



**Associations of Social Cohesion and Socioeconomic Status
with Health Behaviours Among Older Mexican People**

**Thesis
MSc Health Economics, Policy, and Law**

Nudia Rimanda Pangesti

Research Report

Student ID

544453

Supervisor

Prof. dr. A.P. Nieboer

Reading Committee

L.J. Bakker M.Sc.

Rotterdam, 19th of September, 2021

Word count: 9037

Acknowledgement

First of all, I am genuinely thankful for the opportunity to work on the thesis in the Socio-medicine department. Furthermore, I would like to express my deepest gratitude to my supervisor, Prof. dr. AP Nieboer, for continued guidance and valuable feedback. This thesis would not have been possible without her sincerity and encouragement throughout the project. It is an honor to learn from Prof. dr. AP Nieboer. Secondly, I am thankful for Zeyun Feng as a senior researcher in the socio-medicine department. Her feedback helped me understand the topic better and gave me insights into my analysis process.

Lastly, I would also like to thank my parents for their outstanding support throughout this journey. In addition, I am grateful for my husband, Pamungkas, family, and best friends, who always give me unconditional support and encouraging advice during my master's degree.

Nudia Rimanda Pangesti

Eindhoven, September 2021

Abstract

Objective: To investigate the associations of social cohesion and socioeconomic status (SES) with health behaviours in older adults in Mexico.

Methods: This study used data for Mexico from the World Health Organization's Study on Global Ageing and Adult Health. Logistic regression and multivariate linear regression were used to assess relationships between social cohesion, SES, and health behaviours while controlling for covariates.

Results: Older people who reported greater social cohesion were more likely to have adequate vegetable and fruit consumption and be socially active; they were more likely to be daily smokers but were not physically more active. Older people with higher incomes were more likely to be socially active. Participants with higher education levels were more likely to be physically and socially active.

Discussion: The findings of this study are an essential step to a better understanding of the role social cohesion and SES play in protecting and maintaining healthy behaviours among older adults in Mexico.

Keywords

social cohesion, socioeconomic status, physical activity, healthy diet, smoking, social participation, health behaviour, Mexico, older adults

Contents

Title Page	1
Abstract	3
Contents	4
Introduction	5
Objective and Research Question	9
Theory	9
Mexico Population Ageing	9
Health Behaviours and Non-communicable diseases	9
Healthy Diet	10
Physical Activity	10
Smoking	11
Social Participation	11
Socioeconomic Status and Health Behaviours	12
Social Cohesion and Health Behaviours	14
Possible Confounders	16
Methods	20
Participants and Data	20
Independent Variables	20
Dependent Variables	21
Statistical Analyses	23
Validity and Reliability	25
Results	25
Characteristics of the Study Populations	26
Bivariate Analysis	28
Multivariate Analysis	30
Discussion	31
Associations of Social Cohesion with Health Behaviours	31
Associations of Socioeconomic Status with Health Behaviours	34
Associations of Covariates with Health Behaviours	35
Strengths and Limitations	36
Conclusion	37
References	38
Appendices	53
Appendix 1 – Social Cohesion Questionnaire	53
Appendix 2 – Social Participation Questionnaire	54

1. Introduction

Mexico has the 11th-largest population worldwide and is the largest Spanish-speaking nation. Projections show that the number of older people (aged ≥ 60 years) in Mexico will increase from 6.3% of the total population in 2010 to nearly 23% by 2050, due to decreased infant mortality, higher life expectancy at birth and declining fertility (Smith & Goldman, 2007; United Nations, 2015). However, higher life expectancy does not guarantee that people will spend these added years in good health (Chatterji et al., 2015; Yu et al., 2017). The older population has been associated with an increased risk of disability and frailty (Clegg et al., 2013; Guzman-castillo et al., 2017). In addition, a rise in chronic conditions, such as diabetes and chronic kidney disease, exists among the older population (Gomez-Dantes et al., 2016).

Effective public health interventions to help people maintain and improve health, reduce disease risks and manage illness usually require behaviour change (Chiu et al., 2020; Koutsogeorgou et al., 2014). The World Health Organization (WHO) in 2011 stressed that smoking, unhealthy diet, and decreased physical activity (PA) and social participation are modifiable health behaviours to reduce the worldwide chronic disease burden (Feng et al., 2020). Staying socially active is part of a healthy lifestyle in addition to traditional health behaviours such as physical activity, not smoking and healthy diet for older people's health and quality of life (Feng et al., 2020).

The importance of leading a healthy lifestyle among older people in Mexico is critical. In Mexico, smoking is a severe public health problem and one of the most critical risk factors for diseases and mortality (Pan American Health Organization, 2015). Although Mexico has seen declines in smoking prevalence in the last 20 years, it still had >16 million smokers (16%) in 2017 (Arciniega et al., 2020). In addition, the proportion of physically inactive older Mexicans has been

increasing (Medina et al., 2013; Medina et al., 2021), with 28.9% of the older Mexican population inactive. Furthermore, current Mexican dietary patterns are characterised by a high intake of processed foods high in sugars and saturated fat, animal-based products, and low amounts of healthy foods such as fruit and vegetables (Castellanos-Gutiérrez et al., 2021). In the context of social participation, a study in Mexico has described the importance of being socially active in successful ageing for older adults (Reyes-Uribe, 2015). Investigating the factors associated with health behaviours may help prioritise scarce resources and target health interventions in the country.

Socioeconomic status (SES) affects health and well-being, thus contributing to health inequalities, a significant public health concern (Marmot, 2005). SES indicators, namely education and income, are associated with health behaviours (Darmon & Drewnoski, 2008; Pampel et al., 2010). High-SES individuals possess more health advantages than those with lower SES (Wang et al., 2018). Low-SES individuals are more likely to have unhealthy behaviours, increasing their risk of poor health (Wardle & Steptoe, 2003). Studies on health behaviour show that educational level can influence health by increasing a person's ability to obtain information, leading to healthier lifestyle choices (Grundy & Holt, 2002). The accumulation of information over time increases education's impact on health in later life (Mirowsky & Ross, 2003). In addition to education, income levels have been reported to influence health, with wealthier individuals typically reporting better health and choosing healthier behaviours (McMunn et al., 2009; Williams et al., 2008).

Most studies on the influence of SES on health behaviours have been conducted in high-income countries and shown that higher SES is correlated with higher diet quality, higher PA and lower rates of smoking (Darmon & Drewnoski, 2008; Dynesen et al., 2003; Giskes et al., 2010;

Mayén et al., 2014; Pampel et al., 2010). Similarly, in Mexico, adults with higher income and higher education levels have a lower likelihood of smoking (Bardach et al., 2016). Additionally, in accordance with findings in high-income countries, low-income people in Latin American countries have nearly twice the probability of being active smokers than do high-income people (Bardach et al., 2016). However, the relationship between education, income and PA is mixed. In Mexico, adults with higher income and higher education levels are more likely to be physically active (Aarsland et al., 2020; Arredondo et al., 2018). However, another study found that women with higher SES reported decreased PA in urban Mexico (Gómez et al., 2009). In addition, the relationship between education and income and healthy diet in Mexico varies. Adults with higher income levels, along with women, report higher vegetable and fruit (VF) consumption (Doubova et al., 2016). In contrast, less-educated people report better diet quality (less fast-food consumption, more wholegrain consumption) than those with higher education (Lopez-Olmedo et al., 2019; Satia, 2009). Factors other than SES differences apparently also play a role in people's dietary intake.

In addition to SES, research has shown that social cohesion (Cradock et al., 2009) can significantly influence health behaviour (Feng et al., 2021). Social cohesion is valued as an essential determinant of population health (Chuang et al., 2013). In general, social cohesion refers to strong social bonds and an absence of social conflict in an interdependent society (Berkman et al., 2000; Durkheim, 1964). Previous studies have described the importance of social cohesion for people's health behaviours in Western countries (King, 2008; Van Dyck et al., 2015; Yip et al., 2016). A more cohesive society has more neighbourhood activities, including sports and PA, giving people more chances to adopt and sustain healthy behaviours (Cohen et al., 2006; Cramm & Nieboer, 2015; Gao et al., 2015). Furthermore, empirical studies have found that greater

social cohesion is associated with a healthier diet among adults (Calise et al., 2019; Denney et al., 2017), with benefits to nutrition and food security among children (Denney et al., 2017; Havemann & Pridmore, 2005). However, little is known about the influence of social cohesion on older people's health behaviours. To the best of our knowledge, no study has been done on the role of social cohesion in the health behaviour of older people living in Mexico.

The association of sociodemographic factors such as age, sex, marital status and place of residence with health behaviours has also been well-documented for older people in Mexico (Ortiz-Hernández et al., 2006; Medina et al., 2003; Franco-Marina, 2007; Kim et al., 2007). Studies have shown associations of area of residence with physical activity (Ortiz-Hernández & Ramos-Ibáñez, 2010) and healthy diet (Sandra Pérez-Tepayo, 2020; Ortiz-Hernandez et al., 2006). A study in Mexico showed that the sex of the participants confounded the relationship between education and smoking (Kim et al., 2000). Feng et al. (2020) showed that sociodemographic factors confounded the relationship between social cohesion and health behaviours, but this study was only conducted among older people in China.

Research is currently lacking on associations between social cohesion, SES and health behaviours among older people in Mexico while considering sociodemographic background variables. No study has investigated the association of social cohesion and SES with different health behaviours in a national sample of older Mexican people. This research aimed to fill this gap by assessing relationships between social cohesion, SES and health behaviours among older adults in Mexico from a nationally representative database.

2. Objective and Research Questions

This study aimed to investigate the associations of social cohesion and SES with health behaviours (PA, a healthy diet, not smoking and social participation) among older adults in Mexico, based on nationally representative data from the WHO's Study on Global Ageing and Adult Health (SAGE). This research contributes to understanding factors associated with health behaviours that are essential for designing appropriate health promotion programmes for older adults. The research question examined was as follows:

What is the influence of social cohesion and SES (namely, income and education) on health behaviours (including PA, a healthy diet, not smoking and social participation) among older people in Mexico while controlling for individuals' background characteristics?

3. Theory

Mexico Population Ageing

The population is rapidly ageing in Mexico, with comparatively low living standards and inadequate healthcare and benefit systems (Palloni et al., 2002; Smith & Goldman, 2007). Not surprisingly, older Mexicans' poverty rates are higher than other age groups (Huenchuan, 2013; Secretaría de Desarrollo Social, 2013). Many older adults live in extreme poverty and do not have sufficient money for food and other basic needs (Angel et al., 2017).

Health Behaviours and Non-Communicable Diseases

While the ongoing increase in life expectancy is a significant accomplishment, it presents the challenge of keeping older people active and preserving their well-being (Cramm et al., 2013). A

decline in physical and mental health and the development of non-communicable diseases (NCDs) often accompany advanced age (Daskalopoulou et al., 2019). Healthy behaviours, such as PA, VF consumption and not smoking, have positive effects on the ageing process, slowing functional decline, increasing quality of life (Drewnowski & Evan, 2001), contributing to the prevention of NCDs and their complications (Ayas et al., 2003; Reiner et al., 2013; Willet, 2002), and decreasing the risk of premature mortality (Loef & Walach, 2012). However, the proportion of older adults who report healthy behaviours is lower than in other age groups (Sun et al., 2013).

Healthy Diet

VF consumption is a critical component of a healthy diet, with high dietary fibre, vitamins, minerals and phytochemicals, especially antioxidants (Slavin & Lyod, 2012). A WHO Food and Agriculture Organization (FAO) report recommended a minimum of 400 g VF per day (excluding potatoes and other starchy tubers) to prevent NCDs and several micronutrient deficiencies, especially in less-developed countries (FAO, 2016; WHO, 2003). Various studies have associated low intake of VF with chronic conditions, such as cardiovascular diseases, high blood pressure, hypercholesterolemia, osteoporosis, many cancers, chronic obstructive pulmonary disease and respiratory problems (Adebawo et al., 2006; Schneider et al., 2007; Williamson, 1996).

Physical Activity

The WHO recommendation for adults aged ≥ 65 years is to undertake at least 150 minutes of moderate-intensity aerobic PA throughout the week, at least 75 minutes of vigorous-intensity aerobic PA throughout the week, or an equivalent combination of moderate- and vigorous-intensity activity (WHO, 2010). Regular PA can have significant health benefits for people in every age

group. It can prolong years of active independent living, decrease disability and increase quality of life for older people (Division of Ageing and Seniors, 2011). A large-scale longitudinal 8-year study found that every additional 15 minutes of daily PA up to 100 minutes per day resulted in a further 4% decrease in mortality from any cause (Wen et al., 2011). In addition, increasing PA helps reduce the burden on health and social care by enabling healthy ageing (Davis, 2007; American College of Sports Medicine, 2009). However, in Mexico, only 12.2% of older adults engage in the recommended amount of PA (Campos- Pérez et al., 2016). Such a low PA level might be associated with physical and psychological health issues for this age group (McPhee et al., 2016; Murrock & Graor 2014).

Smoking

Smoking is still a leading cause of preventable morbidity and premature mortality, especially in low- and middle-income countries (Bump & Reich, 2013; Erhardt, 2009). As a direct cause of cardiovascular disease, cancer and respiratory diseases, smoking imposes an immense burden on the healthcare system (Allender et al., 2009). In addition, older adults are at higher risk of adverse effects from smoking, due to longer exposure and ageing (Kim et al., 2007).

Social Participation

Besides traditional health behaviours (PA, maintenance of a healthy diet and not smoking), the ability of older adults to stay socially active and connected to others is also important for health and quality of life (Feng et al., 2020). Social participation is acknowledged as a crucial element of active ageing (WHO, 2002). Studies have found a positive influence of social participation on health among older adults (Kondo et al., 2007; Sirven & Debrand, 2008; Veenstra, 2000). One

reason is that older people have more free time to participate in social activities due to retirement (Christoforou, 2005) or fewer familial constraints (Bolin et al., 2003). Policies promoting social participation could help maintain good health (Sirven & Debrand, 2008).

Socioeconomic Status and Health Behaviours

Several mechanisms underlie the relationship between SES differences and health behaviours (Pampel et al., 2010). The first is referred to as the ‘healthy lifestyle’ mechanism: adults with higher education favour pursuing healthy behaviours (e.g., PA, healthy diet; Orden et al., 2005). Education allows people to gain better access to information and understand the science behind nutritional needs and healthy behaviours (Smith, 2000), and it may also lead them to be more risk-averse (Cutler & Muney, 2009). For example, education helps shape people’s behaviour in developing stronger self-control and maintaining healthy behaviours (Levasseur, 2015; Lynch & von Hippel, 2016; Orden et al., 2005). Another mechanism is that higher-income adults possess more wealth, which allows them to purchase goods that improve health, such as health insurance and fitness training.

Studies from high-income countries have shown associations between SES and health behaviours (Darmon & Drewnoski, 2008; Dynesen et al., 2003; Giskes et al., 2010; Mayén et al., 2014; Pampel et al., 2010). However, results on these associations in developing countries have been mixed. For example, even though adults in Mexico with higher income and higher education had higher PA (Aarsland et al., 2020), another study found that women with higher SES reported decreased PA (Gómez et al., 2009). Possible reasons for the latter finding are sprawling urbanisation, the nature of many jobs and changes in transport methods that contribute to a sedentary lifestyle (Gómez et al., 2009).

The reported relationships between SES and a healthy diet in Mexico are mixed. Doubova et al. (2016) found that adults with higher income reported higher VF consumption. Another study found that both low-SES and high-SES groups in Mexico had insufficient VF consumption (Lopez-Olmedo et al., 2019). Lopez-Olmedo (2019) and Satia (2009) found that adults with a lower educational level reported better diet quality than those with higher education (Lopez-Olmedo et al., 2019; Satia, 2009). Possible explanations for the latter finding are that adults with lower SES consume more legumes and wholegrain cereals, maintain a traditional diet or have fewer resources to purchase modern packaged processed foods, which tend to be less healthy (Lopez-Olmedo et al., 2019). The rise in intake of energy-dense foods rich in sugar and fat has resulted in an imbalance between intake and energy expenditure (Gómez et al., 2009).

Findings on smoking are inconsistent as well. Bardach et al. (2016) found that low incomes among young people and adults were strongly associated with a higher prevalence of active smoking in Latin American countries. In contrast, another study in Mexico found that adult women with high SES were more likely to be smokers (Arciniega et al., 2018). Similarly, education and assets were positively associated with smoking among rural and urban women in a study conducted by Buttenheim et al. (2010). Rural men with higher education and more assets were also more likely to smoke, but higher education was linked to less smoking among urban men (Buttenheim et al., 2010). Smoking has also been found to be positively associated with income in urban areas among older adults, while in rural areas, those with more wealth were less likely to smoke (Smith & Goldman, 2007).

Social Cohesion and Health Behaviours

Research has suggested that social circumstances (Pampel et al., 2010) and social and environmental factors (McNeill et al., 2006), such as social cohesion (Cradock et al., 2009), influence healthy behaviours. For the current study, the definition of social cohesion given by Chan et al. (2006, p. 290) is used: ‘social cohesion is a state of affairs concerning both the vertical and the horizontal interactions among members of a society, as characterised by a set of attitudes and norms that include trust, a sense of belonging, and the willingness to participate and help, as well as their behavioural manifestations’. Thus far, empirical studies have emphasised that social cohesion indicators may have a protective function regarding health behaviour (Dragolov et al., 2014; Larsen, 2014; Patterson et al., 2004). Indicators to assess social cohesion that have been used most often in previous studies are trust in citizens (Dragolov et al., 2014; Gao et al., 2015; Gijssberts et al., 2012; Larsen, 2014; Van den Berg et al., 2019; Van Dyck et al., 2015) and perceived safety (Dragolov et al., 2014).

Previous studies in high-income countries have found a significant impact of social cohesion on health behaviours (Fisher et al., 2004; King, 2008; Utter et al., 2011; Van Dyck et al., 2015; Yip et al., 2016). In older adults, higher social cohesion levels are associated with higher PA levels (King, 2008; Van Dyck et al., 2015). Social cohesion may influence higher PA in many ways (Yip et al., 2016). Cohesive societies may have strong social bonds, such as close communities, which may increase the prevalence of collective engagement in PA among residents (Kahn et al., 2002). More cohesive societies may organise more neighbourhood activities, which provide chances for residents to engage in and sustain healthy behaviours (Cohen et al., 2006; Gao et al., 2015). Social cohesion may also help establish social norms regarding health (Gao et al.,

2015; Patterson et al., 2004); for example, witnessing other residents doing sports every day might encourage others to engage in such activities when the perceived safety level is high (Ueshima et al., 2010).

In accordance with its positive influence on PA, social cohesion may also affect a healthy diet. Social cohesion is based on mutual trust, and it describes the ability of a community to create change, such as by promoting a healthy diet through social norms (Sampson et al., 1997). However, previous findings regarding the association between social cohesion and healthy diet are inconsistent. Some studies reported that greater social cohesion was associated with higher VF intake in adolescents (Franko et al., 2008) and adults (Cuevas et al., 2020), but research conducted in the US showed no significant association between social cohesion and VF consumption (Barnidge et al., 2013).

Regarding the relationship between social cohesion and smoking, social cohesion may involve information-sharing among residents about the side effects of smoking and discourage tobacco use. Thus, it could help build a social norm against smoking. Another potential mechanism explaining the possible relationship between social cohesion and smoking is that social cohesion may strengthen psychological resources (self-esteem, optimism, mutual respect, and hope), making it less likely that people smoke. These psychological resources would lower distress, a known risk factor of smoking (Patterson et al., 2004). Studies have indeed found associations between social cohesion and smoking. In Mexican adults who lived in a neighbourhood with higher social cohesion, smoking intensity was reduced (Fleischer et al., 2015). Additionally, a study in the US found that greater social cohesion was associated with a lower likelihood of being a smoker among adults (Patterson et al., 2004; Alcalá et al., 2016). A study among older Chinese

people also found that greater social cohesion was associated with lower odds of being a daily smoker (Feng et al., 2021).

In addition to traditional health behaviours (PA, healthy diet and not smoking), social participation has been described as a health behaviour in older adults (Feng et al., 2020; Sirven & Debrand, 2008). Studies conducted in the US (Latham & Clarke, 2016) and the UK (Council of Europe, 2020) have shown an association between social cohesion and social participation among older adults. However, the evidence on this subject remains limited, and whether this association exists among older adults in Mexico is unknown.

Possible Confounders: Associations Between Sociodemographic Characteristics and Socioeconomic Status, Social Cohesion and Health Behaviours

The sociodemographic factors of age, sex, marital status and area of residence are associated with SES in older adults. Older Mexicans account for more than 50% of families in households living in extreme poverty (equivalent to households living on one dollar a day), and this percentage increases during times of crisis (Huenchuán, 2013). Many older adults living in extreme poverty do not have enough money for food and necessities, and consequently working in later adulthood is common. In addition to age, sex is related to older adult poverty, mainly because of differences in marital status. Sex differences in marital status explain a large part of income inequality given that 77% of men over age 60 were married compared with only 45% of older women in 2009, with women less likely than men to postpone retirement to compensate for inadequate retirement income (18% vs 52%; Department of Economic and Social Affairs Population Division, 2010). Access to economic resources by men and women differs as a result

of their social network characteristics (Pinquart & Sorensen, 2001). Research suggests that people living in rural areas are lower-educated (Van Gasteren & Hinojosa, 2004) and have lower income than people living in urban areas (International Fund for Agricultural Development, 2014; Smith & Goldman, 2007).

Previous research has also shown associations between health behaviours and the sociodemographic factors of age, sex and area of residence. As people age, they are more likely to face physical limitations resulting in reduced PA in everyday life (Medina et al., 2003; WHO, 2018). Social participation has also been reported to decrease in old age (Feng et al., 2020). The prevalence of smoking has decreased over time in older Mexicans (Franco-Marina, 2007; Arciniega et al., 2020). In addition to age, associations have been found between sex and health behaviours (Del Carmen Morales-Ruán, 2009; Arciniega et al., 2018). Studies in Mexico showed that men are more likely to be physically active than women (Del Carmen Morales-Ruán, 2009; Gómez-Acosta et al., 2009) and more likely to be smokers (Arciniega et al., 2018).

The area of residence (urban vs rural) is incorporated as a covariate in the current study because of its influence on lifestyle, the nature and level of access to health and social services and social support, economic status, and environmental and occupational conditions (Galea, 2005; Smith et al., 2008; Dussault & Franceschini, 2006). Urban location has been associated with a better lifestyle, better access to health services, higher income and education level, and better occupational conditions (Peltzer & Phaswana-Mafuya, 2013, Galea, 2005; Smith et al., 2008; Dussault & Franceschini, 2006). In Mexico, healthy diets are associated with SES and area of residence. The patterns of diet differ for people living in urban and rural areas. In urban areas, the higher the SES, the greater the diversity in dietary patterns including dairy products, cereals, meats, saturated fat, fruits and vegetables. Conversely, a low SES in rural areas is reflected in a dietary

pattern based primarily on corn derivatives combined with beans and legumes. The availability of diet resources and the lifestyle of people in urban and rural areas play a role in healthy diet.

Finally, regarding the association between sociodemographic factors and social cohesion, evidence shows associations with age, sex, marital status and area of residence. Social cohesion is vital for older people (Cramm & Nieboer, 2015). Several studies have emphasised that social cohesion has a protective function, especially for the older population, which has declined health (Cramm & Nieboer, 2015; Feng et al., 2021; Young et al., 2004). In addition, men and women tend to generate different personal networks, which assist different functions. Women generally report greater network interconnectedness and larger kin and informal relationship networks than do men (Antonucci & Akiyama, 1987; Antonucci et al., 2002). However, as a result of this kin orientation, women's networks lack heterogeneity (Wellman & Wortley, 1990). Men also demonstrate a higher level of institutional trust than women (van Oorschot & Arts, 2005). In contrast, proclaimed informal solidarity is higher among women than men because women tend to be more sensitive to mutual responsibility, values of reciprocity, and care (van Oorschot et al., 2005; Einolf, 2011).

Previous studies have also found an association between neighbourhood social cohesion and the area of residence. A study in Australia reported strong negative associations between social connectedness and living in an urban area compared with living in nonurban areas (Stone & Hulse, 2007). Moreover, Burnette et al. (2021) found that social cohesion mattered more for older adults living with families in urban areas than it did for their age peers in China's rural areas. Living in an urban area is negatively associated with the extent of voluntary work a person offers, their likelihood of civic action, their reported levels of neighbourhood interaction, and their sense of feeling part of the local community. In addition, moving to an urban area negatively influences

reported levels of neighbourhood interaction, perceived social support and satisfaction with belonging to the local community (Stone & Hulse, 2007).

Conceptual Model

Figure 1 shows the expected associations between social cohesion and SES (namely, income and education) and the health behaviours of PA, healthy diet, not smoking and social participation among older people in Mexico. This study hypothesises that older Mexican people with high SES and greater social cohesion are more likely to be physically active, have a healthy diet and have higher social participation, and are less likely to be daily smokers. To avoid confounding, the sociodemographic factors of age, sex, marital status and area of residence will be controlled for because of their association with SES, social cohesion and health behaviours.

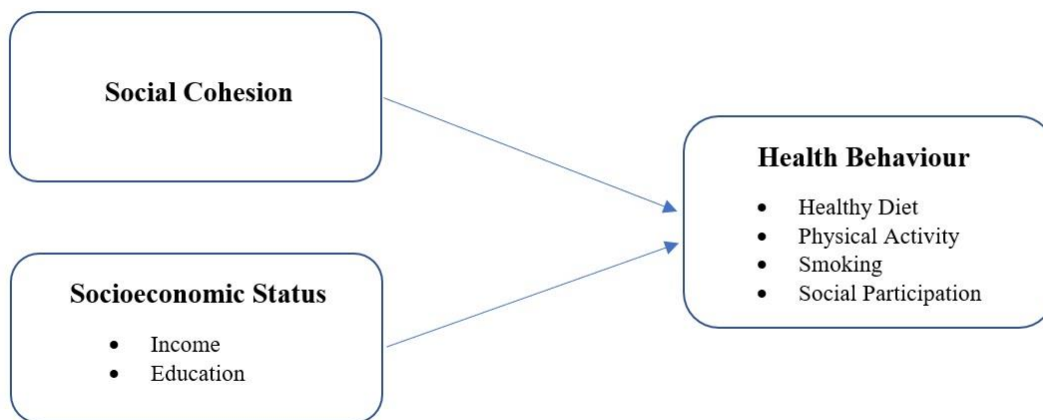


Figure 1 Conceptual model of associations of social cohesion and socioeconomic status with health behaviours.

4. Methods

Participants and Data

Data for this analysis come from the WHO's SAGE Wave 1 Mexico Survey. SAGE is a nationally representative study of people aged ≥ 50 years in six low- and middle-income countries (China, Ghana, India, Mexico, Russian Federation and South Africa). The survey was carried out in Mexico between 2009 and 2010 (Pública & Kowal, 2015). SAGE Wave 1 Mexico representative data were collected using a multistage, stratified, cluster-sampling approach from 31 of Mexico's 32 states (Pública & Kowal, 2015). The survey was conducted electronically using a computer assisted (CAPI) program developed by SAGE Mexico, and each interviewer had a laptop computer for conducting face-to-face interviews. The inclusion age in this thesis is ≥ 60 years because the retirement is 65 years in Mexico (Organisation for Economic Co-operation and Development, 2019). The response rate was 57.1% for those aged 60–69 years, 57.9% for those aged 70–79 years, and 83.2% for those aged ≥ 80 years (Pública & Kowal, 2015). The original sample for SAGE dataset included 2,315 participants from Mexico. After excluding older people < 60 the study sample consisted of 1,881 participants. Further details of WHO SAGE sampling have been presented elsewhere (Kowal et al., 2012).

Independent Variables

Social Cohesion Scale

Social cohesion was measured using a mean score based on respondents' answers to five questions developed by WHO SAGE about trust and safety (Appendix 1). The social cohesion indicators were neighbourhood trust, trust in co-workers, trust in strangers, feeling safe while staying alone

at home, and feeling safe while walking alone after dark in the street. Respondents rated these items on a 5-point Likert scale. The answers were inversely coded for interpretation. For the trust items, the scale ranged from 1 (to a minimal extent) to 5 (to a very great extent), and for the safety items, it ranged from 1 (not safe at all) to 5 (completely safe). For these indicators, three of five items had to be answered (Cronbach's $\alpha=0.722$). Higher scores indicated higher social cohesion.

Socioeconomic Status

Education and income were used as variables to measure SES in this study because these are essential factors affecting health behaviours (McMullin & Cairney, 2004; Smith & Goldman, 2007). Education was categorised as lower (completed primary school or less, 0) or higher (completed secondary school or more, 1). Estimation of basic income was based on ownership of a set of durable household goods, house characteristics (e.g., type of floor) and living conditions, including access to services (e.g., proper sanitation, clean water; Ferguson et al., 2003).

Sociodemographic Characteristics

Sociodemographic variables controlled for in this analysis were sex (male, 0; female, 1), age (years), area of residence (urban, 0; rural, 1) and marital status (single [never married, separated, divorced, widowed], 0; married [currently married, cohabiting], 1).

Dependent Variables

Physical Activity

The PA assessment used response variables from a general PA self-reported questionnaire (WHO, 2004). Participants were asked to provide information on the average number of days per week

and the duration they engaged in vigorous and moderate PA. Vigorous PA could be sports, work activity, leisure and recreational activities. Moderate PA could be housekeeping (washing clothes by hand, cleaning the house, and gardening), stretching, and dancing at a regular pace. The WHO (2019) threshold was used to differentiate PA as sufficient (≥ 150 minutes/week moderate or ≥ 75 minutes/week vigorous PA, 1) or insufficient (< 150 minutes/week moderate or < 75 minutes/week vigorous PA, 0).

Healthy Diet

The indicator of a healthy diet was adequate VF intake. WHO guidelines were used to categorise sufficient (two or more servings of fruit and three or more servings of vegetables/day, 1) or insufficient (fewer than two servings of fruit and fewer than three servings of vegetables, 0) VF consumption (WHO, 2004).

Smoking

Smoking behaviour was assessed by asking whether participants were daily smokers, categorised as 0 (not a daily smoker) or 1 (daily smoker).

Social Participation Scale

Social participation was measured using the mean scale for the 9-item questionnaire developed for SAGE (Appendix 2). Items concerned respondents' frequency of community involvement in the last 12 months. The items were 'You attended any public meeting in which there was a discussion of local or school affairs' (public meeting), 'You met personally with someone who is considered to be a community leader' (meet leader), 'You attended any group, club, society, union, or organisational meeting' (club involvement), 'You worked with other people in the neighbourhood to fix or improve something' (neighbourhood), 'You had friends over to your home' (friends),

‘Been in the home of someone who lives in a different neighbourhood than you do or had them in your home’ (other home), ‘You socialised with co-workers outside of work’ (relationship with co-workers), ‘You attended religious services (not including weddings and funerals)’, ‘You got out of the house/your dwelling to attend social meetings, activities, programmes, or events or to visit friends or relatives’ (how often to go out). Responses varied from ‘never’ (1) to ‘daily’ (5). Total social participation scores were assessed by summing the item scores (Cronbach’s $\alpha=0.722$).

Statistical Analyses

Descriptive statistics and frequencies were used to characterise the study population. Correlations between variables were assessed with bivariate analysis using Spearman’s and Pearson’s correlations where appropriate. Associations of social cohesion and SES with health behaviours (categorical variables: PA, maintenance of a healthy diet and smoking) were assessed by estimating odds ratios (ORs) with 95% confidence intervals (CIs) using a logistic regression model. Associations between social cohesion and social participation (a continuous variable) were evaluated by estimating β coefficients and standard error (SE) using a multivariate linear regression model. All analyses were adjusted for age, sex, marital status and area of residence to investigate the unbiased relationship between social cohesion and SES (exposures) and health behaviours (outcome). Analyses were performed using IBM SPSS version 27. $P<0.05$ was considered statistically significant. All statistical tests were two-sided.

The dataset comprised a total of 1,881 observations. However, in large (observational) datasets, missing data is a common issue, primarily when using surveys. This may occur due to equipment failure, incomplete questionnaires, privacy-sensitive matters and other factors. Because the collected SAGE datasets included missing values, these were dealt with appropriately. Preliminary exploratory data analysis was performed to assess missing values, detect outliers and

check for normality. For the calculation of the correlation, pairwise deletion was chosen. The number of respondents (n [%]) for each variable used in the correlation is presented in the results section. For the logistics regression, the standard-setting 'listwise' deletion was applied; in this case, SPSS discarded all data for an issue with one or more missing values.

The linear regression assumptions were evaluated in this study. The assumption of the linear relationship between independent and dependent variables was met. Furthermore, the assumption of normality was assessed with a histogram, a P-P plot and a Kolmogorov-Smirnov normality test (Kim, 2019). Inspection of the histogram and the P-P plot did not reveal substantive deviations from a normal distribution. The Kolmogorov-Smirnov test was significant (0.00), but we decided not to transform the scale scores because the instruments are commonly used in previous research and are described as reliable and valid (Awuviry-Newton et al., 2021; Feng, et al., 2020; Feng et al., 2021). In addition, the variance inflation factor (VIF) was calculated to show whether a predictor had a strong linear relationship with the other predictor(s). This was calculated among independent variables to determine the severity of multicollinearity. The VIF score of all covariates did not exceed the recommended value of 10, suggesting no multicollinearity problems among independent variables included in the analyses (O'Brien, 2007). The autocorrelation assumption was evaluated using the Durbin-Watson test, which tests the null hypothesis that the residuals are not linearly auto-correlated (Kim, 2019; Schreiber-Gregory & Bader, 2018). No autocorrelation was found (Durbin-Watson test: 1.78). In the context of the assumption of heteroscedasticity, no violations were found. The assumptions of logistic regression were also evaluated. No violations of the appropriateness of the outcome structure and no multicollinearity were found. The goodness-of-fit test was assessed using Omnibus tests (Ducharme & Ferrigno, 2012), and no violations were found (sig. >0.05).

Validity and Reliability

The validity of this research was increased by using well-validated measurement instruments and applying the widely used 5-point Likert scale of social cohesion and social participation. The reliability of this study was assured by its large sample size and the positive reliability test of the social cohesion scale and the social participation scale. The Cronbach's α for the questionnaires was assessed before further statistical analyses were performed. Furthermore, the results are generalisable for older people because this research used nationally representative data and possibly may be transferred (external validity) to comparable countries. In addition, this research can be repeated because it provides insight into how the research data were obtained and processed. Therefore, the study is expected to produce the same results using the same available data and method.

5. Results

Table 1 shows the characteristics of the study participants. Of the 1,881 participants included, the mean age (standard deviation; SD) was 71.15 (8.35) years; 60.9% of participants were female, 58.2% were non-single, 72.5% were from urban areas and 84.9% had lower educational levels. Overall, the prevalence of smoking was 11.9%. The prevalence of insufficient VF consumption was 86.5%, and 44% of participants reported inadequate PA. The mean social participation scale score was 1.68 (SD: 0.5). The mean social cohesion scale score was 2.95 (SD: 0.88).

Table 1 Characteristics of the study population (n=1,881)

	n	%	Mean (SD)
Sociodemographic characteristics			
Age (years) range 60–105	1881		71.15 (8.35)
Sex			
<i>Missing 8 (0.4%)</i>			
Male	733	39.1	
Female	1140	60.9	
Marital status			
<i>Missing 97 (5.2%)</i>			
Single	745	41.8	
Non-single	1039	58.2	
Areas of residence			
Urban	1364	72.5	
Rural	517	27.5	
SES and social cohesion variables			
Educational level			
<i>Missing 97 (5.2%)</i>			
Lower	1514	84.9	
Higher	270	15.1	
Income quintile			
<i>Missing 3 (0.2%)</i>			
Q1 (lowest)	425	22.6	
Q2	409	21.8	
Q3	349	18.6	
Q4	368	19.6	
Q5 (highest)	327	17.4	

	n	%	Mean (SD)
Social cohesion scale			
<i>Missing 103 (5.5%)</i>	1778		2.95 (0.88)
Health behaviours			
Smoking			
<i>Missing 100 (5.3%)</i>			
Not a daily smoker	1569	88.1	
Daily smoker	212	11.9	
VF consumption			
<i>Missing 114 (6.1%)</i>			
Insufficient	1529	86.5	
Sufficient	238	13.5	
PA			
<i>Missing 96 (5.1%)</i>			
Inadequate	786	44.0	
Adequate	999	56.0	
Social participation scale			
<i>Missing 103 (5.5%)</i>			
Total	1778		1.68 (0.5)

SD, standard deviation; SES, socioeconomic status; VF, vegetables and fruit; PA, physical activity.

No data on age or area of residence were missing.

Table 2 shows the correlations between study variables. Spearman's correlation was used to evaluate relationships involving categorical variables (smoking, VF consumption and PA), and Pearson's correlation was used to evaluate relationships involving continuous variables (social cohesion and social participation). Social cohesion and social participation were significantly correlated ($r=0.118$, $P<0.01$), meaning that higher social cohesion was associated with higher

social participation. Positive correlations were also found between social cohesion and VF consumption ($r=0.078$, $P<0.01$) and social cohesion and smoking ($r=0.070$, $P<0.01$). Older Mexicans who reported higher levels of social cohesion were more likely to have sufficient VF intake and more likely to be daily smokers. However, the correlations between social cohesion and health behaviours (social participation, VF consumption and smoking) were weak. Furthermore, income was associated with VF consumption ($r=0.126$, $P<0.01$) and social participation ($r=0.101$, $P<0.01$), meaning that older Mexicans who reported higher income were more likely to have sufficient VF intake and more likely to be socially active. Correlations with education were statistically significant for PA ($r=0.068$, $P<0.01$), VF consumption ($r=0.077$, $P<0.01$) and social participation ($r=0.096$, $P<0.01$). This means that older Mexicans with higher education levels were more likely to have sufficient PA and VF intake and to be socially active. However, the reported associations between SES and health behaviours were weak.

Table 2 Spearman’s and Pearson’s correlations of the study variables

	PA	VF consumption	Daily smoker	Social participation
Independent variables				
Social cohesion	0.035	0.078**	0.070**	0.118**
n	1778	1763	1777	1778
Income	0.008	0.126**	0.010	0.101**
n	1782	1764	1778	1775
Education	0.068**	0.077**	0.014	0.096**
n	1782	1767	1781	1778

* $p<0.05$ ** $p<0.01$

Table 3 presents the results of the logistic regression and linear regression analyses predicting associations between social cohesion, SES and health behaviours among older Mexican people, while controlling for covariates.

In the multivariate analyses, adjusted for age, sex, marital status and place of residence, higher mean scores for social cohesion were positively and significantly associated with higher levels of social participation ($\beta=0.108$, $P<0.01$). Higher social cohesion was associated with a higher likelihood of adequate VF consumption (OR 1.316, 95% CI 1.095–1.581; $P<0.01$) and higher odds of being a daily smoker (OR 1.354, 95% CI 1.115–1.644; $P<0.05$). In accordance with the bivariate analysis, no association was found between social cohesion and PA in the multivariate logistic regression analysis. Older adults with higher incomes tended to be more socially active ($\beta=0.069$, $P<0.01$) than those with lower incomes. Higher education level was associated with higher odds of having adequate PA (OR 1.407, 95% CI 1.052–1.883; $P<0.05$) and a higher likelihood of being socially active ($\beta=0.088$, $P<0.01$) compared to a lower education level.

In the multivariate analysis, as expected, older age was associated with lower odds of adequate PA (OR 0.940, 95% CI 0.927–0.952; $P<0.01$), a lower likelihood of being a daily smoker (OR 0.979, 95% CI 0.959–0.999; $P<0.05$) and a lower likelihood of being socially active ($\beta=-0.100$, $P<0.01$). Male sex was associated with higher odds of adequate PA (OR 1.483, 95% CI 1.197–1.838; $P<0.01$) and being a daily smoker (OR 3.973, 95% CI 2.862–5.515; $P<0.01$). No association was found between marital status and PA, VF consumption, daily smoking or social participation in the multivariate regression analysis. Those residing in urban areas were associated with a higher likelihood of being daily smokers (OR 1.497, 95% CI 1.047–2.139; $P<0.05$) and being socially active ($\beta=0.092$, $P<0.01$) than those residing in rural areas.

Table 3 Multivariate associations between social cohesion and health behaviours (n=1,881)

	PA	VF consumption	Daily smoker	Social participation §		
	OR (95% CI)	OR (95% CI)	OR (95% CI)	B	β	SE
Independent variables						
Social cohesion	1.089 (0.960–1.236)	1.316** (1.095–1.581)	1.354** (1.115–1.644)	0.075**	0.108**	0.016
Income	1.232 (0.892–1.702)	1.377 (0.842–2.250)	1.191 (0.721–1.967)	0.026**	0.069**	0.009
Education (high)	1.407* (1.052–1.883)	1.288 (0.896–1.850)	0.967 (0.634–1.475)	0.132**	0.088**	0.037
Covariates						
Age	0.940** (0.927–0.952)	0.987 (0.969–1.006)	0.979* (0.959–0.999)	-0.007**	-0.100**	0.002
Sex (male)	1.483** (1.197–1.838)	1.098 (0.813–1.482)	3.973** (2.862–5.515)	-0.010	-0.009	0.027
Marital status (non-single)	1.144 (0.922–1.418)	1.024 (0.748–1.401)	0.775 (0.553–1.086)	0.016	0.014	0.028
Residence (urban)	0.941 (0.751–1.179)	1.232 (0.878–1.729)	1.497* (1.047–2.139)	0.111**	0.092**	0.029
Constant	57.650**	0.184*	0.092**	1.816**		
R^2	0.094 (Nagelkerke)	0.046 (Nagelkerke)	0.098 (Nagelkerke)	0.044	0.044	
n	1775	1760	1774	1775		

* $P < 0.05$, ** $P < 0.01$. Higher social participation scores represent greater social participation.

SE, standard error; OR, odds ratio; CI, confidence interval. § continuous variable.

SE, standard error; PA, physical activity; OR, odds ratio.

6. Discussion

In general, this study revealed that older Mexican people with greater social cohesion were more likely to be socially active and have sufficient VF consumption. In contrast with our expectations, older people who reported higher social cohesion were more likely to be daily smokers and were not physically more active. Individuals on higher incomes were more socially active than those on lower incomes. Individuals with higher education were more likely to have adequate PA and participate in social activities than those with lower education. Associations of social cohesion and SES with health behaviours remained robust after controlling for sociodemographic factors. The present study's findings add to the growing literature on the relationship between social cohesion and health behaviours in older Mexican people.

Associations of Social Cohesion with Health Behaviours

This study found that greater social cohesion increased the odds of smoking, whereas most previous studies (Feng et al., 2021; Alcalá et al., 2016; Patterson et al., 2004) found that social cohesion was associated with a lower likelihood of smoking. However, this study is in agreement with Ahern et al. (2009), where in a neighbourhood with weaker antismoking norms, higher social cohesion was associated with higher smoking prevalence in New York City. That study also found that higher collective efficacy was associated with more smoking in neighbourhoods with permissive smoking norms. As such, smoking norms in the neighbourhood modified the relationship between collective efficacy and smoking. Furthermore, a study by Fleischer et al. (2015) in Mexico found that higher social cohesion was associated with higher smoking rates in the least violent neighbourhoods. In low-violence areas, more cohesive neighbourhoods may promote a higher rate of smoking through more permissive social norms. Although this study did not test this directly, social norms might help explain this relationship. Future studies should

investigate these possibilities, particularly in the context of the influence of social cohesion, along with social norms affecting smoking behaviour.

Following our expectations, this study found that older people with greater social cohesion were more likely to have higher social participation, following findings from the US (Latham & Clarke, 2016) and China (Feng et al., 2021). No comparable data were yet available for older adults in Mexico. In the current social context, people often tend to limit their interaction with others. When they do interact, they are more likely to do so with their inner circle and only participate in social activities when they can trust the people around them (Allik & Realo, 2004). This implies that the rise in social participation in older people is increasingly affected by social cohesion factors (e.g., trust and perceived safety; Feng et al., 2021).

The lack of association between social cohesion and PA in this study did not support our hypothesis. It was consistent with Feng et al.'s (2021) finding that social cohesion was not associated with PA among older adults in China and Legh-Jones and Moore's (2012) finding that perceived generalised trust was not associated with PA in an adult population. However, Quinn (2019) found that social cohesion was associated with PA, and other researchers also found social cohesion to be positively associated with leisure-time PA (Murillo et al., 2016; Quinn et al., 2019; Van Dyck et al., 2015; Lindström, 2003). This discrepancy may be the result of different PA measures used among studies (Yip et al., 2016). Specifically, this study included multiple types of PA (e.g., work, fitness, leisure), whereas Quinn et al. (2019), Murillo et al. (2016), Van Dyck et al. (2015) and Lindström (2003) focused mainly on associations between social cohesion and leisure-time PA. Therefore, social cohesion may be more relevant to leisure-time physical activities compared to other types of PA.

This study found a positive association between greater social cohesion and sufficient VF consumption among older adults. This is in line with Feng et al. (2021), Machida and Yoshida (2019) and Johnson (2010), who revealed positive associations between greater social cohesion and sufficient VF intake in China, Japan and the US. However, previous findings on VF consumption are inconsistent. Barnidge et al. (2013) found no significant association between social cohesion and VF consumption. Mackenbach (2016) conducted a multinational study in Europe and found an association with fruit but not vegetable consumption. This discrepancy may be due to examining different study populations using different measures. The current study used WHO guidelines to categorise adequate and inadequate VF consumption as one variable. In contrast, Mackenbach et al. (2016) measured vegetable consumption and fruit consumption separately as two variables, and Barnidge (2013) used only one rating for the measurement. In addition, this study explored a sample of older adults living throughout Mexico. In comparison, Barnidge (2013) chose older adults in rural settings in the US, and Mackenbach (2016) observed a general adult population living in urban areas in Europe. Nevertheless, the findings of this study are in line with the hypothesis, which postulated the presence of such an association between social cohesion and VF consumption. More cohesive societies may organise more neighbourhood activities, which provide chances for residents to engage in and sustain healthy behaviours (Cohen et al., 2006; Gao et al., 2015). Social cohesion may help establish social norms regarding health (Gao et al., 2015; Patterson et al., 2004). The mutual trust in social cohesion may describe the ability of a community to create change, such as by promoting a healthy diet through social norms (Sampson et al., 1997).

Associations of Socioeconomic Status with Health Behaviours

This study found that older Mexican people with higher incomes were more likely to participate in social activities, in line with previous findings from China and Sweden (Feng et al., 2020; Feng et al., 2021; Mood & Jonsson, 2016). This study is the first to report this association for Mexico. Impoverished individuals may not be able to bear the costs of social activities, such as material objects required for leisure activities, club membership fees, and the expenses of dining out or hosting dinner parties, due to a lack of income (Callan et al., 1993; Feng et al., 2020; Scharf et al., 2005). As a result, poverty causes a significant risk of exclusion from social life (Scharf et al., 2005). In addition, shame and an inability to live a decent life can lead to decreased social participation (Sen, 1983). Previous research has shown income as having a crucial impact on the social engagement of older adults in a highly collectivistic culture over time (Mood & Jonsson., 2016; Feng et al., 2020).

In this study, people with higher education levels were more likely to participate in social activities. This finding is consistent with studies from high-income countries (Feng et al., 2020; Katagiri, 2012; Van Groenou & Deeg, 2010). In addition, education may affect people's attitudes towards life into older age (Bukov et al., 2002; Gesthuizen et al., 2006). Higher education is also associated with higher tolerance of social norms and interest in social matters among older adults (Gesthuizen et al., 2006).

Accordingly, participants with higher education also had higher PA. This aligns with studies conducted in Mexico and the US (Crespo et al., 1999; Ortiz-Hernández & Ramos-Ibáñez, 2010). These findings imply that people with higher education have a better understanding of health-related issues, gain better access to information about healthy diet and are more concerned

about their health (Smith, 2000). The finding of this study is in line with the hypothesis, which postulated the presence of such an association between education and PA.

Associations of the Covariates Age, Sex, Area of Residence with Health Behaviours

This study revealed that older Mexican people were less likely to have adequate PA. This is consistent with previous research in Mexico and globally (Feng et al., 2021; Hallal et al., 2012; Medina et al., 2013; WHO, 2018). Older people are more likely to have physical limitations, resulting in less PA. They are also less likely to be daily smokers. This study finding is consistent with previous studies in Mexico finding that the prevalence of smoking was lower for the older population (Franco-Marina, 2007; Zavala-Arciniega et al., 2020).

Older participants were also more likely to have lower social participation. This finding is in line with previous studies (Dawson-Townsend, 2019; Desrosiers et al., 2004; Van Hees et al., 2020). Ageing can intensify the risk of shrinking social networks due to the death of peers in the later years of life (Bukov et al., 2002; Dawson-Townsend, 2019; Van Hees et al., 2020).

Men were more likely to be physically active. Previous findings on sex and PA in Mexico are inconsistent. Del Carmen Morales-Ruán (2009) found that men in Mexico were more likely to be physically active. However, Doubova (2016) found that men exercised less than women and engaged in unhealthy behaviours. This discrepancy may be explained by the present study using different PA measures. Specifically, it included multiple types of PA (work, fitness, and leisure), whereas Doubova (2016) focused mainly on the associations between older adult sex and leisure-time PA. Men were also more likely than women to be daily smokers. This finding is consistent with research by Franco-Marina (2007) and Arciniega (2015), which found that smoking prevalence was higher for men than women in Mexico. People living in urban areas were more likely to be daily smokers and have higher social participation. This is consistent with previous

studies in Latin American countries, where living in urban areas was found to increase the likelihood of smoking (Arciniega et al., 2015; Kim et al., 2007).

Strengths and Limitations

This study presents evidence on associations of social cohesion and SES with health behaviours in Mexico among older adults. This research contributes to the growing interest in studies on the ageing population, specifically in Mexico, using data from a large population-based sample to investigate associations between social cohesion and SES with health behaviours. The study minimised bias by controlling for sociodemographic background characteristics as various potential confounders in the regression model.

A limitation is the study's reliance on cross-sectional data, which does not allow interpretation of causal relations among social cohesion, SES and health behaviours. Further research needs to investigate longitudinal relationships among these factors with a nationally representative database. Moreover, further qualitative research proposing to understand why social cohesion may or may not promote healthy behaviour would be beneficial. Additionally, while the response rate was high, it was lower for the age groups 60–69 and 70–79 years compared to ≥ 80 years, which may limit the generalisability of the study findings. For further research regarding social cohesion and health behaviour, it may be relevant to investigate how other factors may play a role in the associations of social cohesion and health behaviours (potential interdependencies). Furthermore, bundling health behaviours should be considered, given that a previous study highlighted that people who quit smoking tend to gain weight due to the consumption of more foods as rewards (Spring et al., 2012). In addition, particularly relating to the influence of social cohesion on smoking behaviour, social norms may affect health behaviour in older Mexicans.

Regarding a healthy diet, VF consumption as an indicator of a healthy diet cannot fully reflect an individual's diet. Therefore, future researchers should use more detailed dietary information according to WHO guidelines to expand this study's ability to evaluate a healthy diet. Lastly, the measurement of social cohesion was limited to trust and safety indicators due to the limitation on the data. It is recommended that future research address this limitation of the current study design by using a more comprehensive measure of social cohesion while also using a longitudinal study design to obtain insight into the association between social cohesion, SES, and health behaviour.

7. Conclusion

In this study, greater social cohesion was associated with adequate VF intake and active social participation among older adults in Mexico. However, it was not associated with being physically more active. In contrast with our expectations, older people who reported higher social cohesion were more likely to be daily smokers. Higher income was associated with active social participation but not with other health behaviours. A higher level of education was associated with being physically more active and higher social participation. These findings are a vital step towards a better understanding of social cohesion and SES in protecting and maintaining healthy behaviours among older adults in Mexico. Policymakers and professionals in public health should consider social cohesion and SES in designing health promotion strategies among older adults in Mexico.

References

- Aarsland, V., Borda, M. G., Aarsland, D., Garcia-Cifuentes, E., Anderssen, S. A., Tovar-Rios, D. A., Gomez-Arteaga, C., & Perez-Zepeda, M. U. (2020). Association between physical activity and cognition in Mexican and Korean older adults. *Archives of Gerontology and Geriatrics*, 89(January), 104047. <https://doi.org/10.1016/j.archger.2020.104047>
- Adebawo, O., Salau, B., Ezima, E., Oyefuga, O., Ajani, E., Idowu, G., Famodu, A., & Osilesi, O. (2006). Fruits and vegetables moderate lipid cardiovascular risk factor in hypertensive patients. *Lipids in health and disease*, 5, 14. <https://doi-org.eur.idm.oclc.org/10.1186/1476-511X-5-14>
- Ahern, J., Galea, S., Hubbard, A., & Syme, S. L. (2009). Neighborhood smoking norms modify the relation between collective efficacy and smoking behavior. *Drug and Alcohol Dependence*, 100(1–2), 138–145. <https://doi.org/10.1016/j.drugalcdep.2008.09.012>
- Alcalá, H.E., Sharif, M.Z., Albert, S.L. (2016). Social cohesion and the smoking behaviors of adults living with children. *Addictive Behaviors*53, 201–205.
- Allender, S., Balakrishnan, R., Scarborough, P., Webster, P., & Rayner, M. (2009). The burden of smoking-related ill health in the UK. *Tobacco control*, 18(4), 262–267. <https://doi-org.eur.idm.oclc.org/10.1136/tc.2008.026294>
- Allik, J., Realo, A. (2004). Individualism-collectivism and social capital. *Journal of cross-cultural psychology*, 35(1), 29-49.
- American College of Sports Medicine, Chodzko-Zajko, W. J., Proctor, D. N., Fiatarone Singh, M. A., Minson, C. T., Nigg, C. R., Salem, G. J., & Skinner, J. S. (2009). American College of Sports Medicine position stand. Exercise and physical activity for older adults. *Medicine and science in sports and exercise*, 41(7), 1510–1530. <https://doi-org.eur.idm.oclc.org/10.1249/MSS.0b013e3181a0c95c>
- Angel, J. L., Vega, W., López-Ortega, M., & Pruchno, R. (2017). Aging in Mexico: Population trends and emerging issues. *Gerontologist*, 57(2), 153–162. <https://doi.org/10.1093/geront/gnw136>
- Antonucci, T. C., & Akiyama, H. (1987). Social networks in adult life and a preliminary examination of the convoy model. *Journals of Gerontology*, 42(5), 519–527. <https://doi.org/10.1093/geronj/42.5.519>
- Arciniega, Z.L., Paz Ballesteros, W. C., Mejia Gil, S. C., ReynalesShigematsu, L. M. (2018). Social determinants of tobacco smoking in Mexico stratified by sex and age. Mexico, Global Adult Tobacco Survey (GATS) 2009 and 2015. *Tobacco Induced Diseases*, 16(1), 783. <https://doi.org/10.18332/tid/84328>

- Arredondo, A., Torres, C., Orozco, E., Pacheco, S., Huang, F., Zambrano, E., & Bolaños-Jiménez, F. (2019). Socio-economic indicators, dietary patterns, and physical activity as determinants of maternal obesity in middle-income countries: Evidences from a cohort study in Mexico. *International Journal of Health Planning and Management*, 34(1), e713–e725. <https://doi.org/10.1002/hpm.2684>
- Avila, M. H. (2009). The Mexican National Health and Nutrition Survey 2006. *SaludPública de México*, 51 Suppl 4(2), 621–629.
- Awuviry-Newton, K., Wales, K., Tavener, M., Kowal, P., & Byles, J. (2021). Functional difficulties and toileting among older adults in Ghana: Evidence from the World Health Organization Study on global AGEing and adult health (SAGE) Ghana Wave 1. *Ageing and Society*, 1-23. doi:10.1017/S0144686X21000453
- Ayas, N. T., White, D. P., Al-Delaimy, W. K., Manson, J. E., Stampfer, M. J., Speizer, F. E., Patel, S., & Hu, F. B. (2003). A prospective study of self-reported sleep duration and incident diabetes in women. *Diabetes care*, 26(2), 380–384. <https://doi-org.eur.idm.oclc.org/10.2337/diacare.26.2.380>
- Bardach, A., Andrés, H., Perdomo, G., & Ruano, R. A. (2016). Income levels and prevalence of smoking in Latin America : a systematic review and meta-analysis. *Rev PanamSalud Publica*, 40(4), 1–9. <http://iris.paho.org/xmlui/bitstream/handle/123456789/31309/v40n4a12-eng.pdf?sequence=5&isAllowed=y>
- Barnidge, E. K., Hipp, P. R., Estlund, A., Duggan, K., Barnhart, K. J., Brownson, R. C. (2013). Association between community garden participation and fruit and vegetable consumption in rural Missouri. *International Journal of Behavioral Nutrition and Physical Activity*, 10(1), 128.
- Berkman, L. F. (1995). The role of social relations in health promotion. *Psychosomatic Medicine*, 57(3), 245–254. <https://doi.org/10.1097/00006842-199505000-00006>
- Biritwum, R., Mensah, G., Yawson, A., & Minicuci, N. (2013). Study on global AGEing and Adult Health (SAGE), Wave 1. *Who Sage*, 1–111.
- Bolin, K., Lindgren, B., Lindström, M., & Nystedt, P. (2003). Investments in social capital--implications of social interactions for the production of health. *Social science & medicine (1982)*, 56(12), 2379–2390. [https://doi-org.eur.idm.oclc.org/10.1016/s0277-9536\(02\)00242-3](https://doi-org.eur.idm.oclc.org/10.1016/s0277-9536(02)00242-3)
- Bukov, A., Maas, I., & Lampert, T. (2002). Social participation in very old age: cross-sectional and longitudinal findings from BASE. Berlin Aging Study. *The journals of gerontology. Series B, Psychological sciences and social sciences*, 57(6), P510–P517. <https://doi-org.eur.idm.oclc.org/10.1093/geronb/57.6.p510>

- Bump, J. B., & Reich, M. R. (2013). Political economy analysis for tobacco control in low- and middle-income countries. *Health policy and planning*, 28(2), 123–133. <https://doi-org.eur.idm.oclc.org/10.1093/heapol/czs049>
- Burnette, D., Ye, X., Cheng, Z., & Ruan, H. (2021). Living alone, social cohesion, and quality of life among older adults in rural and urban China: A conditional process analysis. *International Psychogeriatrics*, 33(5), 469–479. <https://doi.org/10.1017/S1041610220001210>
- Buttenheim, A. M., Wong, R., Goldman, N., & Pebley, A. R. (2010). Does social status predict adult smoking and obesity? Results from the 2000 Mexican national health survey. *Global Public Health*, 5(4), 413–426. <https://doi.org/10.1080/17441690902756062>
- Calise, T. V., Chow, W., Ryder, A., & Wingerter, C. (2019). Food Access and Its Relationship to Perceived Walkability, Safety, and Social Cohesion. *Health Promotion Practice*, 20(6), 858–867. <https://doi.org/10.1177/1524839918778553>
- Callan, T., Nolan, B., & Whelan, C. (1993). Resources, Deprivation and the Measurement of Poverty. *Journal of Social Policy*, 22(2), 141–172. doi:10.1017/S0047279400019280
- Campos-Pérez, W., González-Becerra, K., Ramos-López, O., Silva-Gómez, J. A., Barrón-Cabrera, E., Roman, S., Panduro, A., & Martínez-López, E. (2016). Same Dietary but Different Physical Activity Pattern in Normal-weight and Overweight Mexican Subjects. *Journal of Food and Nutrition Research*, 4(11), 729–735. <https://doi.org/10.12691/jfnr-4-11-5>
- Chan, J., To, H. P., & Chan, E. (2006). Reconsidering social cohesion: Developing a definition and analytical framework for empirical research. *Social Indicators Research*, 75(2), 273–302. <https://doi.org/10.1007/s11205-005-2118-1>
- Chatterji, S., Byles, J., Cutler, D., Seeman, T., & Verdes, E. (2015). Health, functioning, and disability in older adults - Present status and future implications. *The Lancet*, 385(9967), 563–575. [https://doi.org/10.1016/S0140-6736\(14\)61462-8](https://doi.org/10.1016/S0140-6736(14)61462-8)
- Christoforou, A. (2011). On the Determinants of Social Capital in Greece Compared to Countries of the European Union. *SSRN Electronic Journal*, 1. <https://doi.org/10.2139/ssrn.726142>
- Chuang, Y.-C., Chuang, K., & Yang, T. (2013). Social cohesion matters in health. *International Journal for Equity in Health*, 12(87), (28 October 2013)-(28 October 2013). https://auth.lib.unc.edu/ezproxy_auth.php?url=http://search.ebscohost.com/login.aspx?direct=true&db=lhh&AN=20133386685&site=ehost-live&scope=site%0Ahttp://www.equityhealthj.com/content/12/1/87/abstract%0Aemail:yingchih@tmu.edu.tw%5Cadinma@tmu.edu.tw%5Cyt
- Clegg, A., Young, J., Iliffe, S., Rikkert, M. O., & Rockwood, K. (2013). Frailty in elderly people. *The Lancet*, 381(9868), 752–762. [https://doi.org/10.1016/S0140-6736\(12\)62167-9](https://doi.org/10.1016/S0140-6736(12)62167-9)

- Cohen, D. A., Finch, B. K., Bower, A., & Sastry, N. (2006). Collective efficacy and obesity: The potential influence of social factors on health. *Social Science and Medicine*, 62(3), 769–778. <https://doi.org/10.1016/j.socscimed.2005.06.033>
- Council of Europe. (2020). Social participation and social cohesion in the EU macro-regions: cultural routes and community engagement. Available at: <https://rm.coe.int/routes4u-elearning-manual-cultural-routes-and-community-engagement/16809ee4dd%0A%0A>
- Cradock, A. L., Kawachi, I., Colditz, G. A., Gortmaker, S. L., & Buka, S. L. (2009). Neighborhood social cohesion and youth participation in physical activity in Chicago. *Social Science and Medicine*, 68(3), 427–435. <https://doi.org/10.1016/j.socscimed.2008.10.028>
- Cramm, J. M., & Nieboer, A. P. (2015). Social cohesion and belonging predict the well-being of community-dwelling older people. *BMC Geriatrics*, 15(1). <https://doi.org/10.1186/s12877-015-0027-y>
- Crespo, C. J., Smit, E., Andersen, R. E., Carter-Pokras, O., & Ainsworth, B. E. (2000). Race/ethnicity, social class and their relation to physical inactivity during leisure time: results from the Third National Health and Nutrition Examination Survey, 1988-1994. *American journal of preventive medicine*, 18(1), 46–53. [https://doi-org.eur.idm.oclc.org/10.1016/s0749-3797\(99\)00105-1](https://doi-org.eur.idm.oclc.org/10.1016/s0749-3797(99)00105-1)
- Cuevas, A. G., Kawachi, I., Ortiz, K., Pena, M., Reitzel, L. R., McNeill, L. H. (2020). Greater social cohesion is associated with lower body mass index among African American adults. *Preventive Medicine Reports*, 101098.
- Darmon, N., & Drewnowski, A. (2008). Does social class predict diet quality? *American Journal of Clinical Nutrition*, 87(5), 1107–1117. <https://doi.org/10.1093/ajcn/87.5.1107>
- Davis, M. G., & Fox, K. R. (2007). Physical activity patterns assessed by accelerometry in older people. *European journal of applied physiology*, 100(5), 581–589. <https://doi-org.eur.idm.oclc.org/10.1007/s00421-006-0320-8>
- Dawson-townsend, K. (2019). SSM - Population Health Social participation patterns and their associations with health and well-being for older adults. *SSM - Population Health*, 8(December 2018), 100424. <https://doi.org/10.1016/j.ssmph.2019.100424>
- Del Carmen Morales-Ruán, M., Hernández-Prado, B., Gómez-Acosta, L. M., Shamah-Levy, T., & Cuevas-Nasu, L. (2009). Obesity, overweight, screen time and physical activity in mexican adolescents. *Salud Publica de Mexico*, 51(SUPPL.4), 613–620. <https://doi.org/10.1590/S0036-36342009001000016>
- Denney, J. T., Kimbro, R. T., Heck, K., & Cubbin, C. (2017). Social Cohesion and Food Insecurity: Insights from the Geographic Research on Wellbeing (GROW) Study. *Maternal and child health journal*, 21(2), 343–350. <https://doi-org.eur.idm.oclc.org/10.1007/s10995-016-2119-5>

- Department of Economic and Social Affairs Population Division (2010). *Population ageing and development: 2009*. New York, NY: United Nations.
- Desrosiers, J., Noreau, L., & Rochette, A. (2004). Social participation of older adults in Quebec. *Aging clinical and experimental research*, *16*(5), 406–412. <https://doi-org.eur.idm.oclc.org/10.1007/BF03324572>
- Doubova, S. V., Sánchez-García, S., Infante-Castañeda, C., & Pérez-Cuevas, R. (2016). Factors associated with regular physical exercise and consumption of fruits and vegetables among Mexican older adults. *BMC Public Health*, *16*(1), 1–9. <https://doi.org/10.1186/s12889-016-3628-2>
- Dragolov, G., Ignacz, Z., Lorenz, J., Delhey, J., & Boehnke, K. (2014). *Social Cohesion Radar, Measuring Common Ground: An International Comparison of Social Cohesion. Methods Report*. 1–55.
- Drenowski, A., & Evans, W. J. (2001). Nutrition and quality of life in older adults. *Journals of Gerontology - Series A Biological Sciences and Medical Sciences*, *56*(1i), 54–64. https://doi.org/10.1093/gerona/56.suppl_2.54
- Ducharme, G. R., & Ferrigno, S. (2012). Journal of Statistical Planning and Inference An omnibus test of goodness-of-fit for conditional distributions with applications to regression models. *Journal of Statistical Planning and Inference*, *142*(10), 2748–2761. <https://doi.org/10.1016/j.jspi.2012.04.008>
- Durkheim, E. (1964). *The division of labor in society* (G. Simpson, Trans.). New York: Free Press.
- Dynesen, A. W., Haraldsdóttir, J., Holm, L., & Astrup, A. (2003). Sociodemographic differences in dietary habits described by food frequency questions - Results from Denmark. *European Journal of Clinical Nutrition*, *57*(12), 1586–1597. <https://doi.org/10.1038/sj.ejcn.1601728>
- Einolf, C. J. (2011). Gender differences in the correlates of volunteering and charitable giving. *Nonprofit and Voluntary Sector Quarterly*, *40*(6), 1092–1112. <https://doi.org/10.1177/0899764010385949>
- Erhardt L. (2009). Cigarette smoking: an undertreated risk factor for cardiovascular disease. *Atherosclerosis*, *205*(1), 23–32. <https://doi-org.eur.idm.oclc.org/10.1016/j.atherosclerosis.2009.01.007>
- FAO. (2015). *Promotion of Fruit and Vegetables for Health: Report of the Pacific Regional workshop*. <http://www.fao.org/3/a-i4935e.pdf>
- Feng, Z., Cramm, J. M., & Nieboer, A. P. (2020). Social participation is an important health behaviour for health and quality of life among chronically ill older Chinese people. *BMC Geriatrics*, *20*(1), 1–10. <https://doi.org/10.1186/s12877-020-01713-6>

- Feng, Z., Cramm, J. M., & Nieboer, A. P. (2021). *Associations of Social Cohesion and Socioeconomic Status with Health Behaviours among Middle-Aged and Older Chinese People*.
- Ferguson, B. D., Tandon, A., Gakidou, E., Murray, C. J. (2003). Estimating permanent income using indicator variables. *Health systems performance assessment: debates, methods and empiricism*. Geneva: World Health Organization, 747-60.
- Fisher, K.J., Li, F., Michael, Y., and Cleveland, M. (2004). Neighborhood-level influences on physical activity among older adults: a multilevel analysis. *Journal of Ageing and Physical Activity* 12, 45–63.
- Fleischer, N.L., Lozano, P., Santillán, E.A., Shigematsu, L.M.R., Thrasher, J.F. (2015). The impact of neighbourhood violence and social cohesion on smoking behaviors among a cohort of smokers in Mexico. *Journal of Epidemiology and Community Health* 69, 1083–1090.
- Franco-Marina, Francisco (2007). Adult smoking trends in Mexico: An analysis of the Mexican National Addiction Surveys. *Salud Pública de México*, 49(2),137-146.[fecha de Consulta 4 de Agosto de 2021]. ISSN: 0036-3634. Disponible en: <https://www.redalyc.org/articulo.oa?id=10609004>
- Franko, D. L., Thompson, D., Bauserman, R., Affenito, S. G., Striegel-Moore, R. H. (2008). What’s love got to do with it? Family cohesion and healthy eating behaviors in adolescent girls. *International journal of eating disorders*, 41(4), 360-367.
- Galea, S., Freudenberg, N., & Vlahov, D. (2005). Cities and population health. *Social science & medicine* (1982), 60(5), 1017–1033. <https://doi.org/10.1016/j.socscimed.2004.06.036>
- Gao, J., Fu, H., Li, J., & Jia, Y. (2015). Association between social and built environments and leisure-time physical activity among Chinese older adults - A multilevel analysis Energy balance-related behaviours. *BMC Public Health*, 15(1), 1–11. <https://doi.org/10.1186/s12889-015-2684-3>
- Gesthuizen, M. (2006). How socially committed are the Dutch low-educated? Historical trends, life-course changes, and two explanations for educational differences. *European Sociological Review*, 22(1), 91–105. <https://doi.org/10.1093/esr/jci045>
- Gijsberts, M., Van Der Meer, T., & Dagevos, J. (2012). “Hunkering down” in multi-ethnic neighbourhoods? the effects of ethnic diversity on dimensions of social cohesion. *European Sociological Review*, 28(4), 527–537. <https://doi.org/10.1093/esr/jcr022>
- Giskes, K., Avendaño, M., Brug, J., & Kunst, A. E. (2010). A systematic review of studies on socioeconomic inequalities in dietary intakes associated with weight gain and overweight/obesity conducted among European adults. *Obesity Reviews*, 11(6), 413–429. <https://doi.org/10.1111/j.1467-789X.2009.00658.x>

- Gómez-Acosta, L. M., Hernández-Prado, B., Morales, M. del C., & Shamah-Levy, T. (2009). The Mexican National Health and Nutrition Survey 2006. *Salud Pública de México*, 51 Suppl 4(2), 621–629.
- Gómez-Dantés, H., Fullman, N., Lamadrid-Figueroa, H., Cahuana-Hurtado, L., Darney, B., Avila-Burgos, L., Correa-Rotter, R., Rivera, J. A., Barquera, S., González-Pier, E., Aburto-Soto, T., de Castro, E. F. A., Barrientos-Gutiérrez, T., Basto-Abreu, A. C., Batis, C., Borges, G., Campos-Nonato, I., Campuzano-Rincón, J. C., de Jesús Cantoral-Preciado, A., ... Lozano, R. (2016). Dissonant health transition in the states of Mexico, 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013. *The Lancet*, 388(10058), 2386–2402. [https://doi.org/10.1016/S0140-6736\(16\)31773-1](https://doi.org/10.1016/S0140-6736(16)31773-1)
- Green A, Janmaat JG, Cheng H: Regimes of social cohesion-LLAKES Research Paper No. 1. 2009, London: Centre for Learning and Life Chances in Knowledge Economies and Societies, Institute of Education
- Green, A., & Janmaat, J. G. (2011). Regimes of Social Cohesion. *Regimes of Social Cohesion*. <https://doi.org/10.1057/9780230308633>
- Guzman-castillo, M., Ahmadi-abhari, S., Bandosz, P., Capewell, S., Steptoe, A., Singh-manoux, A., Kivimaki, M., Shipley, M. J., Brunner, E. J., & Flaherty, M. O. (2017). Articles Forecasted trends in disability and life expectancy in England and Wales up to 2025: a modelling study. *The Lancet Public Health*, 2(7), e307–e313. [https://doi.org/10.1016/S2468-2667\(17\)30091-9](https://doi.org/10.1016/S2468-2667(17)30091-9)
- Hallal, P. C., Andersen, L. B., Bull, F. C., Guthold, R., Haskell, W., Ekelund, U., & Lancet Physical Activity Series Working Group (2012). Global physical activity levels: surveillance progress, pitfalls, and prospects. *Lancet (London, England)*, 380(9838), 247–257. [https://doi-org.eur.idm.oclc.org/10.1016/S0140-6736\(12\)60646-1](https://doi-org.eur.idm.oclc.org/10.1016/S0140-6736(12)60646-1)
- Havemann, K., & Pridmore, P. (2005). Social Cohesion: the Missing Link To Better Health and Nutrition in a globalized world. *Arusha Conference, “ New Frontiers of Social Policy,” January 2005*, 1–37.
- Huenchuan, Sandra. (2013). Ageing, solidarity and social protection in Latin America and the Caribbean: time for progress towards equality. *Libros de la CEPAL, Naciones Unidas Comisión Económica para América Latina y el Caribe (CEPAL)*, 117 edited by Eclac.
- International Fund for Agricultural Development. (2014). *Investing in rural people in Mexico*. 8. http://www.ifad.org/operations/projects/regions/pl/factsheet/mexico_e.pdf
- Johnson, C. M., Sharkey, J. R., & Dean, W. R. (2010). Eating behaviors and social capital are associated with fruit and vegetable intake among rural adults. *Journal of Hunger and Environmental Nutrition*, 5(3), 302–315. <https://doi.org/10.1080/19320248.2010.504094>

- Kahn, E. B., Ramsey, L. T., Brownson, R. C., Heath, G. W., Howze, E. H., Powell, K. E., Stone, E. J., Rajab, M. W., & Corso, P. (2002). The effectiveness of interventions to increase physical activity. A systematic review. *American journal of preventive medicine*, 22(4 Suppl), 73–107. [https://doi.org/10.1016/s0749-3797\(02\)00434-8](https://doi.org/10.1016/s0749-3797(02)00434-8)
- Katagiri, M. (2012). Economic Consequences of Population Aging in Japan: Effects Through Changes in Demand Structure. *Singapore Economic Review*. <https://doi.org/10.1142/S0217590818420067>
- Kim, H.-Y. (2019). Statistical notes for clinical researchers: simple linear regression 3 – residual analysis. *Restorative Dentistry & Endodontics*, 44(1), 1–8. <https://doi.org/10.5395/rde.2019.44.e11>
- Kim, S. S. (2008). Predictors of short-term smoking cessation among Korean American men. *Public Health Nursing*, 25(6), 516–525. <https://doi.org/10.1111/j.1525-1446.2008.00738.x>
- Kim, S., De La Rosa, M., Rice, C. P., & Delva, J. (2007). Prevalence of smoking and drinking among older adults in seven urban cities in Latin America and the Caribbean. *Substance use & misuse*, 42(9), 1455–1475. <https://doi.org/10.1080/10826080701212501>
- King, D. (2008) Neighborhood and individual factors in activity in older adults: results from the Neighborhood and Senior Health Study. *Journal of Ageing and Physical Activity* 16, 144–170.
- Kondo, N., Minai, J., Imai, H., & Yamagata, Z. (2007). Engagement in a cohesive group and higher-level functional capacity in older adults in Japan: a case of the Mujin. *Social science & medicine* (1982), 64(11), 2311–2323. <https://doi-org.eur.idm.oclc.org/10.1016/j.socscimed.2007.02.009>
- Koutsogeorgou, E., Davies, J. K., Aranda, K., Zissi, A., Chatzikou, M., Cerniauskaite, M., Quintas, R., Raggi, A., & Leonardi, M. (2014). Healthy and active ageing: Social capital in health promotion. *Health Education Journal*, 73(6), 627–641. <https://doi.org/10.1177/0017896913509255>
- Kowal, P., Chatterji, S., Naidoo, N., Biritwum, R., Fan, W., Lopez, R., Ridaura, R., Maximova, T., Arokiasamy, P., Phaswana-Mafuya, N., Williams, S., Minicuci, N., D'Este, C., Peltzer, K., Boerma, J.T. (2012). Data resource profile: the World Health Organization Study on global AGEing and adult health (SAGE). *International Journal of Epidemiology* 41, 1639–1649.
- Larsen, C. A. (2013). The Rise and Fall of Social Cohesion The Construction and De-construction of Social Trust in the US, UK, Sweden and Denmark. *Oxford University Press*.
- Latham, K., & Clarke, P. J. (2016). Neighborhood disorder, perceived social cohesion, and social participation among older Americans: Findings from the National Health & Aging Trends Study. *Journal of Aging and Health*, 30(1), 3-26.

- Legh-Jones, H., & Moore, S. (2012). Network social capital, social participation, and physical inactivity in an urban adult population. *Social science & medicine*, 74(9), 1362-1367.
- Levasseur, M., Généreux, M., Bruneau, J. F., Vanasse, A., Chabot, É., Beaulac, C., & Bédard, M. M. (2015). Importance of proximity to resources, social support, transportation and neighborhood security for mobility and social participation in older adults: Results from a scoping study. *BMC Public Health*, 15(1), 1–19. <https://doi.org/10.1186/s12889-015-1824-0>
- Lindström, M., Moghaddassi, M., & Merlo, J. (2003). Social capital and leisure time physical activity: A population based multilevel analysis in Malmö, Sweden. *Journal of Epidemiology and Community Health*, 57(1), 23–28. <https://doi.org/10.1136/jech.57.1.23>
- Loef, M., & Walach, H. (2012). The combined effects of healthy lifestyle behaviors on all cause mortality: a systematic review and meta-analysis. *Preventive medicine*, 55(3), 163–170. <https://doi-org.eur.idm.oclc.org/10.1016/j.ypmed.2012.06.017>
- Lopez-Olmedo, N., Popkin, B. M., & Taillie, L. S. (2019). Association between socioeconomic status and diet quality in Mexican men and women: A cross-sectional study. *PLoS ONE*, 14(10), 1–16. <https://doi.org/10.1371/journal.pone.0224385>
- Lynch, J. L., & von Hippel, P. T. (2016). An education gradient in health, a health gradient in education, or a confounded gradient in both? *Social Science and Medicine*, 154, 18–27. <https://doi.org/10.1016/j.socscimed.2016.02.029>
- Machida, D., & Yoshida, T. (2019). Factors that affect nonmarket fruit and vegetable receptions: Analyses of two cross-sectional surveys in Gunma, Japan. *Agriculture (Switzerland)*, 9(11), 1–12. <https://doi.org/10.3390/agriculture9110230>
- Mackenbach, J. D., Lakerveld, J., van Lenthe, F. J., Kawachi, I., McKee, M., Rutter, H., ... & Brug, J. (2016). Neighbourhood social capital: measurement issues and associations with health outcomes. *Obesity Reviews*, 17, 96-107.
- Marmot, M. (2005). Social determinants of health inequalities. *The Lancet*, 365, 1099–1104. <https://doi.org/10.1017/CBO9780511844027.011>
- Mayén, A. L., Marques-Vidal, P., Paccaud, F., Bovet, P., & Stringhini, S. (2014). Socioeconomic determinants of dietary patterns in low- and middle-income countries: A systematic review. *American Journal of Clinical Nutrition*, 100(6), 1520–1531. <https://doi.org/10.3945/ajcn.114.089029>
- McMullin, J.A., Cairney, J. (2004) Self-esteem and the intersection of age, class, and gender. *Journal of Ageing Studies* 18, 75–90.
- McNeill, L. H., Kreuter, M. W., & Subramanian, S. V. (2006). Social Environment and Physical activity: A review of concepts and evidence. *Social Science and Medicine*, 63(4), 1011–1022. <https://doi.org/10.1016/j.socscimed.2006.03.012>

- McPhee, J. S., French, D. P., Jackson, D., Nazroo, J., Pendleton, N., & Degens, H. (2016). Physical activity in older age: perspectives for healthy ageing and frailty. *Biogerontology*, *17*(3), 567–580. <https://doi-org.eur.idm.oclc.org/10.1007/s10522-016-9641-0>
- Medina, C., Janssen, I., Campos, I., & Barquera, S. (2013). Physical inactivity prevalence and trends among Mexican adults: Results from the National Health and Nutrition Survey (ENSANUT) 2006 and 2012. *BMC Public Health*, *13*(1). <https://doi.org/10.1186/1471-2458-13-1063>
- Monsivais, P., & Drewnowski, A. (2009). Lower-Energy-Density Diets Are Associated with Higher Monetary Costs per Kilocalorie and Are Consumed by Women of Higher Socioeconomic Status. *Journal of the American Dietetic Association*, *109*(5), 814–822. <https://doi.org/10.1016/j.jada.2009.02.002>
- Monteiro, C. A., Moura, E. C., Conde, W. L., & Popkin, B. M. (2004). Socioeconomic status and obesity in adult populations of developing countries: A review. *Bulletin of the World Health Organization*, *82*(12), 940–946. <https://doi.org/S0042-96862004001200011>
- Mood, C., & Jonsson, J. O. (2016). The Social Consequences of Poverty: An Empirical Test on Longitudinal Data. *Social Indicators Research*, *127*(2), 633–652. <https://doi.org/10.1007/s11205-015-0983-9>
- Muntrer, P., Gu, D., Wildman, R. P., Chen, J., Qan, W., Whelton, P. K., & He, J. (2005). Prevalence of physical activity among Chinese adults: Results from the International Collaborative Study of Cardiovascular Disease in Asia. *American Journal of Public Health*, *95*(9), 1631–1636. <https://doi.org/10.2105/AJPH.2004.044743>
- Murillo, R., Echeverria, S., & Vasquez, E. (2016). Differences in neighborhood social cohesion and aerobic physical activity by Latino subgroup. *SSM - Population Health*, *2*, 536–541. <https://doi.org/10.1016/j.ssmph.2016.08.003>
- Murrock, C. J., & Graor, C. H. (2014). Effects of dance on depression, physical function, and disability in underserved adults. *Journal of aging and physical activity*, *22*(3), 380–385. <https://doi-org.eur.idm.oclc.org/10.1123/japa.2013-0003>
- O'Brien, R.M. (2007). A caution regarding rules of thumb for variance inflation factors. *Qual. Quant.*, *41*, 673–690.
- Organisation for Economic Co-operation and Development. (2019). *Pension at a glance: Country Profiles Mexico*. 24(December), 88–91.
- Ortiz-Hernández, L., & Ramos-Ibáñez, N. (2010). Sociodemographic factors associated with physical activity in Mexican adults. *Public health nutrition*, *13*(7), 1131–1138. <https://doi-org.eur.idm.oclc.org/10.1017/S1368980010000261>

- Ortiz-Hernández, L., Delgado-Sánchez, G., & Hernández-Briones, A. (2006). Cambios en factores relacionados con la transición alimentaria y nutricional en México. *Gaceta Medica de Mexico*, *142*(3), 181–193.
- Palloni, A., Pinto-Aguirre, G., & Pelaez, M. (2002). Demographic and health conditions of ageing in Latin America and the Caribbean. *International Journal of Epidemiology*, *31*(4), 762–771. <https://doi.org/10.1093/ije/31.4.762>
- Pampel, F. C., & Rogers, R. G. (2016). *Socioeconomic Status, Smoking, and Health: A Test of Competing Theories of Cumulative Advantage* Author (s): Fred C . Pampel and Richard G . Rogers Published by: American Sociological Association Stable URL : <http://www.jstor.org/stable/3653847> Acces. 45(3), 306–321.
- Pampel, F. C., Krueger, P. M., & Denney, J. T. (2010). Socioeconomic disparities in health behaviors. *Annual Review of Sociology*, *36*, 349–370. <https://doi.org/10.1146/annurev.soc.012809.102529>
- Patterson, J. M., Eberly, L. E., Ding, Y., & Hargreaves, M. (2004). Associations of smoking prevalence with individual and area level social cohesion. *Journal of Epidemiology and Community Health*, *58*(8), 692–697. <https://doi.org/10.1136/jech.2003.009167>
- Peltzer, K., & Phaswana-Mafuya, N. (2013). Depression and associated factors in older adults in South Africa. *Global health action*, *6*, 1–9. <https://doi.org/10.3402/gha.v6i0.18871>
- Pérez-Tepayo, S., Rodríguez-Ramírez, S., Unar-Munguía, M., & Shamah-Levy, T. (2020). Trends in the dietary patterns of Mexican adults by sociodemographic characteristics. *Nutrition Journal*, *19*(1), 1–10. <https://doi.org/10.1186/s12937-020-00568-2>
- Pinquart, M., & Sörensen, S. (2001). Gender differences in self-concept and psychological well-being in old age. *The Journal of Gerontology*, *56*(4), 195–213. <http://psychsocgerontology.oxfordjournals.org/content/56/4/P195.short>.
- Quinn, T. D., Wu, F., Mody, D., Bushover, B., Mendez, D. D., Schiff, M., & Fabio, A. (2019). Associations between neighborhood social cohesion and physical activity in the United States, national health interview survey, 2017. *Preventing Chronic Disease*, *16*(12), 1–11. <https://doi.org/10.5888/pcd16.190085>
- Reiner, M., Niermann, C., Jekauc, D., & Woll, A. (2013). Long-term health benefits of physical activity--a systematic review of longitudinal studies. *BMC public health*, *13*, 813. <https://doi-org.eur.idm.oclc.org/10.1186/1471-2458-13-813>
- Reyes Uribe, A. C. (2015). Perceptions of successful aging among Mexican older adults. *Journal of Behavior, Health & Social Issues*, *7*(2), 9–17. <https://doi.org/10.5460/jbhsi.v7.2.52888>

- Sampson, R. J., Raudenbush, S. W., & Earls, F. (1997). Neighborhoods and violent crime: A multilevel study of collective efficacy. *Science*, 277(5328), 918–924. <https://doi.org/10.1126/science.277.5328.918>
- Sataloff, R. T., Johns, M. M., & Kost, K. M. (2015). *World Population Prospects: The 2015 Revision, Key Findings and Advance Tables United Nations, Department of Economic and Social Affairs, Population Division, 2015*.
- Satia, J. A. (2009). Diet-Related Disparities: Understanding the Problem and Accelerating Solutions. *Journal of the American Dietetic Association*, 109(4), 610–615. <https://doi.org/10.1016/j.jada.2008.12.019>
- Scharf, T., Phillipson, C., & Smith, A. E. (2005). Social exclusion of older people in deprived urban communities of England. *European Journal of Ageing*, 2(2), 76–87. <https://doi.org/10.1007/s10433-005-0025-6>
- Schneider, M., Norman, R., Steyn, N., Bradshaw, D., & South African Comparative Risk Assessment Collaborating Group (2007). Estimating the burden of disease attributable to low fruit and vegetable intake in South Africa in 2000. *South African medical journal = Suid-Afrikaanse tydskrif vir geneeskunde*, 97(8 Pt 2), 717–723.
- Schreiber-Gregory, D., & Bader, K. (2018). Logistic and Linear Regression Assumptions: Violation Recognition and Control. *Midwest SAS User Group*, 1–21. https://www.lexjansen.com/wuss/2018/130_Final_Paper_PDF.pdf
- Secretaría de Desarrollo Social (SEDESOL). (2013). *Sin Hambre, Cruzada Nacional. Gobierno de la República*. <http://sinhambre.gob.mx/>
- Sen, A. (1983). Poor, Relatively Speaking. *Oxford Economic Papers*, 35(2), new series, 153–169. Retrieved July 14, 2021, from <http://www.jstor.org/stable/2662642>
- Sirven, N., & Debrand, T. (2008). Social participation and healthy ageing: An international comparison using SHARE data. *Social Science and Medicine*, 67(12), 2017–2026. <https://doi.org/10.1016/j.socscimed.2008.09.056>
- Slavin, J. L., & Lloyd, B. (2012). Health benefits of fruits and vegetables. *Advances in nutrition (Bethesda, Md.)*, 3(4), 506–516. <https://doi-org.eur.idm.oclc.org/10.3945/an.112.002154>
- Smith, G. D. (2000). Learning to live with complexity: Ethnicity, socioeconomic position, and health in Britain and the United States. *American Journal of Public Health*, 90(11), 1694–1698. <https://doi.org/10.2105/AJPH.90.11.1694>
- Smith, K. V., & Goldman, N. (2007). Socioeconomic differences in health among older adults in Mexico. *Social Science and Medicine*, 65(7), 1372–1385. <https://doi.org/10.1016/j.socscimed.2007.05.023>

- Stone, W., & Hulse, K. (2007). Housing and social cohesion: an empirical exploration. *AHURI Final Report No.100, Melbourne*(100), Australian Housing and Urban Research Institute. https://melbourneinstitute.unimelb.edu.au/assets/documents/hilda-bibliography/other-publications/pre2010/Stone_et_al_Housing_and_social_cohesion_an_empirical_explorationpdf.pdf
- Sun, X., Shi, Y., Zeng, Q., Wang, Y., Du, W., Wei, N., Xie, R., & Chang, C. (2013). Determinants of health literacy and health behavior regarding infectious respiratory diseases: a pathway model. *BMC public health*, *13*, 261. <https://doi-org.eur.idm.oclc.org/10.1186/1471-2458-13-261>
- Ueshima, K., Fujiwara, T., Takao, S., Suzuki, E., Iwase, T., Doi, H., Kawachi, I. (2010). Does social capital promote physical activity? A population-based study in Japan. *PLoS one*, *5*(8), e12135.
- van den Berg, M. M., van Poppel, M., van Kamp, I., Ruijsbroek, A., Triguero-Mas, M., Gidlow, C., Nieuwenhuijsen, M. J., Gražulevičienė, R., van Mechelen, W., Kruize, H., & Maas, J. (2019). Do Physical Activity, Social Cohesion, and Loneliness Mediate the Association Between Time Spent Visiting Green Space and Mental Health? *Environment and Behavior*, *51*(2), 144–166. <https://doi.org/10.1177/0013916517738563>
- Van Dyck, D., Teychenne, M., McNaughton, S. A., De Bourdeaudhuij, I., & Salmon, J. (2015). Relationship of the perceived social and physical environment with mental health-related quality of life in middle-aged and older adults: Mediating effects of physical activity. *PLoS ONE*, *10*(3), 1–16. <https://doi.org/10.1371/journal.pone.0120475>
- Van Gameren, E. & Hinojosa, S. U. (2004). Education and Employment Perspectives for Mexican Rural Youth. *Mexsai*, 1–14.
- Van Groenou, M. B., & Deeg, D. J. H. (2010). Formal and informal social participation of the young-old in the Netherlands in 1992 and 2002. *Ageing and Society*, *30*(3), 445–465. <https://doi.org/10.1017/S0144686X09990638>
- van Hees, S., van den Borne, B., Menting, J., & Sattoe, J. (2020). Patterns of social participation among older adults with disabilities and the relationship with well-being: A latent class analysis. *Archives of gerontology and geriatrics*, *86*, 103933. <https://doi.org/10.1016/j.archger.2019.103933>
- van Oorschot, W., & Arts, W. (2005). The social capital of European welfare states: the crowding out hypothesis revisited. *Journal of European Social Policy*, *15*(1), 5–26. <https://doi.org/10.1177/0958928705049159>
- Veenstra G. (2000). Social capital, SES and health: an individual-level analysis. *Social science & medicine* (1982), *50*(5), 619–629. [https://doi-org.eur.idm.oclc.org/10.1016/s0277-9536\(99\)00307-x](https://doi-org.eur.idm.oclc.org/10.1016/s0277-9536(99)00307-x)

- Wang, F., Zhen, Q., Li, K., & Wen, X. (2018). Association of socioeconomic status and health-related behavior with elderly health in China. *PLoS ONE*, *13*(9), 1–14. <https://doi.org/10.1371/journal.pone.0204237>
- Wardle, J., & Steptoe, A. (2003). Socioeconomic differences in attitudes and beliefs about healthy lifestyles. *Journal of Epidemiology and Community Health*, *57*(6), 440–443. <https://doi.org/10.1136/jech.57.6.440>
- Wellman, B., & Wortley, S. (1990). *Different Strokes from Different Folks : Community Ties and Social Support* Author (s): Barry Wellman and Scot Wortley Published by : The University of Chicago Press Stable URL : <https://www.jstor.org/stable/2781064> *Different Strokes from Different Folks : Community Ties and Social Support* . *96*(3), 558–588.
- Wen, C. P., Wai, J. P., Tsai, M. K., Yang, Y. C., Cheng, T. Y., Lee, M. C., Chan, H. T., Tsao, C. K., Tsai, S. P., & Wu, X. (2011). Minimum amount of physical activity for reduced mortality and extended life expectancy: a prospective cohort study. *Lancet (London, England)*, *378*(9798), 1244–1253. [https://doi-org.eur.idm.oclc.org/10.1016/S0140-6736\(11\)60749-6](https://doi-org.eur.idm.oclc.org/10.1016/S0140-6736(11)60749-6)
- Willett W. C. (2002). Balancing life-style and genomics research for disease prevention. *Science (New York, N.Y.)*, *296*(5568), 695–698. <https://doi-org.eur.idm.oclc.org/10.1126/science.1071055>
- Williamson, G. (1996), Protective effects of fruits and vegetables in the diet, *Nutrition & Food Science*, *96*, 1, pp. 6-10. <https://doi-org.eur.idm.oclc.org/10.1108/00346659610105806>
- World Health Organization (2018). *WHO global action plan on physical activity 2018 -2030 INTRODUCTION Background. 2011*(August 2017), 1–36. http://www.who.int/ncds/governance/gappa_version_4August2017.pdf?ua=1
- World Health Organization. (2003). Fruit and vegetable promotion initiative/a meeting report. *Report of the Meeting*, 29. <http://apps.who.int/iris/handle/10665/68395>
- World Health Organization. Global Strategy on Diet, Physical Activity and Health. 2004. https://www.who.int/dietphysicalactivity/strategy/eb11344/strategy_english_web.pdf. Accessed 9 March 2021
- World Health Organization. Global Strategy on Diet, Physical Activity and Health. 2019. https://www.who.int/dietphysicalactivity/factsheet_olderadults/en/. Accessed 9 March 2021
- Yip, C., Sarma, S., & Wilk, P. (2016). The association between social cohesion and physical activity in Canada: A multilevel analysis. *SSM - Population Health*, *2*(September), 718–723. <https://doi.org/10.1016/j.ssmph.2016.09.010>

- Young, A. F., Russell, A., & Powers, J. R. (2004). The sense of belonging to a neighbourhood: Can it be measured and is it related to health and well-being in older women? *Social Science and Medicine*, *59*(12), 2627–2637. <https://doi.org/10.1016/j.socscimed.2004.05.001>
- Yu, R., Wong, M., Chong, K. C., Chang, B., Lum, C. M., Auyeung, T. W., Lee, J., Lee, R., & Woo, J. (2018). Trajectories of frailty among Chinese older people in Hong Kong between 2001 and 2012: An age-period-cohort analysis. *Age and Ageing*, *47*(2), 254–261. <https://doi.org/10.1093/ageing/afx170>
- Zavala-Arciniega, L., Reynales-Shigematsu, L. M., Levy, D. T., Lau, Y. K., Meza, R., Gutiérrez-Torres, D. S., Arillo-Santillán, E., Fleischer, N. L., & Thrasher, J. (2020). Smoking trends in Mexico, 2002-2016: Before and after the ratification of the WHO's Framework Convention on Tobacco Control. *Tobacco Control*, *29*(6), 687–691. <https://doi.org/10.1136/tobaccocontrol-2019-055153>

Appendix 1

Social cohesion scale

How much you trust different groups of people . . .					
	To a very small extent	To a small extent	Neither great nor small extent	To a great extent	To a very great extent
First, think about people in your neighbourhood. Generally speaking, would you say that you can trust them?					
	1	2	3	4	5
Now, think about people whom you work with. Generally speaking, would you say that you can trust them?					
	1	2	3	4	5
How about strangers? Generally speaking, would you say that you can trust them?					
	1	2	3	4	5
Questions about safety in the area where you live.					
	Not safe at all	Slightly safe	Moderately safe	Very safe	Completely safe
In general, how safe from crime and violence do you feel when you are alone at home?					
	1	2	3	4	5
How safe do you feel when walking down your street alone after dark?					
	1	2	3	4	5

Appendix 2

Social participation scale

How often in the last 12 months have you . . .

1. Attended any public meeting in which there was a discussion of local or school affairs?
2. Met personally with someone you consider to be a community leader?
3. Attended any group, club, society, union, or organisational meeting?
4. Worked with other people in your neighbourhood to fix or improve something?
5. Had friends over to your home?
6. Been in the home of someone who lives in a different neighbourhood than you do or had them in your home?
7. Socialised with co-workers outside of work?
8. Attended religious services (not including weddings and funerals)?
9. Got out of the house/your dwelling to attend social meetings, activities, programmes, or events or to visit friends or relatives?