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## ID 1460 | RELATIONSHIPS BETWEEN HEALTH STATUS AND SOCIOECONOMIC AND HEALTH SERVICES INDICATORS DURING THE FINANCIAL CRISIS

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**ABSTRACT:** The literature has highlighted the association between social and economic determinants and physical and mental health. Several studies have stated that the positive correlation between socioeconomic status and health is different between countries and welfare states in Europe. On the other, the current financial crisis might have modified this relationship. Due to all the above, the aims of this research are to analyse the relationships between self-perceived health status and socioeconomic variables in Europe at NUTS 2 level (European regional statistical unit) focusing on the influence of the spatial factor during the financial crisis. Taking into account the focus on spatial effects, the analysis includes the continental regions and the closest ones, removing from the analysis the remote and far regions in order to assess the geographic influence. Moreover, in order to consider spatial relationships between regions, this research combines simple linear, spatial lag, spatial error and geographically weighted regressions. The analysis has related to the health status with macroeconomic indicators (income of households by inhabitant, GDP per capita in PPS and unemployment rate), social indicators (tertiary education rate and at-risk-of-poverty rate), and health indicators (crude death rate, hospital beds rate, life expectancy and medical doctor rate) during 2008-2014. Four models for each year have been designed using classical and spatial regression methods. The models show that self-perceived health is explained significantly by unemployment, risk of poverty, tertiary education and medical doctor rates for 2008, 2010 and 2014. In addition, life expectancy, hospital beds and death rates show collinearity worsening the models. Finally, the results support the objective of the research: the regression models improve when the geographical location and distance between analysis units are considered. Missing data and the lack of other interesting socioeconomic variables at regional level together with the ecological fallacy are the main limitations of this study. The results support the existence of contextual effects among European regions that varies the association between socioeconomic measures and health status throughout the time. The findings also points out the relevance of social context in explaining the differences in individuals' states of health. Thus, the spatial analysis have stated that the macroeconomic

indicators do not explain significantly the self-perceived health status in contrast to the social indicators during the financial crisis.

## 1 INTRODUCTION

The literature has highlighted the association between social and economic determinants and physical and mental health (Angner, Ray, Saag, & Allison, 2009; Bartley, Sacker, & Clarke, 2004; Wilkinson & Marmot, 2003). Several studies have stated that the positive correlation between socioeconomic status and health is different between countries and welfare states in Europe (Adams, 2003; Alvarez-Galvez, 2016; Alvarez-Galvez et al., 2013; Alvarez-Galvez, Rodero-Cosano, García-Alonso, & Salvador-Carulla, 2014; Eikemo, Bambra, Judge, & Ringdal, 2008; Frijters, Haisken-DeNew, & Shields, 2005). Income inequalities within countries could harm the self-perceived health status (Costa-Font & Hernández-Quevedo, 2012, p.; Nummela, Sulander, Heinonen, & Uutela, 2007; Wilkinson, 1996, 1997). In Europe, research has been focused on analysing this relationship, obtaining different and, sometime, unexpected findings (Fritzell, Neramo, & Lundberg, 2004; Grossman, 2000; Smith, 2004). Therefore, including income as explanatory variable is a necessary but not sufficient to disentangling the diversity and complexity of other social dimension that could also lead to these inequalities (Marmot, 2010).

In general, little attention has been paid to those social determinants that could have a direct impact on the well-being and health of populations. Álvarez-Galvez et al. (2013) compared the relationship between three different measures of socioeconomic status (income, education and occupational status) and the self-perceived health status for a sample of European countries during the period 2002-2008. They found that differences in self-perceived health in Scandinavian countries and Anglo-Saxon countries exhibits a higher relationship with economic dimensions (income and occupational status), whereas southern and eastern countries these differences are linked to educational differences. For example, in Spain, the universal access to a public health system has led to less difference in self-perceived health despite the rising income inequalities during financial crisis. On the other hand, occupational status and education gain in importance in a country with over-qualified workers that do not have working conditions with the pay levels in line with their educational attainment (Allen & Velden, 2001; Chevalier, 2003).

Therefore, to get a better understanding of the effects of crisis on self-perceived health status is necessary to include economic as well as social dimension. Moreover, all these variables should be studied within their spatial framework. Enriching studies in such a way allows a better applicability of public policies, improving the detection of those areas where shortage are discovered (García-Alonso, Pérez-Naranjo, & Fernández-Caballero, 2011) and the implementation of concrete actions. In addition, the range of variable selected to study the relationship with self-perceived health status can be enlarged (García-Alonso, Salvador-Carulla, Negrín-Hernández, & Moreno-Küstner, 2010; Moreno-Küstner, García-Alonso, Negrín Hernández, Torres-González, & Salvador-Carulla, 2008; Prieto-Lara & Ocaña-Riola, 2010).

Due to all the above, the aim of this research is to analyse the relationships between self-perceived health status and socioeconomic variables in Europe at NUTS 2 level (European regional statistical unit) focusing on the influence of the spatial factor during the financial crisis.

## 2 SCOPE OF STUDY AND METHOD

The analysis has related to the health status with macroeconomic indicators (income of households by inhabitant, GDP per capita in PPS and unemployment rate), social indicators (tertiary education rate and at-risk-of-poverty rate), and health indicators (crude death rate, hospital beds rate, life expectancy and medical doctor rate) during 2008-2014. Once analysed the multicollinearity, some of the independent variables had to be eliminated, that is, income of households by inhabitant, GDP per capita in PPS, crude death rate, hospital beds rate and life expectancy, remaining as risk factors the unemployment rate, tertiary education rate and at-risk-of-poverty rate medical doctor rate in study. We analyse different geographic areas that allow us to assess the global effect of the crisis at the level of European regions (NUT2), whose data are available in Eurostat and in the European Social Survey. Taking into account the focus on spatial effects, the analysis includes the continental regions and the closest ones, removing from the analysis the remote and far regions in order to assess the geographic influence.

Moreover, in order to consider spatial relationships between regions, this research combines simple linear, spatial lag, spatial error and geographically weighted regressions. The simple regression analysis finds a linear relationship between a dependent variable and a set of explanatory variables, by minimizing the sum of squared prediction errors, hence, least squares. The analysis assumes the errors have a normal distribution with mean of zero, homoscedastic and uncorrelated. When the variables has spatial correlated, these assumptions may not always meet. Thus, it is necessary to resort to other methods. To be able to introduce the spatial dependence there are two distinct ways: as an additional regressor in the form of a spatially lagged dependent variable or in the error structure. The spatial lag model is appropriate when the focus of interest is the assessment of the existence and strength of spatial interaction. Spatial error model is appropriate when the concern is with correcting for the potentially biasing influence of the spatial autocorrelation, due to the use of spatial data (Anselin, 2001). Finally, Geographically Weighted Regression (GWR) is other of several spatial regression techniques. This provides a local model of the variable or process you are trying to understand/predict by fitting a regression equation to every feature in the dataset. GWR constructs these separate equations by incorporating the dependent and explanatory variables of features falling within the bandwidth of each target feature.

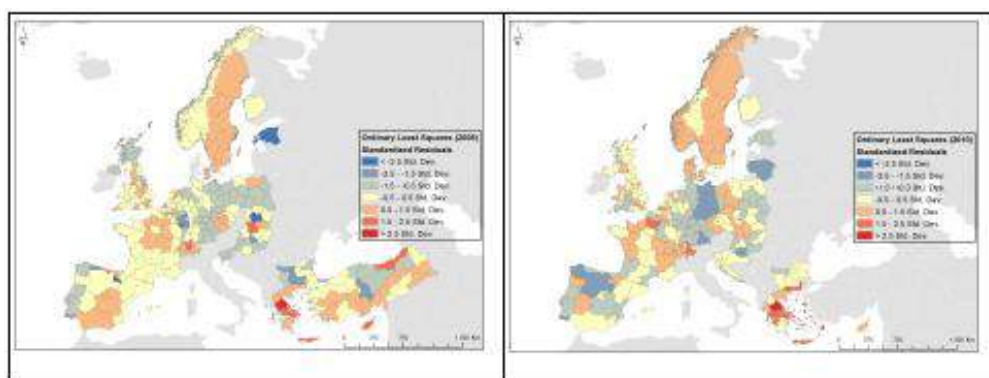
### 3 RESULTS AND DISCUSS

The results of OLS regression are shown in Table 1. During the whole period 2002-2008, it can be observed that the greater the educational level, the greater the self-perceived health status. Just the opposite happens with the relationship between unemployment and self-perceived health status. In addition, the relationship between deprivation and self-perceived health status gets worse along the period.

Variable	$\beta$ Coefficient 2008	$\beta$ Coefficient 2010	$\beta$ Coefficient 2012	$\beta$ Coefficient 2014
Constant	3.40***	3.28***	3.59***	3.79***
Unemployment	-0.03***	-0.01***	-0.00	-0.01**
Risk-of-poverty	0.02***	0.01***	-0.00	-0.01**
Tertiary education	0.01***	0.01***	0.01***	0.01***
Medical doctor	0.00*	0.00*	0.00	0.00***

Table 1 –  $\beta$  Coefficient of the OLS Regression  
Source: Authors' elaboration.

Maps in Figure 1 show that self-perceived health status got worse across many European countries, especially for year 2012. Northern and Mediterranean areas exhibit the lowest values for the variable.



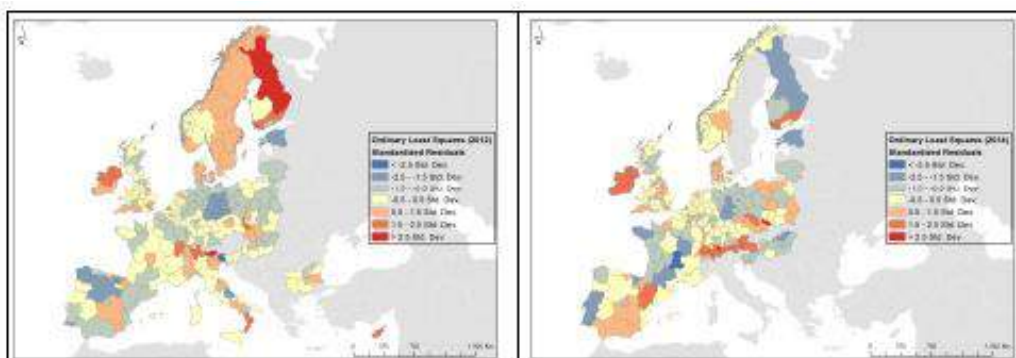


Figure 1 – Ordinary Least Square Regression 2008-2014. Source: Authors' elaboration

Focusing on SLR results (Table 2), similar but smoothed pattern than in the previous one can be observed. Tertiary studies and unemployment are significant along the whole period of study, this is an expected but weaker behaviour. On the other hand, the values for the lag variable indicates that this type of regression could not be appropriate for the study.

Variable	$\beta$ Coefficient 2008	$\beta$ Coefficient 2010	$\beta$ Coefficient 2012	$\beta$ Coefficient 2014
Health-lag	0.37*	0.8***	0.56***	-0.01
Constant	2.00***	0.40	1.46**	3.84***
Unemployment	-0.02***	-0.00	-0.00	-0.01**
Risk-of-poverty	0.01***	0.01**	-0.00	0.01**
Tertiary education	0.01***	0.01***	0.01***	0.01***
Medical doctor	0.00**	0.00	0.00	-0.00***

Table 2 –  $\beta$  Coefficient of the Spatial Lag Regression  
Source: Authors' elaboration.

Maps in Figure 2 allow us to identify the smoothed effects in the decrease of self-perceived health status. This could indicate that effect of crisis on self-perceived health status appears lagged in the time, that is, the worst results appears since 2014.

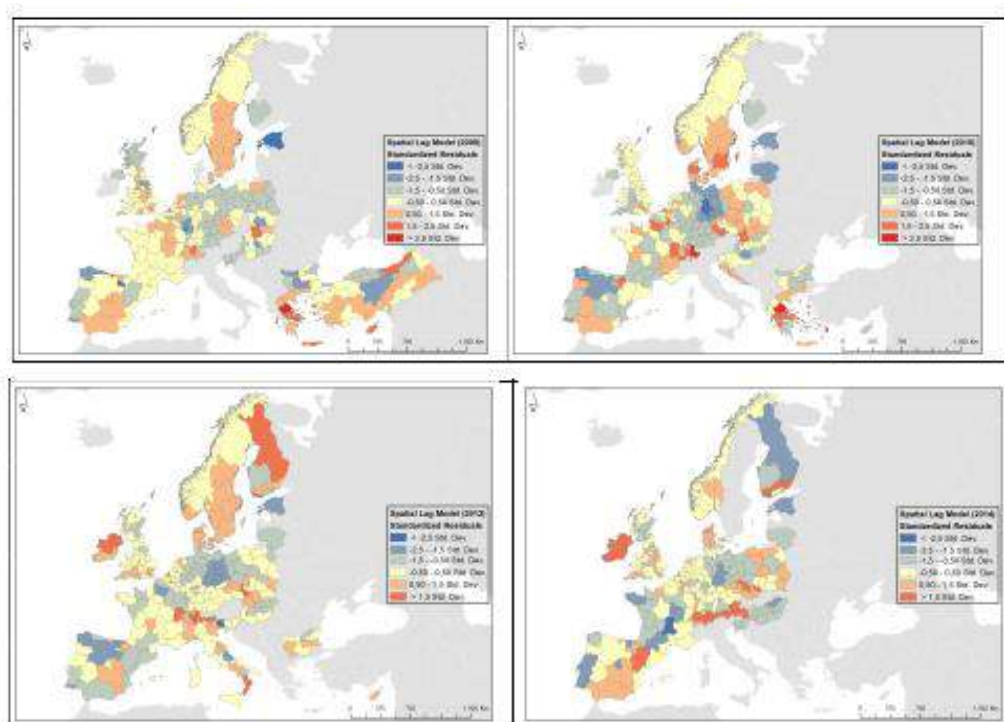


Figure 2–Spatial Lag Regression 2008-2014

Table 3 shows the result for SER. As in the previous analyses, education exerts a positive influence on self-perceived health status, which has remained more or less constant during the period, whereas unemployment and deprivation exhibits a negative influence, rising over the years, especially in 2014. In this occasion the medical doctor per inhabitant does not appear to have any influence on the explanatory variable, as in the cases mentioned above.

Variable	$\beta$ Coefficient 2008	$\beta$ Coefficient 2010	$\beta$ Coefficient 2012	$\beta$ Coefficient 2014
Constant	3.41***	3.51***	3.63***	3.78***
Unemployment	-0.02***	0.00	-0.00	-0.01*
Risk-of-poverty	0.01***	0.00	-0.00	-0.01**
Tertiary education	0.01***	0.01***	0.01***	0.01***
Medical doctor	0.00*	-0.00	-0.00	0.00*
Lambda	0.79***	0.85***	0.57**	0.15

Table 3 –  $\beta$  Coefficient of the Spatial Error Regression  
Source: Authors' elaboration.

Maps 3 shows that self-perceived health status was worse in the Mediterranean area at the beginnings of the period of study. As time goes by, this situation spread among the remaining European regions. The worst situation is reached at the end of the period.

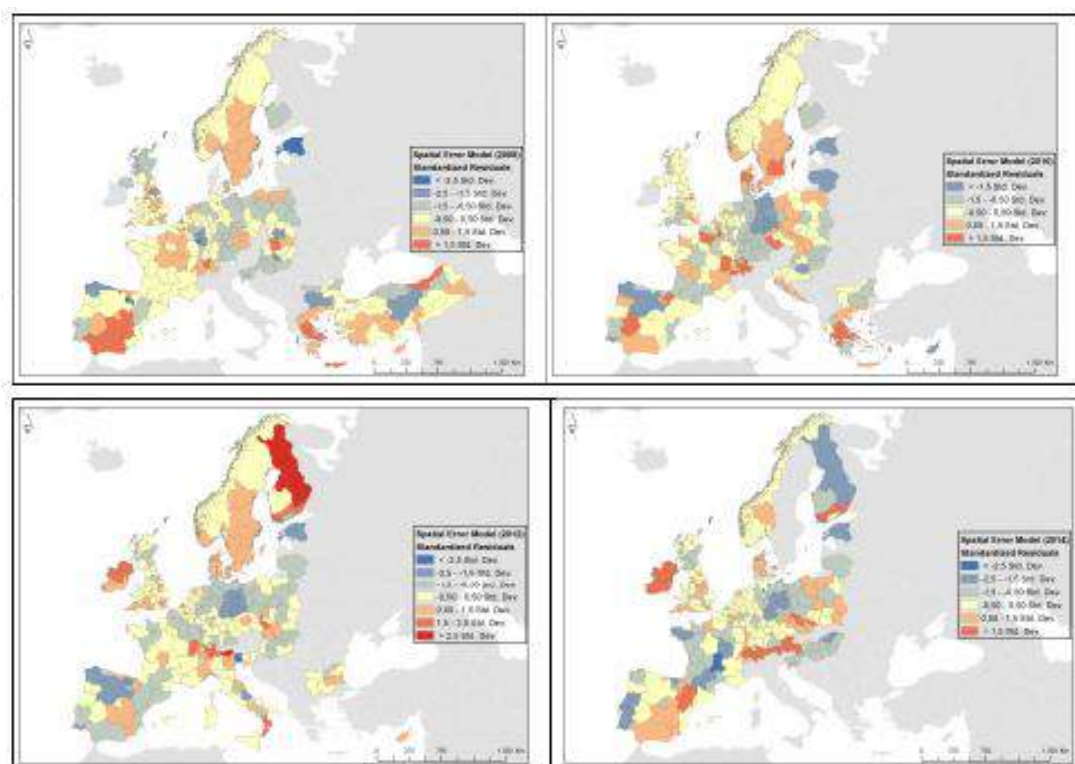


Figure 3–Spatial Error Regression 2008-2014. Source: Authors' elaboration.

Finally, the results for GWR (Table 4) indicates that the most parsimonious model amongst all the years correspond to 2012. This result is the same as in the three previous models, but the explained variability is slightly lower.

GWR	2008	2010	2012	2014
Residual Squares	5.70	4.90	7.10	4.89
Sigma	0.16	0.16	0.18	0.16
AIC	-193.94	-182.60	-135.62	-162.79
R <sup>2</sup>	0.52	0.57	0.43	0.46
R <sup>2</sup> Adjusted	0.48	0.51	0.39	0.41

Table 4 – Statistics GWR  
Source: Authors' elaboration.

Although maps in Figure 4 shows a situation quite similar to the previous one, the GWR model fits better the relationship among the explanatory variables and the self-perceived health status.

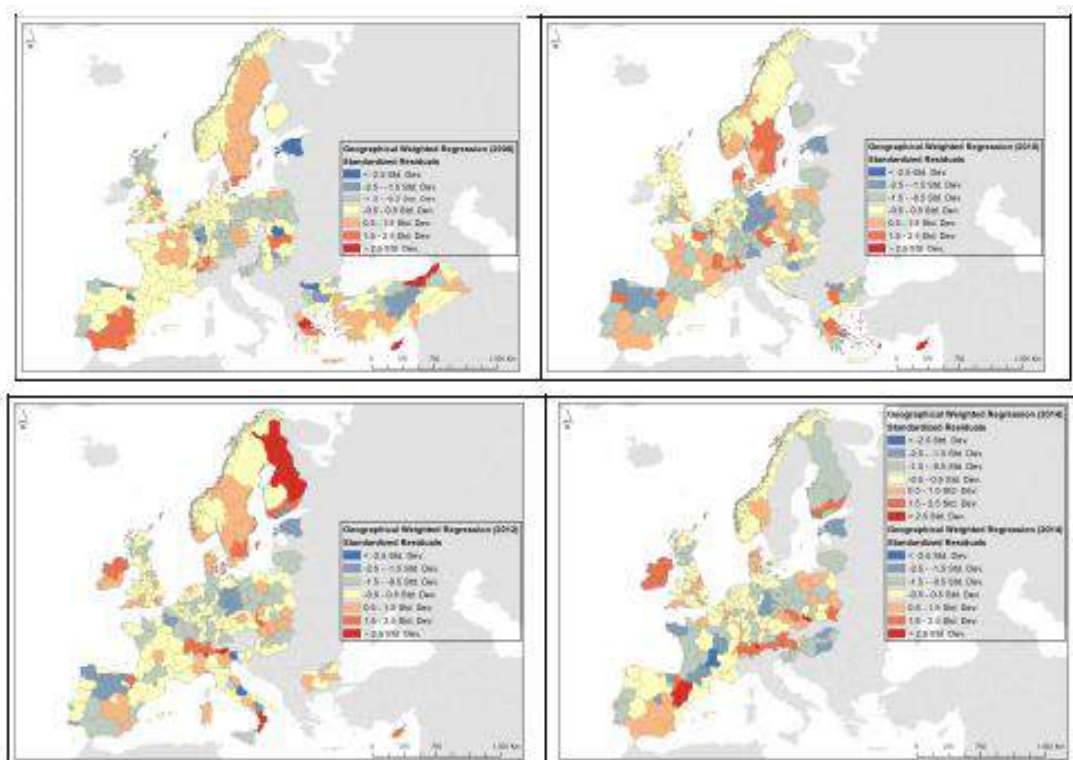


Figure 4– Geographically Weighted Regression 2008-2014. Source: Authors' elaboration.

After comparing the four models, it can be concluded that those techniques that taking into account the spatial factor seem to be more suitable to study the relationship between self-perceived health status and the selected explanatory variables, especially the GWR model. In general, all the explanatory variables has a slight effect on self-perceived health status, with the exception of the number of doctor per inhabitant that do does not exert any effect. Education has a positive and constant effect for the whole period, whereas unemployment and deprivation has a negative effect, which gets worse over the years, especially during the last part of the period. Finally, we can state that self-perceived health status gets worse over the years, reaching a peak in 2014. The lagged effects of crisis on the health can explain this. Even so, it should be noted that these effects are moderate since the variations of self-perceived health status is quite slight or non-significant.

#### 4 CONCLUSION

Missing data and the lack of other interesting socioeconomic variables at regional level together with the ecological fallacy are the main limitations of this study. The results support the existence of contextual effects among European regions that varies the association between socioeconomic measures and health status throughout the time. The findings also points out the relevance of social context in explaining the

differences in individuals' states of health. Thus, the spatial analysis have stated that the macroeconomic indicators do not explain significantly self-perceived health status in contrast to the social indicators during the financial crisis. However, the results for 2012 are contradictory and need further analysis.

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## **ID 1489 | URBAN GREEN SPACE AND THEIR IMPACTS ON PHYSICAL ACTIVITY LEVELS OF OLDER PEOPLE: EXPLORING APPROPRIATE METHODOLOGIES**

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### **1 INTRODUCTION**

Extended life expectancy and the decrease in the birth rate have led to a global concern of population ageing (Garin et al., 2014) and is resulting in increasing pressures on public health expenditure. Evidence has shown that physical inactivity among older adults is associated with higher mortality, morbidity and an increased burden of non-communicable diseases (NCDs) worldwide (Adams et al., 2014; Arango et al., 2013; Woodcock et al., 2011). Although regular physical activity (PA) brings health benefits, there are high levels of physical inactivity within the general population. Worldwide, 31.1% adults are physical inactive (Hallal et al., 2012), in terms of older adults (aged 60 years and above) the proportion meeting physical activity guidelines ranged from 2.4 to 83.0% in a review of fifty three studies (Sun et al., 2013). In Europe, it was found that 60–70% of older adults fail to meet physical activity guidelines (Eurobarometer, 2010). Low levels of physical activity of older adults is clearly a very substantial public health challenge.

There is a growing body of research that examines the relationship between the built environment and physical activity (Handy et al., 2002; Nagel et al., 2008; Rech et al., 2012). It is widely recognized that physical activity is affected by a wide variety of built environment-related attributes, including street connectivity, residential density, land-use mix (Clifton et al., 2009; Lawrence D. Frank et al., 2005) as well as sidewalks, trails, recreational facilities, parks (Ferdinand et al., 2012), traffic density and speed, crime and safety and so on. (Ferdinand et al., 2012; Prezza et al., 2001). Besides, Physical activity can be categorized into four domains, including transportation, recreation, household and occupation, and each of these are influenced by different aspects of the built environment. For example, PA in the household and occupation domains appears to be less related to the relationships with the built environment (Van Cauwenberg et al., 2011), but transport and recreation offer key opportunities for interventions to promote health. This is critical for older adults who are more likely to suffer from a decrease in physical functions, and thus they are more vulnerable to be impacted by built environment barriers towards PA (Forsyth et al., 2009; Rantakokko et al., 2009). However, there is limited research focused on this specific demographic group (Van Cauwenberg et al., 2011; Cunningham and Michael, 2004). Therefore, it is imperative to enhance our understanding on the relationship between the built environment and physical activity, to