

The Socio-Economic Health Deprivation Index and its association with mortality and attitudes towards influenza vaccination among the elderly in Palermo, Sicily

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Keywords

Socio-Economic Deprivation Index • Influenza vaccination coverage • Elderly • Social determinants of health

Summary

Introduction. Socio-economic status (SES) seems to be a determinant of health and is associated with vaccination coverage among older and at-risk populations. The aim of this study was to evaluate trends in health outcomes and the Socio-Economic and Health Deprivation Index (SEHDI) among elderly people in the city of Palermo.

Methods. In the 2015 CCM project, the Palermo Unit collected mortality data for use in validating the SEHDI. Italian census data from 2009 to 2015 on overall mortality and causes of death were used. The outcome used to validate the SEHDI was vaccination coverage from the 2009-2010 to 2014-2015 influenza seasons among the elderly in Palermo.

Results. The SEHDI correlated significantly with all-cause mortality ($p < 0.05$), though this correlation displayed a decreasing trend.

Regarding mortality due to influenza or pneumonia, however, the significant correlation ($p < 0.05$) showed an increasing trend. A linear trend was observed in the inverse correlation between the SEHDI and vaccination coverage rates ($p < 0.05$), with an overall 27% vaccination coverage among older people. Elderly subjects living in a census district with more regular immigrants, divorced people and single-parent families were more reluctant to undergo influenza vaccination.

Conclusions. This study allowed us to identify subgroups of elderly people who are less likely to adhere to influenza vaccination, and to whom health promotion interventions could be addressed in order to facilitate "healthy aging".

Introduction

Vaccination is the most effective means of reducing influenza disease both among at-risk subjects and in the general population [1, 2]. The Italian Preventive Plan envisions free-of-charge influenza vaccination for over 65-year-old subjects and those at risk [3]. Nevertheless, in Italy almost 8 million cases of influenza-like illness (ILI) occur every year, imposing a heavy burden in terms of hospitalization and mortality [4-6]. Vaccination coverage in Italy is below the recommended level of 75% and has shown a decreasing trend in recent years (52.6% among subjects over 65 years old during the 2016-17 influenza season). Consequently, direct medical costs have risen, owing to the increase in Emergency Department and hospital admissions [7]. Literature data have shown that socio-economic status and deprivation play a major role in vaccination adherence [8-11]. Indeed, an association has been seen between income level and vaccination coverage among older and at-risk subjects. This has prompted the hypothesis that Socio-Economic Status (SES) is a determinant of health status and the ability to comply with preventive recommendations and healthcare indications. In this regard, low SES has been associated with low vaccination coverage in Spain, France and the UK [10]. By contrast,

influenza vaccination coverage in Italy is reported to be higher among older people of lower SES [12, 13]. The same association has been observed among people with comorbidities who have a higher risk of acquiring influenza [14].

The Department of Science for Health Promotion and Mother-Child care of Palermo University contributed to the 2015 CCM project financed by the Ministry of Health. This project was called "Influenza vaccination among older people: developing a deprivation index of SES characteristics and informative/educational needs in order to increase vaccination coverage, so as to reduce influenza-related Emergency Department access and hospitalization". The purpose of the project was to validate a new socio-economic health-status deprivation index with a view to evaluating preventive strategies and health outcomes in the city of Palermo.

The main aim of the present study was to evaluate the trend in health outcomes and the socio-economic health-status deprivation index among subjects aged over 65 years in Palermo. The secondary objective was to evaluate the multidimensional features of SES, in order to identify groups of people at higher risk of refusing influenza vaccination.

Methods

In the 2015 CCM project, the Palermo Unit dealt with collection of mortality data for use in validating the local deprivation index. The 2011 Italian census data on the city of Palermo were used to depict demographic characteristics. Data on overall mortality and causes of death from 2009 to 2016 were extracted by applying the ICD9 classification to the registry of causes of death, which is managed by the Sicilian Regional Health Authority [15]. Observed and expected deaths ($n = 39,831$), stratified by age and sex, were correlated with geographic information on the over 650,000 people living in Palermo.

All the demographic and socio-economic variables from the 2011 Italian Census of Population and Households were used to compute the Socio-Economic and Health Deprivation Index (SEHDI) for the municipality of Palermo, at Census block (or Census tract) territorial level. The SEHDI was computed according to the studies conducted by Lillini and Vercelli on local deprivation indexes as a tool for evaluating health inequalities in a population [16]. The values of the SEHDI were classified into five levels of deprivation (high, medium-high, medium, medium-low, and low).

The SEHDI was then used to study the vaccination coverage distribution from the 2009-2010 to 2014-2015 influenza seasons among Palermo residents. For each influenza season, vaccination coverage in each Census tract was evaluated. This was calculated by recording vaccination adherence among subjects aged over 64 years; these data were then linked to each Census block by plotting the geographical distribution of the offices of the subjects' general prac-

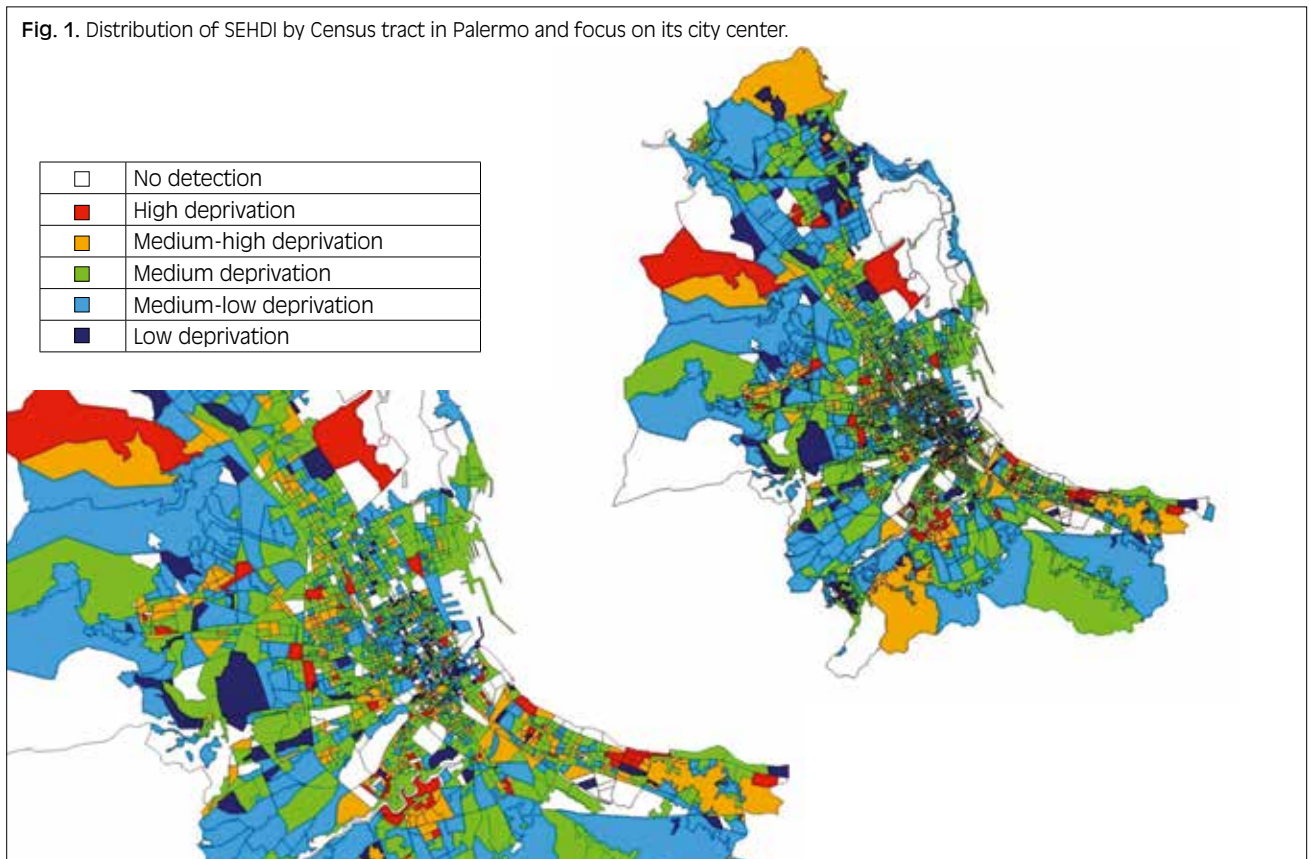
tioners. Demographic, economic, housing and mortality variables were used to carry out a principal-component factor analysis, in order to draw up the deprivation index. The distribution of vaccination coverage according to the SEHDI was evaluated by ANOVA, using the F-test and the test of linearity for trend. Pearson's test was used to evaluate bivariate correlations between vaccination coverage and demographic characteristics (divorced, secondary school education level, percentage of retired people or school-children, students, regular migrants and the frequency of single-parent families with at least one child < 15 years old) stratified by deprivation index. In all analyses, a two-tailed significance level was applied ($p < 0.05$).

Results

SEHDI AND HEALTH OUTCOMES OF THE ELDERLY POPULATION IN PALERMO

The distribution of the population living in the city of Palermo, in terms of the different SEHDI groups, was quite homogeneous, since almost half of the population (46%) was classified as having a "medium deprivation" level. Moreover, the extreme groups of SEHDI accounted for only a small proportion of the general population. Figure 1 shows the distribution of the SEHDI by Census tract; the SEHDI distribution in the historical center of the city is shown in detail.

Through factor analysis, three main groups of variables responsible for 64% of the variability of the SEHDI were



Tab. I. Factor analysis of SEHDI demographic, economic and housing variables.

	Factor 1 (socio-economic) = 28.2%	Factor 2 (socio-cultural) = 21.9%	Factor 3 (family-related deprivation) = 14.2%
SEHDI variables	% earners from labor or capital income	Mean number of people per family	% single-parent families with at least one child < 15years old
	Old age index	% primary school diploma	
	Index of structural dependence	% literate subjects	
		% illiterate subjects	
Total explained variance = 64.3%			

Tab. II. Trend in overall mortality and mortality due to influenza or pneumonia and SEHDI among the elderly population of Palermo.

SEHDI level	Overall deaths observed 65+ M	Overall mortality SMR 65+ M	95% CI		Overall deaths observed 65+ F	Overall mortality SMR 65+ F	95% CI	
High	363	1.12	1.01	1.24	393	0.90	0.81	0.99
Medium-high	1640	1.05	1.00	1.10	1980	1.00	0.96	1.05
Medium	3729	1.04	1.00	1.07	4484	1.02	0.99	1.05
Medium low	1964	0.89	0.85	0.93	2306	0.97	0.93	1.01
Low	148	0.86	0.72	1.00	201	1.16	1.00	1.32
Total	7844	1.00	0.98	1.02	9364	1.00	0.98	1.02
Trend		<i>p</i> < 0.05 L				<i>p</i> < 0.05 NL		
SEHDI level	Influenza and pneumonia deaths observed 65+ M	Influenza and pneumonia mortality SMR 65+ M	95% CI		Influenza and pneumonia deaths observed 65+ F	Influenza and pneumonia mortality SMR 65+ F	95% CI	
High	12	1.57	0.68	2.46	5	0.65	0.08	1.23
Medium-high	33	0.90	0.59	1.20	25	0.72	0.44	1.01
Medium	86	1.01	0.80	1.23	88	1.14	0.90	1.38
Medium low	52	1.00	0.73	1.27	42	1.01	0.70	1.32
Low	2	0.49	0.00	1.17	2	0.66	0.00	1.58
Total	185	1.00	0.85	1.14	162	0.99	0.84	1.14
Trend		<i>p</i> < 0.05 L				<i>p</i> < 0.05 NL		

M: male; F: female; SMR: Standardized Mortality Rate; SEHDI: Index of deprivation in Palermo; L: Linear trend; NL: Non-Linear trend.

identified (Tab. I). In detail, the socio-economic group accounted for almost 1/3 (28%) of the general population variability, followed by socio-cultural factors (22%) and deprivation related to the family context (14%). As shown in Table II, the analysis of all-cause mortality, according to the SEHDI within the city of Palermo stressed a linear distribution in the old men (decreasing at deprivation decreasing, $p < 0.05$), not in old women, where a non-linear association as found ($p < 0.05$). Table II also shows a significant correlation between mortality due to influenza or pneumonia and higher deprivation indexes ($p < 0.05$). On stratifying the results of the mortality analysis by gender, an increasing trend in mortality due to influenza or pneumonia was found among elderly men as the deprivation index increased ($p < 0.05$). By contrast, a decreasing trend in mortality and was observed in elderly women as the deprivation index increased ($p < 0.05$).

SEHDI AND VACCINATION COVERAGE AMONG THE ELDERLY POPULATION IN PALERMO

Average influenza vaccination coverage among people aged more than 64 years and resident in Palermo between the 2009-2010 and 2014-2015 influenza seasons was 27%.

On comparing vaccination coverage with deprivation levels, a linear trend in the correlation between coverage rate increase and deprivation index decrease ($p < 0.05$) was observed, with 29% coverage in the “medium deprivation” group (Tab. III).

The Pearson bivariate correlation between vaccination coverage and socio-economic variables showed that elderly subjects in Palermo were more reluctant to undergo influenza vaccination if they lived in census districts with more immigrants, divorced people and single-parent families. Conversely, influenza vaccination coverage was higher among the elderly living in census districts with more people of a higher educational level (at least high school degree) or students, retired people and school-children (not working population) (Tab. IV).

Discussion

Social and economic disadvantage is a predictor of mortality, not only in Italy but also worldwide, as reported in several studies [17-22]. However, no standardized concise indicators that appropriately describe the variability of socio-economic status are available. Accordingly, this study

aimed to draw up a new deprivation index which would include all-cause mortality as a health indicator and to apply this to the socio-economic context of the various districts of the city of Palermo. A further aim was to validate a tool that could identify sub-groups of elderly people who are most likely not to undergo influenza vaccination.

The SEHDI deprivation index did not show a wide range of distribution, with a large part of the general population belonging to the “medium deprivation” level. This distribution could suggest that the deprivation index of the residents of Palermo is determined predominantly by socio-economic and cultural factors rather than by variables concerning the family context. This consideration seems to fit into the general social framework observed in Southern Italy, where productivity is lower than in Northern and Central Italy [18].

The correlation of SEHDI with all-cause and specific mortality rates among the elderly revealed a higher risk of mortality in the most disadvantaged population groups in men and a higher risk of mortality among less socio-economically disadvantaged groups in women. These data are quite different from those that emerged from a previous study conducted in Sicily, in which higher mortality rates were observed among the elderly in the most disadvantaged population groups [17].

Regarding the specific mortality rates due to influenza or pneumonia, a similar difference between men and women was observed. Specifically, the mortality was increasing at increasing deprivation in old men, while among old women lower mortality rates correlated with lower deprivation. This effect could be attributable to different attitudes towards disease prevention according to gender, as shown

Tab. III. Vaccination coverage and SEHDI of Palermo city from 2009/2010 to 2014/2015.

SEHDI	Vaccination coverage 65+ 2009/10-2014/15 (%)
High deprivation	19.05
Medium-high deprivation	24.64
Medium deprivation	28.68
Medium-low deprivation	26.81
Low deprivation	27.25
Overall	27.12
Trend	$p < 0.05$ L

L: Linear trend.

Tab. IV. Correlation between vaccination coverage and demographic characteristics.

		Vaccination coverage 65+ 2009/10-2014/15 (%)
% divorced	β -coefficient	-0.095
	p-value	0.042
% upper secondary school	β -coefficient	0.131
	p-value	0.016
% not belonging to the labor force	β -coefficient	0.095
	p-value	0.043
% students	β -coefficient	0.132
	p-value	0.016
% foreigners and stateless persons residing in Italy	β -coefficient	-0.131
	p-value	0.016
% single-parent families with children under 15 years	β -coefficient	-0.106
	p-value	0.053

by a recent Sicilian study on adhesion to Pap smear testing [23].

Assessment of influenza vaccination coverage rates among the elderly in Palermo during five consecutive influenza seasons showed a linear trend in the correlation between higher deprivation groups and lower vaccination adherence, as previously reported in other studies [8, 10, 24]. This trend was different from that reported in other Italian Regions involved in the 2015 CCM project and in other studies, in which lower influenza vaccination adherence was related with a lower deprivation index [10, 12, 13].

On analyzing influenza vaccination coverage in relation to deprivation clusters, it emerged that a large proportion of elderly people lived in areas of higher deprivation, where variables most frequently associated with “hard-to-reach” subjects (divorce, lower level of education, foreigners) are encountered [25, 26].

Conclusions

By correlating this socio-economic and health deprivation index with influenza vaccination coverage in the city of Palermo, we were able to identify those sub-groups of elderly people who were most likely to adhere to influenza vaccination. The present study therefore contributes to identifying population subgroups for which health promotion interventions could be organized, in order to facilitate “healthy aging” of the elderly population.

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Conflict of interest statement

None declared.

Authors' contributions

VR reviewed literature, interpreted data, checked data validity and wrote first draft of the paper. AC coordinated and supervised data collection, built figure, checked data validity, performed statistical analysis and revised the manuscript. IS and SP designed the data collection instruments and collected the data. CC reviewed literature, interpreted data and revised the manuscript. AC conceptualized and designed the study, interpreted data and revised the manuscript. All authors have read and approved the final manuscript.

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