being.

Yet despite the continued academic interest of the broken windows thesis, this theory itself has received relatively little empirical research (Abdullah et al., 2015). The results of a study in the UK context contradict the broken windows thesis, indicating that Wilson and Kelling's hypothesis does not fully applied in the UK context (Stafford et al., 2005). Their findings highlight the influence of the residential environment on women's health (Stafford et al., 2005).

2.2   The Built Environment, Fear of Crime and Health
Fear of crime is a significant urban stressor that has harmful psychological effects on individuals. The effects of the built environment on individual's fear of crime is not new. Shaw and McKay (1942) were among the first to point out the deleterious effects on individuals caused by signs of disorder. Wilson (1975) proposed that people were not troubled by crime only, but they can be affected by deteriorated conditions surrounding them. Studies also suggested that there is a link between physical design features and fear of crime (Hunter, 1987; Newman, 1972).

Fear of crime is an important issue not only for individuals but also for neighbourhoods and wider societies because it affects community health (Abdullah et al., 2015). It restricts personal activities in the neighbourhood, increases dissatisfaction with the neighbourhood and reduces the overall quality of life (McCrea et al., 2005). The proponents of crime prevention by design strategies believe that physical factors diminish residents' fear of crime. This strategy shows the impact of neighbourhood factors on individuals' behaviour in protecting their households. Likewise, theories of the determinants of mental health have focused on crime and fear as major explanatory factors (Lorenc et al., 2012; Stafford et al., 2007).

Evidence suggests the negative consequences of fear of crime to local community such as impaired health and well-being which largely explained by low levels of outdoor physical activity and high levels of psychological distress (Ross, 1993). In the UK context, Chandola (2001) also found a negative association between fear of crime and self-rated health. Although this relationship is a growing area of research, there are still many areas left unexamined. Recent studies have been inconsistent in establishing a casual pathway between fear of crime and health outcomes. For instance, Johnson et al. (2009) found no significant association between these two variables.

2.3   Research Hypotheses
The above discussions suggest that fear of crime is an important predictor of an individual's health. The fear of crime may cause mental and physical health problems (Lorenc et al., 2012). Conversely, mental health problems may increase fear of crime (Jackson & Stafford, 2009). Meanwhile, the fear of crime may be influenced by factors in the built environment. The impact of built environment on crime and fear have been a focus of Crime Prevention Through Environmental Design (CPTED) (Abdullah et al., 2013; Lorenc et al., 2013), which emphasises natural surveillance, access control and maintenance as environmental attributes. Combining these pathways, it seems that the fear may mediate the effects of environment on individual's health (Lorenc et al., 2013). These discussions lead to the following research hypotheses, as shown in Figure 1.

H1. There is a significant relationship between house quality and fear of crime.
H2. There is a significant relationship between house quality and health.

H3. There is a significant relationship between fear of crime and health.
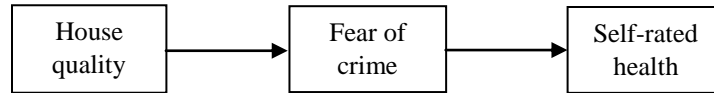H4. Fear of crime mediates the relationship between house quality and health.

Figure 1 The conceptual pathway between the study variables

3   METHODS

3.1   Study Context

This article constitutes a portion of a larger study, which examined the physical characteristics of neighbourhoods and wellbeing of residents. This study was conducted in Penang, Malaysia, specifically in the southern region of Penang which has the highest level of residential burglary compared to other areas in the island (Hedayati-Marzbali et al., 2011). As Malaysia was previously a part of the British Empire, the modern town planning system is highly influenced by the British civil administration system and originated from the UK, but it has been localised throughout decades (Siew, 2007). Penang city structure is also based on land use zoning approach as similar as the British style of zoning. Penang is now the second largest city in the country and has the second highest density of inhabitants per square kilometer.

According to the Overseas Security Advisory Council (OSAC, 2016), the overall crime rate in Malaysia is designated as 'medium' in 2014 to 'high' in 2016 as compared to the U.S. national average. Based on OSAC (2016), there continued to be a noticeable increase in crime, including reported assaults and robberies, sometimes involving weapons, in Kuala Lumpur in 2015. Although violent crime against expatriates is relatively uncommon, petty crime is fairly common and residential break-ins do occur and are becoming more frequent in landed houses (OSAC, 2016). A similar index from Numbeo, the online data collection site, ranked Malaysia fifteenth out of 118 countries for crime index (Numbeo, 2016),
This study utilises probability sampling based on a systematic sampling with random start method to select samples from the population. A team of interview staff was selected and trained to administer the field survey and walked between houses and conducted face-to-face interviews. Eligibility criteria for the study survey included: (1) residence in terraced houses, (2) length of residence at least one year, and (3) age of at least 18 years. The survey was conducted in 2014 with a response rate of 65%. The sample size for this study was 230 samples. Table 1 shows the demographic characteristics of the respondents. The survey illustrated that 45.2% of the respondents were Malay, 43.5% Chinese, 10.4% Indian and almost 1% was other races. Penang Statistics (2014) reported that the majority of Penang population are 44.7% were Malay, followed by Chinese and Indian. The proportions of all ethnic groups were highly comparable with the Penang population.

Table 1 Demographic characteristics of respondents (n = 230)

Characteristic	Description	Frequency	Percentage
Gender	Female	134	58.3
	Male	96	41.7
Race	Malay	104	45.2
	Chinese	100	43.5
	Indian	24	10.4
	Others	2	0.9
Age	18-29 years	7	3
	30-39 years	34	14.8

Characteristic	Description	Frequency	Percentage
	40-49 years	33	14.3
	50-59 years	73	31.7
	60 and over	83	36.1
Marital status	Single, widowed or separated	24	10.4
	Married and living as married	206	89.6
Ownership	Owner	205	89.1
	Tenant/others	25	10.9

3.2   Design and Data Collection

The data for this study were collected through a cross-sectional survey conducted in 2014. A questionnaire was distributed by a team of interview staff who were trained to administer the field survey and walked between houses and conducted face-to-face interviews. A sampling framework was developed from the list of all of the properties in the study area through on-site observation. In addition to providing details about themselves, respondents were required to indicate their level of agreement with the statements, on a 5-point and 7-point scales, for the questions that measured the key constructs.

Fear of crime is the central concept for examining neighbourhood dynamics (Hedayati-Marzbali et al., 2016b) and there is a complex relationship between neighbourhood physical conditions and perceived fear of crime. In this study, we measured fear of crime to examine its mediation role on the relationship between housing quality and health. This variable was derived from the question: in your everyday life, how worried are you about the following situations? The items were: (1) getting burglarised; (2) yourself or someone in your family getting assaulted; (3) having your car stolen; (4) having things stolen from your car in this neighbourhood; (5) being robbed or mugged on the street; and (6) having your property damaged by vandals (Foster et al., 2010; Hedayati-Marzbali et al., 2016a). The response categories ranged from 1, 'extremely not worried', to 7, 'extremely worried'. A higher score indicated more fear of crime. The Cronbach's alpha of the six items was 0.954, indicating good reliability.

In operationalising the built environment in residential areas, studies have considered house quality as one of the main dimensions, also known as image and maintenance. The items employed in the study to measure house quality were adapted and modified based on Wilson and Kelling's (1989) Broken Windows Theory, Hedayati-Marzbali et al. (2016b), Austin et al. (2002) and the study of Cozens et al. (2005). There are six items measuring house quality based on a five-point Likert scale ranging from 1 (low quality) to 5 (high quality). The Cronbach's alpha of the seven items was 0.897, indicating good reliability.

Health was assessed using three general health questions. Three questions based on the work of Baum et al. (2009), Hedayati-Marzbali et al. (2016a), and Wallace (2012), were used to measure the self-rated health variable. The scale was constructed based on a 5-point Likert scale (1=very poor; 5=excellent). Self-rated health was measured by asking the respondents three following questions: (1) 'Would you say that your mental health is poor, fair, good, very good or excellent?';(1) 'Would you say that your physical health is poor, fair, good, very good or excellent?', and (3) 'How would you describe your overall quality of life?'. The Cronbach's alpha of the three items was 0.608, indicating acceptable reliability (Nunnally& Bernstein, 1994).

3.3   Statistical Analyses

Exploratory Factor Analysis (EFA) and reliability tests were used to assess the dimensionality and internal consistency for each of the first-order reflective constructs (Hurley et al., 1997; Nunnally, 1978). The proposed model and hypothesis testing were conducted using Partial Least Squares (PLS) analysis with the Smart PLS M2 software (Ringle et al., 2005). PLS allows specifying both validating the

outer model and fitting the inner model (Diamantopoulos & Winklhofer, 2001).Nonparametric bootstrapping (Wetzels et al., 2009) with 1,000 replications was applied to test the significance of the path coefficient between latent variables as well as between the latent variables and respective manifest variables.

The result is presented in two steps: validating the measurement model and examining the structural model. The former comprises the relationships between the indicators and their respective constructs (the outer model), whereas the latter consists of the relationships between the latent constructs (the inner model). Validating the outer model was accomplished by determining the convergent and discriminant validity and reliability for the reflective constructs (Wetzels et al., 2009). Fitting the inner model was accomplished primarily through path analysis with latent variables. The structural model is assessed to test the hypotheses advanced in this study by examining path coefficients (β) and their significance levels using PLS path modelling with a non-parametric bootstrapping procedure (Chin, 1998; Henseler et al., 2009).

4   RESULTS AND FINDINGS

4.1   Outer Model Analysis

PLS makes no distributional assumptions. Thus, only non-parametric tests can be used to examine the explanatory power of the model (Chin, 1998). Construct validity consists of convergent and discriminant validity. The quality of the outer models was assessed using construct validity as well as the reliability of the latent variables. As shown in Table 2, the convergent validity of the constructs was supported because factor loadings were above the 0.7 threshold (Hair et al., 1998). As such, more than 50% of the variance in the observed variable could be explained by the underlying construct (Hulland, 1999). As shown in Table 2, the bootstrap test indicated that all loadings were significant at the bootstrap-based empirical 95% confidence interval suggesting that all indicators significantly reflect their underlying constructs.

The average variance extracted (AVE) is suggested to have a value of 0.5 and above, which indicates adequate convergence (Bagozzi & Yi, 1988). Because AVE exceeded the required 0.5 threshold, the constructs captured more than 50%of the indicators' variance.CR estimates the degree to which the respective indicators reflect the latent construct. A value of 0.7 and above is suggested for composite reliability and represents good reliability (Hair et al., 2010; Kline, 2010). With respect to discriminant validity, the root of AVE should surpass the correlation coefficient of the construct with every other construct in the model (Fornell & Larcker, 1981) and this was the case in our model (Table 3). The results further show that none of the items has multiple cross-loadings, which suggest preliminary discriminant validity. Table 3 shows that the values were above the recommended value points, thus ensuring achievement of construct validity. Therefore, each construct shares more variance with its own block of indicators than with another latent variable representing a different block of indicators (Henseler et al., 2009). In sum, these results provide support for the overall quality of the reflective constructs' measures.

Table 3 The measurement model results for the latent constructs

Construct	Items	Loadings	Composite reliability (CR)	t value	Average variance extracted (AVE)
House Quality	HQ1	0.809	0.925	8.849***	0.672
	HQ2	0.826		10.654***	
	HQ3	0.805		7.764***	
	HQ4	0.818		7.203***	
	HQ5	0.805		10.195***	
	HQ6	0.855		8.048***	

Construct	Items	Loadings	Composite reliability (CR)	t value	Average variance extracted (AVE)
Fear of Crime	FOC1	0.930	0.964	78.031***	0.815
	FOC2	0.926		83.202***	
	FOC3	0.933		81.832***	
	FOC4	0.896		54.386***	
	FOC5	0.887		47.991***	
	FOC6	0.841		35.957***	
Health	H1	0.902		39.147***	
	H2	0.922	0.931	52.639***	0.818
	H3	0.888		50.648***	

Note. *** p<.01

The discriminant validity was examined using the criterion suggested by Fornell and Larcker (1981). Table 4 shows that the square root of the AVE exceeded the inter-correlations of the constructs in the model. This result suggests that the measure had adequate discriminant validity (Chin, 2010).

Table 4 The discriminant validity of the constructs

	1	2	3
1. Fear of crime	**0.903**		
2. Health	-0.340	**0.904**	
3. House quality	-0.029	0.232	**0.820**

Note: The diagonals (in bold) represent the square root of the AVE.

4.2 Path Estimates and Hypotheses Testing

In the next stage, path analysis was performed to test the four hypotheses generated for this study. Since the outer model evaluation provided evidence of reliability and validity, the inner model estimates were examined to assess the hypothesised relationships among the constructs in the conceptual model. The standardised path coefficients and significance levels provide evidence of the inner model's quality (Hair et al., 2012) and allow researchers to test their proposed model. Table 5 presents the results of the structural model. House quality was positively related to health (β= 0.232, p<0.01). Consistent with other studies conducted on the relationship between neighbourhood environmental conditions and health, the findings of the current study support the notion that enhancing exterior house maintenance and quality of the surrounding environment in residential areas would increase residents' self-rated health (e.g. Jackson & Stafford, 2009; Ross et al., 2000; Wallace et al., 2012).The notion is that the individuals who perceive their physical environment in positive terms will report high self-rated health.

As shown in Figure 2, a negative relationship was found between fear of crime and self-rated health (β= −0.340, p<0.01). However, the relationship between house quality and fear of crime (β= −0.029, p>0.05) was insignificant in this study. The results indicate support for H2 and H3 but not for H1, as shown in Figure 3. The results also reveal that approximately 17% of the variance in health is explained by house quality and fear of crime (R^2=0.174). According to Chin (1998), based on the R^2 index, the explanatory power is weak.

The results further indicate that individuals who perceived high fear of crime in the residential environment, reported their personal health lower than those reported low fear of crime, consistent with the findings of other studies (Chandola, 2001; Hedayati-Marzbali et al., 2016a; Stafford et al., 2007). It was also hypothesised that when residents perceive themselves in an untended area, local control fails and fear of crime increases. However, contrary to what was expected, first hypothesis, that a negative

relationship between house quality and fear of crime was not supported. This suggests that the relationship between house quality and fear of crime in the study area remains unclear.

In addition to direct relationships, this paper estimates the indirect relationship between house quality and self- rated health as shown in Figure 2. Although Baron and Kenny (1986) suggested the necessity of a significant direct effect of a predictor on a criterion for meditation to occur, some authors have argued that this is not necessary (Preacher & Hayes, 2008). To estimate the significance of the indirect effect, many researchers employed the Sobel test (Sobel, 1982). One limitation of the Sobel test is that it requires a normal sampling distribution of the indirect effect (Hayes, 2009), whereas the indirect effect (*ab*) sampling distribution tends to be asymmetric with non-zero values for skewness and kurtosis (Stone & Sobel, 1990).

According to Hayes (2009), tests that assume normality of the sampling distribution should not be used to assess indirect effects and suggests the use of bootstrapping procedure as an alternative approach to test the indirect effects. The *t* values for both direct and indirect effects were computed through a bootstrapping procedure with 230 cases and 1000 samples. It should be noted that the *t* values for indirect effects are obtained by dividing the *ab* by the standard error (SE) of the indirect effect. The SE is the standard deviation of the repeated bootstrap estimates of the indirect effect. The result showed that the *t* value of indirect effect (*t*=0.248) is less than 1.960 and insignificant at the 0.05 level. Therefore, the result does not support H4.
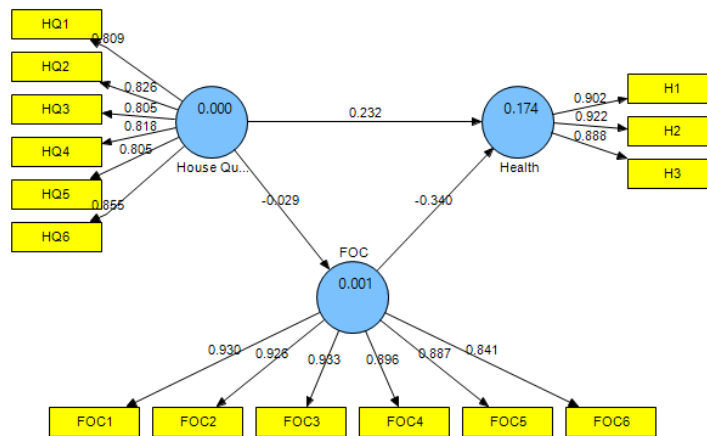

Figure 2 The parameter estimates of the PLS analysis (β value)
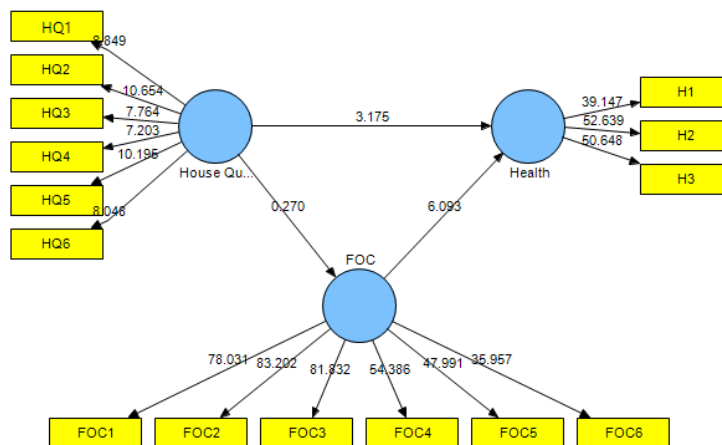

Figure 3 The parameter estimates of the PLS analysis (*t* value)

5   CONCLUSIONS

Historically, health-related concern was one of the major planning initiatives all over the world. Despite the continued interest and the influence of neighbourhood social and physical conditions on criminological literature, the indirect pathway between the neighbourhood conditions and health through fear of crime has not received empirical support, and most existing studies have been criticised for their methodological shortcomings. Until recently, this area of research was an understudied area in criminological literature. In 2001, Chandola attempted to uncover the impact of area differences in health outcomes across the UK and found the significant role of fear in health outcomes. To fill this gap, the current study examined the mediation effect of fear of crime on the relationship between house quality and self-rated health.

This empirical paper examined the relationships between house quality, fear of crime and health in a Malaysian city (that is an important strength of the study, given the predominance of the U.S. and some European contexts, but little research on the topic in the rest of the World), using SEM to test a mediation model. A field survey of a systematic random sample of Penang residents in a residential neighbourhood was used to examine the indirect relationship between house quality and health. It is obvious that interventions involving changes to the neighbourhood physical environment may be a promising way to address fear of crime in residential settings, and the broader health and well-being outcomes. The notion is that environmental changes can contribute in addressing the macro-level determinants of health behaviours, not only in deleterious areas, but also across all settings (Lorenc et al., 2013). However, this area of research has received less attention in the field of place-based crime prevention.

The current work provides a richer and more profound insight into health and well-being in residential setting. It suggests that tangible benefits to residents in the form of improved environmental conditions are possible which may lead to create safer communities and improved health and well-being. Without denying the importance of physical health, positive mental health is increasingly recognised as an important aspect of public health and may be affected by good living environment. While some researchers examine how either physical or mental health are independently related to fear of crime, most studies focus on both categories. The current study measured both physical and mental health on the basis of self-rated health. However, contrary to the expectations, fear of crime does not mediate the relationship between environmental conditions and health outcomes (e.g. Chandola, 2001; Lorenc et al., 2013). The findings of this study contradict stereotypes presented in previous studies which may refer to mixed-racial composition of the study samples. This is in agreement with the social disorganisation theory, suggesting that neighbourhood structure and social processes have great impact on crime and fear, and consequently on health outcomes.

The results of the study influence community planning and design decision makers. Disorder signs send a message to residents that things are getting out of control. Therefore, the physical upkeep and maintenance of the individual private properties may enhance the potential for physical activities within an area, which help increase social contact. Certain environmental features may set the stage for neighbourhood social interactions, thus serving as a foundation for underlying health and well-being. Altering these environmental features may have greater than expected impact on individual's health.

5.1   Limitations and Strengths

Although the present work extends prior neighbourhood-health studies, some important limitations are worth noting. Firstly, the study focuses on the relationship among house quality, fear of crime and health and does not address the effect of environmental conditions at the neighbourhood level. The study would be useful for future work that includes testing the mediating role of fear of crime at both household and neighbourhood levels.

Many factors, such as physical and social vulnerabilities, notably influence the perceived fear of crime, and consequently health outcomes. Failure to control age and gender as physical vulnerabilities is the second limitation of this study. On the one hand, a stream of research focusing on fear of crime seeks to indicate that women and the elderly are more physically vulnerable and more likely to report higher levels of fear of crime than their counterparts (Franklin et al., 2008).On the other hand, social vulnerabilities such as the poor, less-educated people and ethnic minorities may perceive higher levels of fear than other counterparts (Taylor & Hale, 1986).These factors are important because a previous study observed the influence of the residential environment on women's health but not for men (Stafford et al., 2005).

Moreover, as shown in Figure 2, a significant amount of variance in health is left unexplained. Based on the R^2 index, as the explanatory power is weak, the study suggests that there should be other variables that might have great impact on residents' health and well-being such as demographic characteristics, social cohesion, and social control within the neighbourhood environment. Therefore, future research should have a clearer focus particularly taking account of socio demographic, ethnicity (as the study area is a multi-ethnic country) as well as gender. To advance the understanding of the link between man-made environments and health outcomes, one should consider other mediators such as social cohesion, as there is no doubt that individual health and well-being cannot be seen in isolation.

The empirical illustration of the present study of the use of PLS path modelling constitutes only a single study with limited generalisability. Causal interpretations cannot be confirmed because this study is cross-sectional in a specific context (a developing country). Moreover, we described the correlations between the variables rather than causations, so future studies should assess these associations longitudinally. The results of the study are only generalisable to high-crime contexts such as residents living in multiracial neighbourhoods. However, our larger point is that enhancing health and well-being, as one urban policy of the day, could be possible by manipulating the physical environment. Meanwhile, fear of crime may be a barrier to improve individual's health in residential settings. Therefore, policy makers and practitioners should support fear-reduction initiatives through design manipulation.

6 ACKNOWLEDGEMENTS

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