



Health inequalities in Seville, Spain: use of indicators of social deprivation and mortality in small areas

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Summary Objectives. To analyse the spatial distribution of social structure and mortality in Seville, and to examine the association between various social indicators and mortality.

Methods. Small areas of the city were typified on the basis of four social indicators, which were used to derive a social index. Overall mortality and cause of death were studied in two age groups (1+ years and 1-64 years). Pearson's correlation coefficient was used to examine the relationship between the social indicators and mortality.

Results. Significant social and mortality differences, particularly in premature mortality of males, were found between the areas studied. However, when the basic health zones are grouped together by social level, these differences in mortality are not so clear. The social indicators that correlate most closely with mortality are unemployment and illiteracy. When the social index is used, the correlations are weaker. Premature death from trauma in males presents the highest coefficient of correlation with unemployment and illiteracy.

Conclusions. The social index used in the present study places less emphasis on material differences than those used by Townsend et al. and Carstairs and Morris. Also, it was not possible to study mortality by individual neighbourhoods in this study. Both factors could have influenced the finding that the correlations between both types of indicator are weaker with the social index than with unemployment and illiteracy.

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Introduction

The analysis of social inequalities in respect of health is a priority, particularly at a time when

there is much debate about the future of current healthcare systems and about the ways that these future perspectives will enable social demands to be met. It is essentially a question of debating how and how far individual and collective responsibilities should be delimited in the face of the existence of healthcare inequalities.¹⁻⁶ Nájera,⁷ when debating the age-old thorny question of whether individual health is or is not a social

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product, recalled the reference that Antonovsky⁸ made to the victims of the famous sinking of the *Titanic* in contending that 'the time at which one dies is related to one's class'. However, the study of social inequalities in health should not be left as merely an analysis of the deficiencies in the application of the measures of the health system in different social groups;⁹⁻¹² that is, we must not only consider inequalities in services but should also use the analysis of inequalities as a conceptual and methodological tool to reveal the origin and social meaning of health, and to obtain evidence for the need to re-orientate the concepts and approaches on which health policies are based. In short, it is necessary to redefine the concepts of health and disease, and to discuss how the 'social' dimension is being used in health.¹³⁻¹⁸

The study presented here is set in the framework of a wider project which we have been undertaking in Seville, Spain.¹⁹ The purpose of this research is to demonstrate the relationships between the health profile of human groups and what our research group has been calling 'the socio-ecological niche or nest', understanding this as the 'melting pot in which social factors are mixed and interact, where 'ingredients' such as work (if any), the level of education (if any), the living conditions (however squalid or luxurious), the human relationships (in all their diverse forms), ...are all 'cooked' together with the physical environment and with biological and chemical components, etc.' creating the conditions or processes for possible losses of health.¹⁶

In this context, it is clear that we must review whether the traditional parameters (person, place and time) of epidemiology continue to be useful in the analysis of social inequalities in respect of health. Without doubt, the most fundamental change should be that the person (the individual) ceases to be the most relevant parameter in the study of a particular health situation, and gives way to the community as the main unit of analysis. This change is closely related to one of the fundamental problems posed by the science of epidemiology, which is to define the concept of community or population. The current situation is characterized by the absence of a sufficiently clear idea of what concepts of community we are using in epidemiological research.

It is precisely when it comes to defining how we are going to configure these units of populational analysis that we must recognize that, conceptually, a community or population group does not necessarily have to be defined by a spatial principle that conditions it in its entirety. On the other hand, it can be very useful to concentrate first on the spatial

component of a community to delimit the unit of analysis. In this respect, it must be borne in mind that, on the one hand, the population is not distributed at random in the various geographical spaces, and on the other hand, the empirical construction of community units of analysis is conditioned by the fact that a major part of the information used in epidemiology (such as censuses and records) is territorially based. In short, it is a question of using what have come to be termed 'geographical-populational units', which could be useful as the basis for investigation into socio-ecological niches. Taking into account the elements that would comprise the socio-ecological niche, the urban neighbourhood or quarter could be used in the configuration of these units. The urban neighbourhood is a low level of aggregation of individuals, in which it is realistic to consider that they are mutually linked by a series of bonds of co-existence, living together in close proximity within a relatively small common physical and social space. Under this definition, aggregation is much more meaningful than the mere summation of individuals. Our interest centres on taking these smallest units—the neighbourhoods of a city—and creating larger socially homogeneous zones that can serve in the study of differences in health patterns. The intention, then, is to apply, with a greater degree of coherence, the proposed ecological analysis of the cross-relationships between the social and mortality indicators.

To summarize, our general objective is to develop methodologies for the study of the health situation of an urban community. Our specific objectives are: (1) to conduct an analysis of the spatial distribution of the social structure of Seville, characterizing its historical neighbourhoods and basic health zones (BHZs) from the data of the 1991 population census; (2) to study the mortality in Seville during the 1990-1993 period, evaluating its spatial distribution; and (3) to analyse the ecological association between the indicators of mortality used and those of social deprivation.

Methods

For the configuration of socially homogeneous zones of Seville, the census section was chosen as the basic working unit, this being the smallest unit of division for the administration of the municipality, by numbers of inhabitants. From this, we obtained larger administrative and natural units: the BHZs (of which there are 32), the smallest unit of the health administration for planning and

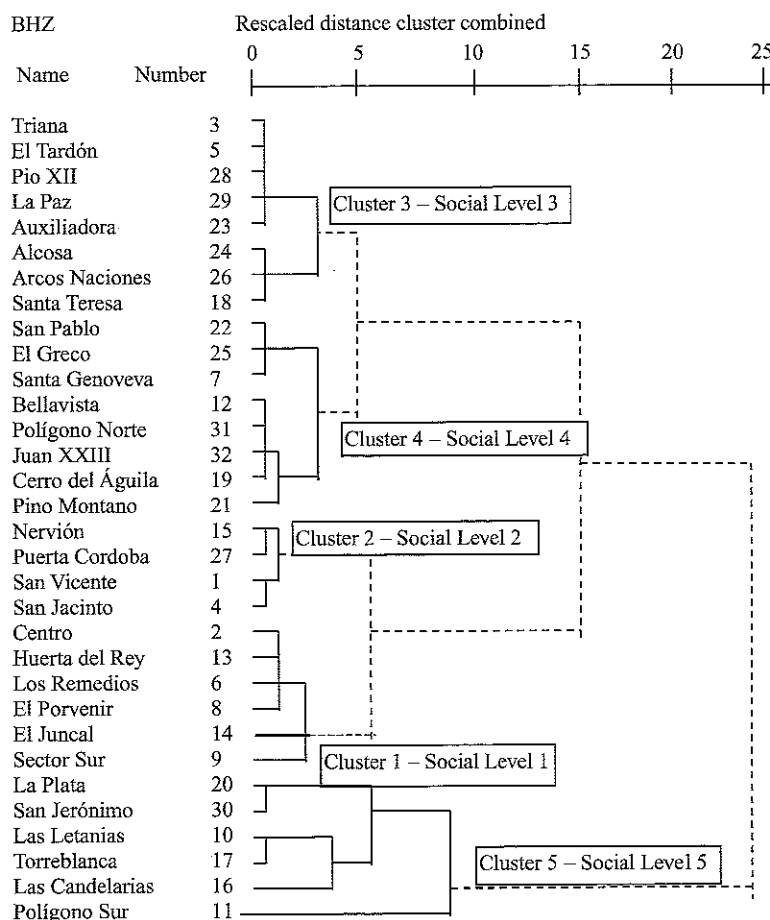
management; and the neighbourhoods (quarters or districts, known as 'barrios') (85 in number), which are smaller territorial units than the BHZs, often historical and cultural in character, where the community social life takes place. The 1991 population census of Seville was the source of population and socio-economic data.²⁰

Various social indicators in respect of these units (the neighbourhood and the BHZ) have been reviewed; in particular, the following were selected for analysis: (1) unemployment among males aged 16 + years; (2) the rate of illiteracy, standardized by age, in females (10-64 years of age); (3) the percentage of females (25-64 years of age) in work and of at least secondary-level education, standardized by age; and (4) the percentage of males and females (aged 25 + years) with university-level education, standardized by age, as an indicator of social status.

For the configuration of socially homogeneous zones, we grouped our units of analysis in function of the results obtained with the four indicators. In addition to applying criteria decided a priori, use

was made of cluster analysis^{21,22} for this grouping. The grouping method was that of the average linkage between groups method,²³ and on this basis, the 85 urban neighbourhoods and 32 BHZs of Seville were characterized and grouped into five separate clusters or social levels.¹⁹

The mortality indicators used were the rates standardized by age (direct method with Seville as the standard population) for males and females, in two different age groups (1 + years and 1-64 years) by BHZ. To increase the stability of the estimates, the deaths recorded in the years 1990, 1991, 1992 and 1993 were aggregated, using the population figure obtained from the 1991 population census as denominator. Of the 17 broad groups of causes listed in the International Classification of Diseases (9th revision),²⁴ the five most prevalent were selected (neoplasms-II, diseases of the circulatory system-VII, diseases of the respiratory system-VIII, diseases of the digestive system-IX, and injury and poisoning-XVII). All the rates and their 95% confidence intervals were calculated using the 'EPIPOB' vital statistics program.²⁵



The cluster number is based on social characteristics (Table 1).

Figure 1 Dendrogram of cluster analysis of basic health zones (BHZ) in Seville. 1991 population census.

To analyse the possible social inequalities in respect of mortality in Seville, we also calculated, in the group aged 1-64 years, the average mortality rates, standardized by age, in the BHZs grouped into five categories by socio-economic level. From the sum of the Z scores of the four socio-economic indicators used, we created a social index such that a positive value of this index indicates a BHZ with a better overall 'social condition' than the average for the city. To study the relationship between the mortality and socio-economic indicators and this new social index, the Pearson correlation coefficients have been calculated.²³

Results

The distribution of the indicator of unemployment in the neighbourhoods of Seville is positively asymmetric in character, such that most of the neighbourhoods present values below those for Seville as a whole in 1991 (19.49%). This asymmetry is much more exaggerated in the indicators of illiteracy of women, and of university graduates of both sexes. The distribution of the indicator of females in work, with secondary-level education, is also skewed to the right, with most neighbourhoods having figures below that of Seville as a whole (15.72%). Similarly, the distribution of the values of

the four socio-economic indicators in the BHZs follows a pattern similar to that of their neighbourhoods.¹⁹

Fig. 1 shows the grouping of BHZs obtained from the cluster analysis. It can be observed that the first four clusters are formed very quickly in the process of analysis, whereas the fifth cluster, presenting the worst social characteristics, is formed by those BHZs that are most heterogeneous as a group. Table 1 shows that Cluster 1 is characterized by presenting the most favourable indicators, particularly the highest figures of females in work (30.44%) and of university graduates of both sexes (31.47%), without any overlaps with other clusters appearing. In contrast, Cluster 5 is characterized by having clearly the worst socio-economic indicators, especially the high unemployment in males (30.78%), high illiteracy in females (5.92%), and the low percentage of females in work (3.70%), without their ranges overlapping with those of Cluster 4 (Fig. 2).

Taking account of the characterization of the neighbourhoods of Seville, the next step was to evaluate the social groupings of BHZs on the basis of the social levels of the individual neighbourhoods comprising each BHZ. In this way, we were able to confirm the correct classification and the degree of internal social homogeneity within each grouping of BHZs (Table 2). It was confirmed that most BHZs

Table 1. Statistics of the social indicators in each cluster and social level. Basic health zones in Seville—1991 census.

Cluster	Social level	Mean	Standard deviation	Maximum	Minimum
Male unemployment (%)					
1	1-very high	14.01	2.33	17.69	10.76
2	2-high	18.0	1.57	19.38	15.99
3	3-medium	16.49	2.21	19.23	12.73
4	4-low	21.41	2.52	24.43	16.15
5	5-very low	30.78	5.61	39.78	24.98
Illiteracy in females (%)					
1	1-very high	0.51	0.3	1.1	0.29
2	2-high	0.83	0.19	1.08	0.61
3	3-medium	1.12	0.45	1.84	0.65
4	4-low	2.15	0.45	2.79	1.5
5	5-very low	5.92	1.24	7.48	4.51
Women in work, with secondary education (%)					
1	1-very high	30.44	1.97	32.0	27.4
2	2-high	23.76	2.63	26.59	21.4
3	3-medium	14.68	3.45	19.78	10.49
4	4-low	9.27	3.69	15.87	4.92
5	5-very low	3.7	1.25	4.98	2.31
University graduates, males and females (%)					
1	1-very high	31.47	3.67	35.99	25.83
2	2-high	19.92	2.94	23.05	16.69
3	3-medium	9.32	2.96	13.79	5.8
4	4-low	5.2	3.0	10.0	1.95
5	5-very low	1.3	0.48	2.09	0.71

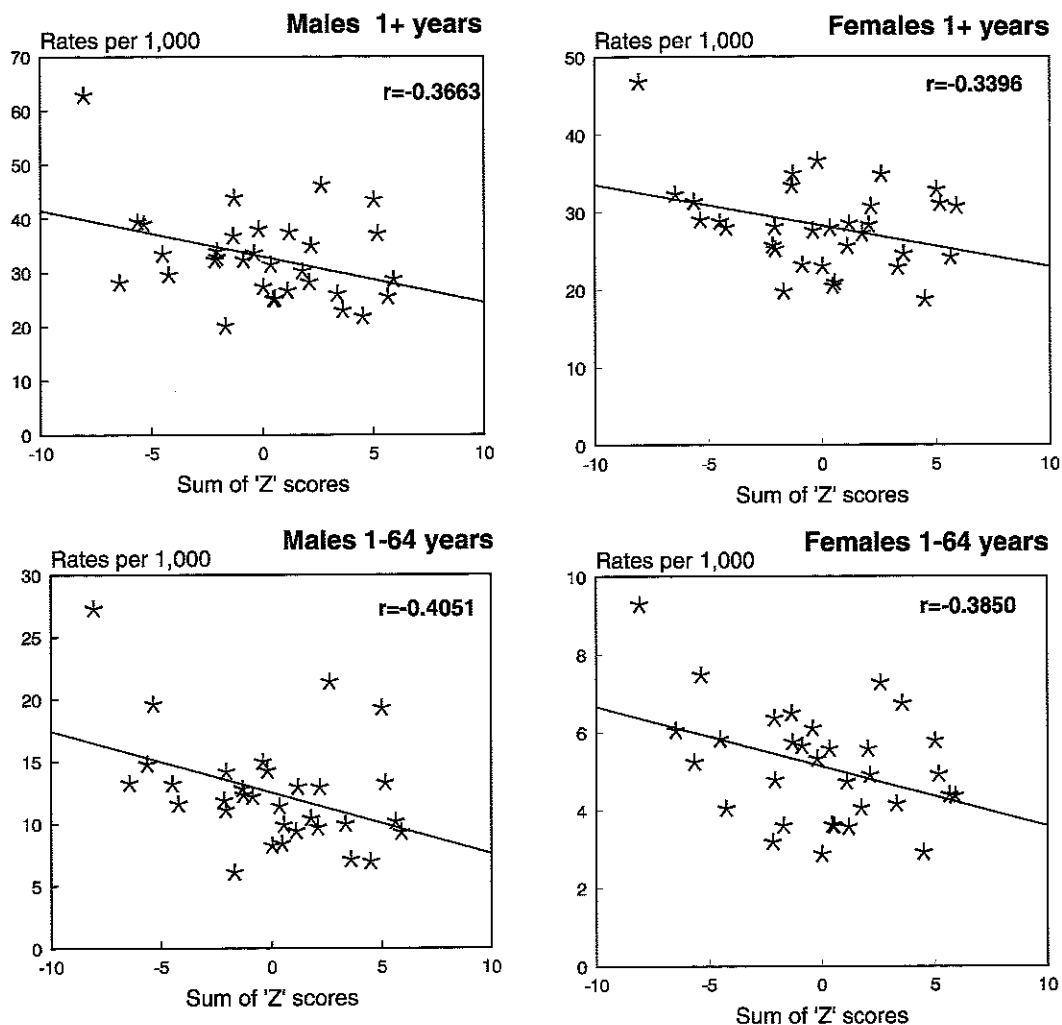


Figure 2 Relationship between social index and age-adjusted mortality rates in basic health zones of Seville. Males and females aged 1 year and over (1+) and 1-64 years. Period 1990-1993.

classified as Social Levels 1, 2 or 5 can be considered to be reasonably homogeneous, in contradistinction to those classified as Social Level 3 ('medium') or 4 ('low') where there are BHZs that do not coincide with the classification given to their neighbourhoods, such as 'El Tardón' and 'Triana' (Level 3) where all the constituent neighbourhoods are of Level 2, and 'Pino Montano' (Level 4) where 100% of its population live in neighbourhoods of Level 3.

The rates of general mortality (of those aged 1+ years) and premature mortality (of those aged 1-64 years) found in the various BHZs show substantial differences. The range of rates is considerably greater in males, and this difference is even more notable in respect of premature mortality (rates of 6.09-27.29) (see Table 3).

In the average mortality rates for each of the five groupings of BHZs by social level, higher stand-

dized rates of female mortality (1-64 years) were observed in Social Levels 4 and 5, with values of 5.55 and 5.68, respectively. However, when their confidence intervals are taken into account, the only clear difference is seen between the lowest and highest levels (Social Levels 5 and 1). In the corresponding male mortality rates, greater differences between groupings or levels can be appreciated, with Social Level 5 (at 15.44) presenting a substantially greater difference from the rest. However, when the confidence intervals are analysed, a slight overlapping with Social Level 2 is observed.

The closest correlation and slope of the regression curves between the rates of mortality and the social index is observed for males aged 1-64 years, although levels of statistical significance are not reached.

Pearson's correlation coefficients between the rates of general mortality and the four indicators

Table 2 Basic health zones (BHZs) of Seville sorted according to social level, and the proportions of population classified to different social levels, in each neighbourhood.

BHZs ^a	Population (number)	Population of the neighbourhoods (%)				
		Social level 1-very high (%)	Social level 2-high (%)	Social level 3-medium (%)	Social level 4-low (%)	Social level 5-very low (%)
<i>Social level 1-very high</i>						
Centro (2)	21,780	100				
Los Remedios (6)	28,944	100				
Porvenir-Montequinto (8)	25,939	89.6		10.4		
Sector Sur (9)	10,945	63.3	25.1			11.6
Huerta del Rey (13)	17,117	60.7	39.3			
El Juncal (14)	26,086		100			
<i>Social level 2-high</i>						
San Vicente (1)	22,916		100			
San Jacinto (4)	21,302		100			
Nervión (15)	18,055		75.7		24.3	
Puerta de Córdoba (27)	23,089		87.6		12.4	
<i>Social level 3-medium</i>						
Triana (3)	19,936		100			
El Tardón (5)	14,384		100			
Santa Teresa (18)	23,148			59.2	40.8	
M ^a Auxiliadora (23)	24,954		60	40		
Alcosa-Polig. Aerop. (24)	44,944		45.9	47.5	6.6	
Las Naciones (26)	19,348			87.4	8.2	4.4
Pío XII (28)	25,898		37.7	29.8	32.5	
La Paz (29)	25,409		34	66		
<i>Social level 4-low</i>						
Santa Genoveva (7)	14,489		31.6		68.4	
Bellavista (12)	13,081				100	
Cerro del Águila (19)	18,445		4.9		95.1	
Pino Montano (21)	27,298			100		
San Pablo (22)	20,568		17.5		82.5	
El Greco (25)	19,914		36		64	
Polígono Norte (31)	31,687			50.4	49.6	
Juan XXIII (32)	13,674			79.3	20.7	
<i>Social level 5-very low</i>						
Las Letanías (10)	18,419			34.7		65.3
Polígono Sur (11)	12,965					100
Las Candelarias (16)	21,377					100
Torreblanca (17)	22,888					100
La Plata (20)	21,450				83.9	16.1
San Jerónimo (30)	12,579				90.1	9.9

^a Numbers in parentheses are the references of the BHZs as shown in Fig. 1.

and the overall social index for the 32 BHZs can be seen in Table 4. Considering the social indicators that correlate most closely with mortality, consistently the most notable in both age groups and in both sexes are unemployment in males and illiteracy in females; mortality in the 1-64-years group is higher in all cases. In this measure of mortality, the variables that are most closely related in males and females are, firstly, unemployment, with an R of 0.62 and 0.60, respectively ($P < 0.001$), and secondly, illiteracy, with an R of 0.47 and 0.46, respectively ($P < 0.01$).

Injury and poisoning, and diseases of the respiratory system are the two groups of causes of death in males that most closely correlate ($R = -0.50$ and

$R = -0.43$, respectively) with the social index. Equally, unemployment and illiteracy are notable for their higher coefficients, especially with injury and poisoning, and levels of statistical significance are found in these cases. In women, neoplasms and diseases of the circulatory system show the closest correlations with these two indicators, although these are not significant.

Discussion

Previously, population or ecological strategies that were configured using population data, either aggregated or separated by geographical areas,

Table 3 Mortality rates, by sex and in both age groups, in the basic health zones (BHZs) of Seville, and grouped by social levels. Age-standardized rates per 1000 (95% confidence intervals) (Period 1990-1993).

BHZs ^a	Age group 1+ years		Age group 1-64 years	
	Females	Males	Females	Males
<i>Social level 1-very high</i>				
Centro (2)	32.87	43.50	5.78	19.30
Los Remedios (6)	24.20	25.52	4.39	10.17
Porvenir-Montequinto(8)	30.71	28.75	4.37	9.31
Sector Sur (9)	24.61	22.96	6.74	7.12
Huerta del Rey (13)	31.08	37.19	4.92	13.3
El Juncal (14)	18.79 ^b	21.84	2.92	6.96
BHZs grouped			4.53 (4.00, 5.06)	10.96 (10.12, 11.80)
<i>Social level 2-high</i>				
San Vicente (1)	34.82	46.23	7.27	21.41
San Jacinto (4)	22.89	26.02	4.16	9.97
Nervión (15)	30.72	35.04	4.90	12.94
Puerta de Córdoba (27)	27.23	30.24	4.06	10.43
BHZs grouped			5.09 (4.41, 5.77)	13.68 (12.53, 14.83)
<i>Social level 3-medium</i>				
Triana (3)	25.64	26.65	4.73	9.41
El Tardón (5)	28.55	37.49	3.57	12.96
Santa Teresa (18)	36.61	38.02	5.32	14.27
M ^a Auxiliadora (23)	28.36	28.20	5.57	9.71
Alcosa-Polig. Aerop. (24)	20.50	25.03	3.62	8.4
Las Naciones (26)	23.04	27.37	2.87 ^b	8.25
Pío XII (28)	20.92	25.17	3.6	9.91
La Paz (29)	27.98	31.45	5.57	11.41
BHZs grouped			4.51 (4.07, 5.95)	10.40 (9.72, 11.08)
<i>Social level 4-low</i>				
Santa Genoveva (7)	23.24	32.34	5.56	12.18
Bellavista (12)	25.73	32.32	3.18	11.86
Cerro del Águila (19)	25.26	33.94	4.77	14.16
Pino Montano (21)	34.95	43.86	5.75	12.32
San Pablo (22)	33.43	36.75	6.49	12.80
El Greco (25)	27.62	33.61	6.10	14.97
Polígono Norte (31)	28.13	32.77	6.36	11.10
Juan XXIII (32)	19.79	20.09 ^b	3.6	6.09 ^b
BHZs grouped			5.55 (4.92, 6.18)	11.81 (10.90, 12.72)
<i>Social level 5-very low</i>				
Las Lctanias (10)	31.38	39.45	5.23	14.79
Polígono Sur (11)	46.74 ^c	62.81 ^c	9.28 ^c	27.29 ^c
Las Candelarias (16)	29.02	39.04	7.47	19.62
Torreblanca (17)	32.32	28.11	6.05	13.26
La Plata (20)	28.03	29.58	4.04	11.59
San Jerónimo (30)	28.81	33.41	5.82	13.19
BHZs grouped			5.68 (5.03, 6.33)	15.44 (14.41, 16.47)

^a Numbers in parentheses are the references of the BHZs as shown in Fig. 1.

^b Lowest values of standardized rates by age.

^c Highest values of standardized rates by age.

were mainly produced for divisions of regions or nations, and much less frequently for divisions of cities.²⁶⁻³⁰ As Carstairs and Morris stated in 1989,³¹ the almost universal use of a postal code as the basis for the classification of areas means that most events can be situated geographically, thus potentially solving many of the limitations attributed to social class. The classification of a population on the basis of the area in which the people live can

increase the possibilities for the epidemiological analysis of a wide range of health data for which the corresponding social class data is not available.

Social indicators

Having tested a variety of indicators, we finally selected four factors that gave a good measure of the two fundamental components of social

Table 4 Pearson's correlation coefficients between social index, social indicators and age-standardized mortality rates by sex and in both age groups by all causes of mortality and only in the 1-64-year age group by broad groups of cause of mortality.

	Social index	Male unemployment	Illiteracy in females	Females in work, with secondary education	University graduates, males and females
All causes of mortality					
<i>Males</i>					
Age group 1-64 years	-0.37	0.50*	0.405	-0.22	-0.20
Age group 1-64 years	-0.41	0.62**	0.47*	-0.20	-0.18
<i>Females</i>					
Age group 1-64 years	-0.34	0.46*	0.44*	-0.19	-0.14
Age group 1-64 years	-0.39	0.60**	0.46*	-0.20	-0.15
Broad groups of cause of mortality (ICD - 9)					
<i>Males aged 1-64 years</i>					
Neoplasms	-0.29	0.38	0.33	-0.19	-0.17
Diseases of the circulatory system	-0.21	0.34	0.26	-0.09	-0.08
Disease of the respiratory system	-0.43	0.39	0.33	-0.43	-0.43
Diseases of the digestive system	-0.25	0.33	0.21	-0.17	-0.19
Injury and poisoning	-0.5	0.71*	0.60*	-0.28	-0.23
<i>Females aged 1-64 years</i>					
Neoplasms	-0.29	0.36	0.40	-0.18	-0.13
Diseases of the circulatory system	-0.28	0.37	0.37	-0.17	-0.11
Disease of the respiratory system	-0.05	0.13	0.05	-0.001	0.003
Diseases of the digestive system	-0.16	0.31	0.20	-0.02	-0.05
Injury and poisoning	-0.07	0.18	0.17	0.03	0.05

*P < 0.01. **P < 0.001

organization: education and work. Two of these four, illiteracy and unemployment, have been used repeatedly to analyse the causal relationships between the 'social' dimension and health.³²⁻⁴⁰ Such well-known and commonly used indices of deprivation as those of Carstairs and Morris³¹ and of Townsend et al.⁴¹ are also found to be composed of four indicators, with unemployment always being one of these. Most previous studies do not use a specific indicator for women; they either do not disaggregate by sex, or take a male-based indicator. In our study, illiteracy among females was used because it is a variable with greater capacity of discrimination. Unemployment in males was only analysed because we wished to use it as an indicator of adverse material conditions; the rate of unemployment in females specifically may be a variable indicating not only precarious economic levels but also other factors such as the degree of participation of females in economic life or a more active social attitude by women. Therefore, as an indicator of social development, we used the percentage of females in work, who also have at least a secondary-level education, as a positive indicator in the sense of more advanced social development. On the basis of these indicators, it was possible to detect significant social disparities in Seville. The indicators

'unemployment' and 'females in work, with secondary education' discriminated most clearly between the different social zones.

Association between mortality and social deprivation indicators

We also observed a differential pattern of mortality in the BHZs, with mortality being higher in Social Levels 4 and 5. The differences were greater in males, particularly in respect of premature mortality, than in females. This finding of greater social differentiation for premature mortality, compared with overall mortality, has also been reported in other studies.^{30,31,42} To a certain extent, the results described here support the existence of a relationship between the social situation of the BHZ and the rate of mortality of its inhabitants, particularly when the extreme values are observed.^{28,43}

Whether the 32 BHZs are taken individually or grouped together to configure five areas in which to analyse the behaviour of the mortality rates, it is difficult to observe an absolute pattern. However, there is a notable relationship between the premature mortality of males and females, and both the social index and the individual indicators of male unemployment and female illiteracy. These data are consistent with other studies.^{26,29,30}

The indicators of deprivation used by Townsend et al.⁴¹ and Carstairs and Morris³¹ place much emphasis on differences in material conditions, using indicators such as households without a car, families without their own home, or overcrowded living conditions, together with unemployment. In contrast, our indicators, that also measure educational levels, not only have an influence on material welfare but also relate to other socio-economic variables that have not received as much attention from other authors and that have been observed to have a clear relationship with health. All these considerations have contributed to the result that, firstly, the correlations found in our study are less close for the set of four indicators taken together as an index than for the indicators analysed individually; and that, secondly, the correlations with the social index are less in our study than in the studies cited previously. For mortality by main groups of causes, the social pattern is different in males and females; in males, the social influence applies particularly in injury and poisoning, and diseases of respiratory system, whereas in females, the social influence is appreciable in neoplasms and diseases of the circulatory system.

Conclusion

Almost 20 years ago, Pringle⁴⁴ complained that in the analysis of the geographical differences of health levels, the available studies were predominantly on the international and inter-regional scales; he attributed the lack of interurban studies to the non-availability of routinely published data at these levels. Oers and Reelick emphasized the need for the development of a local system of information to monitor the state of health of the large municipalities. Townsend et al.²⁶ stated: 'There have been continuous statistical reviews of the geographical inequalities in health but, due in part to the restricted information available for different areas, these reviews have tended more towards up-dates of previous reviews, rather than to in-depth analyses with carefully planned research with the intention that a theory of why there are inequalities in health between populations of different areas might emerge'. In this context, in addition to the problems deriving from the lack of certain types of information, which we also found, the absence of a theory of society must also be stressed. This lack of an explicit representation of the social reality is a serious limiting factor in drawing conclusions regarding the influence of

social structure on health. Nevertheless, it cannot be concluded that we should just fold our arms on the question of health policies because sufficient scientific evidence now exists for action to be taken.⁴⁵

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