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The association between distance to public amenities and cardiovascular risk factors among lower income Singaporeans

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ABSTRACT

Existing evidence on the association between built environment and cardiovascular disease (CVD) risk factors focused on the general population, which may not generalize to higher risk subgroups such as those with lower socio-economic status (SES). We examined the associations between distance to 5 public amenities from residential housing (public polyclinic, subsidized private clinic, healthier eatery, public park and train station) and 12 CVD risk factors (physical inactivity, medical histories and unhealthy dietary habits) among a study sample of low income Singaporeans aged ≥ 40 years (N = 1972). Using data from the Singapore Heart Foundation Health Mapping Exercise 2013–2015, we performed a series of logistic mixed effect regressions, accounting for clustering of respondents in residential blocks and multiple comparisons. Each regression analysis used the minimum distance (in km) between residential housing and each public amenity as an independent continuous variable and a single risk factor as the dependent variable, controlling for demographic characteristics. Increased distance (geographical inaccessibility) to a train station was significantly associated with lower odds of participation in sports whereas greater distance to a subsidized private clinic was associated with lower odds of having high cholesterol diagnosed. Increasing distance to park was positively associated with higher odds of less vegetable and fruits consumption, deep fried food and fast food consumption in the preceding week/month, high BMI at screening and history of diabetes, albeit not achieving statistical significance. Our findings highlighted potential effects of health-promoting amenities on CVD risk factors in urban low-income setting, suggesting gaps for further investigations.

1. Introduction

Cardiovascular disease (CVD) is the leading cause of morbidity and mortality worldwide, accounting for almost half of all non-communicable disease deaths (Laslett et al., 2012). Poor lifestyle behaviors (Cahill et al., 2014) such as physical inactivity and consumption of unhealthy diet are well known CVD risk factors that could lead to obesity and many associated diseases such as heart attack.

Adherence to healthy lifestyle has a substantial effect in reducing CVD morbidity and mortality (Chiuve et al., 2006; Odegaard et al., 2011; Åkesson et al., 2014) independent of pharmacological treatment (Chiuve et al., 2006), thus serving as a promising target for interventions. Based on the social ecological model of health promotion (Golden et al., 2015; McLeroy et al., 1988), such interventions should adopt a population approach by targeting multiple levels of influence including the institution, the community and the built environment to create a

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coherent and conducive setting for behavioral change. Therefore, while conventional interventions tend to focus on the knowledge, attitude and health literacy of individuals, researchers and policy makers are paying more attention to the influence of the environment.

Existing studies have examined the association between access to public amenities (such as public park (Bancroft et al., 2015; Sallis et al., 2016), public transportation (Sallis et al., 2016; Badland & Schofield, 2005), fast food restaurants (Reitzel et al., 2014) and primary care facilities (Wee et al., 2016)) and CVD risk factors (such as physical inactivity, obesity, unhealthy diet and lack of preventive health screening). However, most of them focused on the general population within the US or Europe as highlighted by recent systematic reviews (Papas et al., 2007; Ding & Gebel, 2012). This limits the generalizability of the findings to other settings and population subgroups such as individuals with lower socio-economic status (SES) who are known to have higher CVD risk (Clark et al., 2009) as well as poorer disease awareness, treatment and control (Wee & Koh, 2012). Besides fast food restaurants, there may also be other unhealthy food sources relevant in different cultural contexts. For instance, in Singapore, a multicultural island city state in South East Asia, hawker centers typically serve ready-to-eat street foods that contain more fat and fewer vegetables (Soon & Lam, 2008). They form an integral part of Singaporean's life and culture – almost half (49.3%) of adult Singaporeans dine at hawker centers six or more times per week due to busy lifestyle and affordable price (Soon & Lam, 2008; Health Promotion Board, 2004) – and are recognized as potential contributors to the rising rates of obesity in the country (Soon & Lam, 2008).

Our study examined the association between distance from residential housing to 5 health-promoting public amenities (public polyclinic, subsidized private clinic, healthier eatery, public park and train station) and 12 CVD risk factors (two variables on physical inactivity, five medical histories and five unhealthy dietary habits) among a low-income group living in subsidized rental flats in Singapore. The national median monthly household income of Singapore is $6000 (USD). Lower income individuals are defined as those with a monthly household income less than $1995 (USD) (Department of Statistics Singapore, 2016a) and are eligible to live in subsidized rental flats under the public housing scheme (Housing & Development Board Singapore, 2013). Our study addresses the evidence gap in urban low-income setting as well as local policy needs.

2. Methods

2.1. Hypotheses

Singapore has a total land area 719.7 sq.-km (approximately 65% the size of Hong Kong) with a population of 5 million. Primary care in Singapore is provided by public polyclinics and private general practitioners (GPs) (Khoo et al., 2014). Public polyclinics provide care at subsidized rates to all residents whereas within the private sector, the means-tested Community Health Assist Scheme (CHAS) scheme allows low and middle income Singaporean residents to receive subsidized medical and dental care from participating private GPs (CHAS clinics, hereafter addressed as “subsidized private clinics”) (Ministry of Health Singapore, 2016). Despite their small numbers compared to their private counterparts (18 polyclinics vs > 2000 GP clinics), the polyclinics manage 55% chronic disease patients in the country (Khoo et al., 2014). Access to primary care has been associated with favorable behaviors such as higher uptake of cardiovascular screening (Wee et al., 2016) and preventive care (Starfield et al., 2005) which are important for the management of CVD. Therefore we hypothesized that living further away from these amenities would be associated with higher CVD risk.

Healthier eateries are canteens or restaurants endorsed and funded by the Singapore Health Promotion Board to provide beverages lower in sugar and food lower in calories, use healthier ingredients, serve more fruits and vegetables and incorporate less deep fried food in their menus (Health Promotion Board, 2015). Thus, we hypothesized that living further away from healthier eateries is associated with higher CVD risk, especially those related to unhealthy dietary habits.

The number of parks (Sallis et al., 2016) and access to public transport (Sallis et al., 2016) in a residential area have been associated with higher physical activities. Singapore has a well-connected train network (144 mass rail transit and light rail transit stations) with 2.5 million passenger trips a day, which approximate to 36% total public transport utilization in 2014). (Authority, 2015) Thus we also hypothesized that longer distance away to a park and to a train station were associated with an increase in CVD risk (Sallis et al., 2016).

2.2. Data sources

We obtained the spatial data (shapfiles) from the Singapore Land Authority (SLA) website (Singapore Land Authority, 2016) (subsidized private clinics, healthier eateries, public parks) or identified the locations of the amenities based on official addresses published on websites (train stations, public polyclinic, residential flats).

We obtained individual level data between 2013 and 2015 from the Singapore Heart Foundation Health Mapping Exercise (HME), a door-to-door annual health screening program for low income residents living in public rental flats in Singapore. (Singapore Heart Foundation, 2012) Public rental flats are publicly administered residential flats providing affordable housing for those with low income. In addition to demographic characteristics of individuals who responded to the invitation to health screening program, the data contained 12 CVD risk factors. Specifically, physical inactivity (two variables) included walking < 30 min every day last week and participated in sports < once a week; medical histories (five variables) included hypertension, diabetes, high cholesterol, heart attack and high BMI; unhealthy dietary habits (five variables) included consumption of fast food in the past one month, consumption of deep fried food, vegetables, fruits in the past one week and frequency of dining at hawker center in the past one week. Besides body mass index (BMI) which were measured by trained volunteers at screening, all variables were self-reported.

We obtained ethics approval from the National University of Singapore Institutional Review Board.

2.3. Inclusion & exclusion criteria

We limited our analysis to respondents ≥ 40 years old given their higher risk of CVD. To simplify the analyses, we considered the first participation to the health screening program. In addition, we removed a small number of respondents (n = 40, 1.7%) with > 2 year differences between reported and calculated age based on year of birth as a criteria for poor recall. The final analysis sample contained 1972 respondents.

2.4. Statistical analysis

We investigated the associations between the minimum distances from the residential housing of each respondent to the 5 public amenities (public polyclinic, subsidized private clinic, healthier eatery, public park and train station) and 12 CVD risk factors. As respondents clustered in residential blocks, we performed a series of logistic mixed effect regression models, specifying the residential blocks as the random effect. Each regression analysis used the minimum distance (in km) between residential housing and each public amenity as an independent continuous variable and a single risk factor as the dependent variable, controlling for demographic characteristics (gender, age group, housing type, marital and employment status).

For consistency, all risk factors were represented as binary variables such that the regressions are predicting higher risks or undesirable outcomes, notably walking < 30 min every day last week, participated in sports < once a week and less regular consumption of vegetables