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Featured Article

Sex-specific association between neighborhood characteristics and dementia: The Three-City cohort

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Abstract

Introduction: The living environment affects general health and may influence cognitive aging; however, the relationships between neighborhood characteristics and dementia are still poorly understood.
Methods: We used data from a French population–based prospective study (the Three-City cohort) that included 7016 participants aged 65 years and older with a 12-year follow-up. We used principal components analysis of neighborhood composition indicators to construct the Three-City deprivation score. To study its impact on dementia incidence, we performed survival analyses using a marginal Cox model to take into account intraneighborhood correlations. As interaction with sex was significant, analyses were stratified by sex.
Results: Even after controlling on individual factors, women living in deprived neighborhoods were at higher risk of dementia (hazard ratio = 1.29, 95% confidence interval 1.00–1.67) and Alzheimer's disease (hazard ratio = 1.42, 95% confidence interval 1.09–1.84). No association was found for men.
Discussion: Living in a deprived neighborhood is associated with higher risk of dementia in women.

Keywords: Dementia; Socioeconomic status; Living environment; Neighborhood; Deprivation score; Gender

1. Introduction

There is an increasing interest in the study of environmental impact on different aspects of health and well-being, including mental health [1]. The living environment includes many dimensions (social support, socioeconomic environment, urbanicity, psychosocial stressors, air pollution, nature experience, perceived environment…). In this study, we explored socioeconomic environmental influences.

A growing body of evidence suggests that cognitive functioning in later life is related to socioeconomic environment. These complex features could be encompassed by the neighborhood socioeconomic status (NSES) in which individual characteristics are aggregated in predefined geographical units [2]. NSES is generally regarded as the combination of socioeconomic variables at the individual or household level and is often assessed using a poverty index. It was shown that NSES is related to the overall cognitive functioning of elderly people, after controlling for individual features [3–6], and influences cognitive decline [7,8].

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Some individual characteristics, such as ethnicity [9,10], social class [11], or APOE genotype [12,13], could interact and have a modifying effect on the association between living environment and dementia [14]. For instance, in the US population [9,10], the association between disadvantaged areas and lower cognitive ability has been detected only in ethnic minority groups. This could indicate lower access to community resources or poorer ability to engage in healthy behaviors, all of which may affect cognition [15].

It has been hypothesized that associations between health and neighborhood characteristics are different for men and women [16]. For example, neighborhood deprivation exerts a stronger influence on the cardiovascular health of women [17] and is a stronger predictor of hypertension among women than men. The magnitude of the association between various contextual domains and self-rated health appears to be larger for women in a large cross-sectional study [16]. These studies suggest that the residential context is related to health for both men and women but that the salient factors are different for the two sexes [16]. Studies on residential context conducted on elderly subjects are limited.

To our knowledge, no study has been performed on the impact of the living environment on incident dementia; let alone considered the association with cognitive function according to sex [18]. Considering the importance of the living environment on health and the vulnerability of older people to the environment, it is crucial to better evaluate the influence of the living environment on incident dementia to better define and adapt prevention strategies. Our aim was to analyze how different contextual characteristics (i.e., living environment-related variables), independently of individual features (i.e., level of education, occupation, health status) can influence the risk of dementia and Alzheimer's disease (AD) in a longitudinal community-living elderly cohort. Our analyses were performed separately for men and women.

2. Methods

2.1. Study design and participants

For the present study, we used data from the Three-City (3C) community-living cohort of elderly (≥65 years of age) people who were enrolled from the electoral rolls of three French cities (Bordeaux, Dijon, and Montpellier) between 1999 and 2001. The longitudinal 3C study's main objective [19] was to assess the risk of dementia and cognitive impairment related to vascular factors. Each participant signed an informed consent. The study protocol was approved by the Ethics Committee of the Hospital of Kremlin-Bicêtre and Sud-Méditerranée III.

Among the 9294 participants, we selected those with identifiable geographical area of residence (n = 9247). Analyses were restricted to geographical areas where at least five participants were living (n = 9051). We also excluded 213 subjects with prevalent dementia, and 816 lost to follow-up. Finally, 8022 subjects without dementia at baseline and followed at least once were included. Then, we excluded subjects who had missing data for environmental exposure and individual covariates (sex, level of education, former occupation, income, APOEε4 carrier status, diabetes, depressive symptoms, or cardiovascular history). The analytic sample included 7016 individuals (Fig. 1).

2.2. Individual socioeconomic status

Individual socioeconomic status (SES) measures included level of education (primary/secondary and higher, according to the classification by the French National Institute of Statistics and Economic Studies [INSEE]), monthly household income (≥2287€/<2287€), former occupational category (blue collars: workers, farmers, artisans/white collars), and living alone (yes/no).

2.3. Neighborhood socioeconomic status

We used IRIS ("Ilots Regroupés pour l'Information Statistiques") data, the smallest census aggregation level

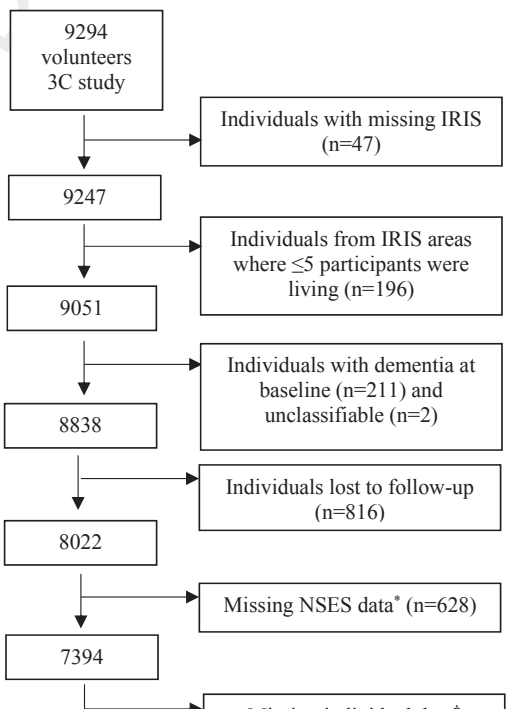

Fig. 1. Flowchart showing how participants from the French 3C cohort were selected for this study. *Median income (n = 450), Gini index (n = 516), interdecile ratio of household net taxable income (n = 594). †Former occupation (n = 23), education level (n = 12), APOE4 carrier status (n = 394), history of cardiovascular diseases (n = 2), diabetes (n = 1). ‡Subjects not included in the analyses were more depressed and lived in more disadvantaged neighborhoods. Abbreviations: IRIS, Ilots Regroupés pour l'Information Statistiques; NSES, neighborhood socioeconomic status.