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The Association between Individual and Area-Level Socioeconomic Indicators with Mortality and Health Outcomes in a Female Cohort Living in the Metropolitan Area of Naples (PROGETTO ATENA)

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INTRODUCTION

Unfavorable socioeconomic conditions are associated with an increased risk of death and the onset of various diseases in the general population across all countries worldwide [1]. The Metropolitan Area of Naples (ANM), characterized by high deprivation, social polarization, and mortality, represents an urban context with high social heterogeneity, offering the opportunity to analyze health inequalities in relation to socioeconomic position (SEP). The relationship between socioeconomic position and health, analyzed through individual and geographical indicators, is crucial to guide effective prevention strategies.

OBJECTIVES

We present here a study whose objectives were (1) to assess the association between socioeconomic position and lifestyle-related risk factors and (2) to estimate the extent to which socioeconomic inequalities, measured at both individual and area levels, influence mortality, breast cancer incidence and cardiovascular diseases in a female cohort from the Progetto ATENA.

METHODS

The Progetto ATENA is a prospective cohort study whose main goal was to investigate the causes of certain chronic diseases that affect the female population more significantly at different life stages. Between 1993 and 1996, the project enrolled 5.062 women aged between 30 and 70 years, residing in the ANM. To estimate incidence and mortality rates, two follow-ups on the participants' health status were conducted (in 2010 and 2016) [2].

Socioeconomic position was measured both at the individual and area levels. At the individual level, the Relative Index of Inequality (RII) was used, divided into tertiles representing decreasing levels of education. At the area level, the 2001 Italian Deprivation Index (DI) [3] was used, calculated by census block, georeferenced according to the residential address, and classified into population quintiles.

Associations with the endpoints (overall mortality, breast cancer, cardiovascular events and coronary heart disease) were studied using Cox proportional hazards regression models [4] adjusted for age, treated as the underlying time variable. For each endpoint, four multivariate models were built: Model 1 included RII tertiles and DI quintiles as covariates; Model 2 included Model 1 covariates plus clinical risk factors (systolic blood pressure, total cholesterol, and diabetes); Model 3 included Model 1 covariates plus lifestyle-related risk factors (smoking, physical activity, BMI, waist circumference, alcohol consumption, Mediterranean diet score, and energy intake); Model 4 included the covariates from both previous models. For breast cancer incidence, Model 2 and Model 4 were developed considering clinical variables such as age at menarche and number of children (instead of total cholesterol and systolic blood pressure). Participants with missing values for the mentioned variables were excluded from the analysis. Trend analyses were also performed.

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RESULTS

Among the 4.814 women included, follow-up recorded 411 deaths, 225 breast cancer diagnoses, 241 cardiovascular events (CVD), and 150 coronary heart disease events (CHD). At baseline, a positive association between the two SEP indices was observed (r=0.318). Both DI and RII were positively associated with systolic blood pressure, BMI, waist circumference, and waist-to-height ratio. Total and HDL cholesterol were negatively associated with both SEP indices. Age and energy intake were positively associated with RII and negatively with DI.

In the mortality analysis, a significant association with DI was observed, with hazard ratios (HR) of 1.56 (Q5 vs Q1, 95%CI 1.13–2.13, p=0.006) in Model 1 and 1.45 (Q5 vs Q1, 95%CI 1.05–2.02, p=0.026) in Model 4; significant trends (p=0.014, p=0.046). Similar results were found for both Model 2 and Model 3.

Similarly, an association between breast cancer incidence and DI was observed in Model 1 (Q5 vs Q1, HR 1.57, 95%CI 1.04–2.38, p=0.032); a significant trend was also observed (p=0.042). Model 2 showed comparable outcomes. In none of the models was RII associated with mortality or breast cancer.

Survival analysis revealed, in all models, a significant association between RII and CVD, with HRs of 1.62 (Q5 vs Q1, 95%CI 1.18–2.21, p=0.003) and 1.44 (Q5 vs Q1, 95%CI 1.03–2.01, p=0.034) in Model 1 and Model 4, respectively. The trends were also significant (p=0.003, p=0.043). Comparable results were observed in Model 2 and Model 3.

Likewise, an association between CHD and RII was observed in all models with HRs of 1.94 (Q5 vs Q1, 95%CI 1.31–2.87, p=0.001) and 1.62 (Q5 vs Q1, 95%CI 1.07–2.48, p=0.024) and significant trends (p=0.001, p=0.025). Analysis revealed similar outcomes for Model 2 and Model 3. In contrast, no significant association between CVD and CHD with DI was found in any of the models.

CONCLUSIONS

The analysis highlights that the local socioeconomic environment influences mortality and breast cancer more than individual education. Conversely, individual education seems to have a greater impact on the risk of cardiovascular events and coronary heart disease than area-level deprivation. In the comparison between Q5 and Q1, an increase of up to 56% in mortality risk and up to 62% in breast cancer risk was observed; in the comparison between RII 3 and RII 1, an increase of up to 62% in CVD risk and up to 94% in CHD risk was observed.

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Table 1. Hazard Ratios (HR) and 95% Confidence Intervals (CI) for Mortality, Breast Cancer, CVD, and CHD by Socioeconomic Position

		Model 1		Model 4	
		HR (95% CI)	p-value	HR (95% CI)	p-value
Morality	Deprivation index				
	Q5 vs Q1	1.56 (1.13-2.13)	0.006	1.45 (1.05-2.02)	0.026
	p-value for trend		0.014		0.046
	Education				
	RII 3 vs RII 1	1.19 (0.93-1.52)	0.170	1.03 (0.79-1.34)	0.847
	p-value for trend		0.200		0.914
Breast cancer	Deprivation index				
	Q5 vs Q1	1.57 (1.04-2.38)	0.032	1.41 (0.92-2.16)	0.114
	p-value for trend		0.042		0.116
	Education				
	RII 3 vs RII 1	0.77 (0.54-1.09)	0.136	0.80 (0.55-1.16)	0.236
	p-value for trend		0.154		0.308
CVD	Deprivation index				
	Q5 vs Q1	1.13 (0.76-1.68)	0.533	1.20 (0.79-1.80)	0.392
	p-value for trend		0.722		0.653
	Education				
	RII 3 vs RII 1	1.62 (1.18-2.21)	0.003	1.44 (1.03-2.01)	0.034
	p-value for trend		0.003		0.043
CHD	Deprivation index				
	Q5 vs Q1	1.08 (0.64-1.80)	0.782	1.15 (0.67-1.99)	0.611
	p-value for trend		0.824		0.716
	Education				
	RII 3 vs RII 1	1.94 (1.31-2.87)	0.001	1.62 (1.07-2.48)	0.024
	p-value for trend		0.001		0.025

Note. Results for Models 2 and 3 are not shown due to space constraints. Model 1: adjusted by age; Model 4: adjusted by age, total cholesterol, diabetes, systolic blood pressure, BMI (adjusted by age, number of daughters, menarche age, diabetes for breast cancer) and smoking status, physical activity, waist/height ratio, alcohol, Mediterranean Index, energy intake.

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