The geography of HIV/AIDS in Portugal

PAULA SANTANA AND HELENA NOGUEIRA

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Portugal has some geographical similarities with Finland: both are small and rather peripherical countries. However, the infection with the Human Immunodeficiency Virus (HIV) has different patterns in Portugal from those in Finland. At the beginning of the 21st century, Portugal is in the first place of the infection with the HIV, with an incidence rate of 105.8 cases per one million inhabitants. The main objective of this paper is to present and explain the geographical diffusion of HIV in Portugal at sub-region level with altogether 28 geographical areas. We were able to identify some geographic hot spot areas with SMR significantly higher than 100. Some areas with AIDS mortality rates significantly above the national standardized rates were identified in the metropolitan area of Lisbon. It was found that the urban/rural dichotomy is the most important factor, explaining 47% and 32% of the variance for male and female AIDS mortality, respectively. This factor identifies a clear opposition between the variables, with a geographical significance.

Paula Santana & Helena Nogueira, Department of Geography, University of Coimbra, 3000 Coimbra, Portugal. E-mails: paulasantana@mail.telepac.pt., helenamarquesnogueira@hotmail.com. *MS received 24 February 2004.*

Introduction

After slightly more than twenty years of HIV/AIDS research, we can conclude that some advances, both in the identification of risk behaviours and in therapeutics, have resulted in very positive outcome, mainly in developed countries, where the epidemic has been controlled and the number of new cases has been decreasing (Moatti 2000). However, the persistence of HIV/AIDS is linked, not only to poverty, social exclusion and new (behavioural) problems (Atlani et al. 2000) but also to the increase of old health problems such as, for instance, tuberculosis (Antunes & Waldman 2001).

This paper's main goal is to identify the geographical variations in HIV/AIDS and TB mortality in mainland Portugal and to identify possible interrelationships between this mortality and some social, economic and demographic factors. In accordance with these objectives, this paper is essentially divided into four parts. In the first part we present the background of this problem. Secondly, we highlight some problems associated with the incidence of these causes of death (HIV/AIDS and TB) in Portugal. The third part is dedicated to risk areas for HIV/AIDS and TB in mainland Portugal. Here, we used factor analysis in order to summarize economic, social, demographic and health variables. Factor analysis was complemented with cluster analysis, leading to the identification of risk behaviours related to gender, age, geographical area, etc. In the last part we present some suggestions that might reduce the non-diminishing tendency that has been observed.

Background

In 1997, the World Health Organisation (WHO) undertook a survey in Portugal identifying the pathologies that had been diagnosed in 71,025 people (men, women and children) infected with HIV since 1994. Pulmonary tuberculosis was detected as one of the most frequent causes of death found in adults. The proportion of deaths due to this cause was about 11%. Similar results have been observed in Africa, where in parallel to the terrible growth of the AIDS epidemic, a concurrent growth in the tuberculosis rates has been recorded, and in the USA, where the infection by HIV has been linked to the growth of notifications of cases of tuberculosis among young adults (Elender et al. 1998). While analysing the results for the city of São Paulo for a period of five years (1994–1998) Antunes and Waldman (2001) concluded that the percentage of deaths by pulmonary tuberculosis, explained by HIV co-infection, showed a level that was much higher than the literature suggested up to that time, approaching 22.4%. Nevertheless, despite the fact that an important association has been shown between HIV and tuberculosis elsewhere, some ecological studies undertaken in the United Kingdom conclude that there is no clear evidence for the afore-mentioned interaction.

Some authors believe that the persistence of HIV/AIDS may be related to negative consequences, although in an indirect form, that the antiretroviral treatments may have in the disease. In other words, the medicines that started being used in 1987 (e.g., AZT), and which became the first victory over the virus, may become, paradoxically, a risk for their users. The risks are related to the negative effects of their prolonged use, influencing the increase in the resistance to these drugs and, on another level, to the negative effects induced by their high toxicity. Adding to this is the possibility that using these drugs immediately after being subjected to risk situations could lead to considering them as a sort of "day-after pill" (Moatti 2000). This peculiarity may have consequences in the attitudes and behaviours which are likely to increase risk situations, for instance, in the growth of confidence, negligence and consequently in the possibility of an increase in the number of new cases of the disease. These behaviours have been pointed out as causes for the epidemic's fresh outbreak in groups that were practically under control, such as homosexuals.

Other authors explain the rise in the epidemic by problems associated with social exclusion to which groups are subjected. In this context, Atlani et al. (2000) present the inadequacy and the inefficacy of health systems in responding to these issues as the cause for the disease. This translates into an increase in inequality of access to services and in the coverage of the infected population, even in countries where the health system guarantees free or very low cost coverage, and also in the attitudes and behaviour of health professionals when confronted with HIV infections.

It is in countries where the epidemic takes more lives that the fight against the disease seems to be more difficult, as governments lack the financial capability to distribute drugs and to improve people's standard of living. As a consequence, there are high rates of premature deaths and this fact constitutes another cause for the ever-increasing impoverishment of these regions and countries.

Even though HIV/AIDS is more frequent in certain groups or geographical areas, it does not restrict itself to these groups or geographical areas. The literature confirms that "vulnerability" increases in geometric progression, mainly in the urban and suburban areas of developing countries. It is, however, a problem that arises also in rich countries as a result of increased mobility (immigration from countries of high incidence) and of non-sustained development (Santana et al. 2001). In other words, the problem is greater where economic growth has not taken into account some fundamental components of the standard of living, well-being and universal and timely access to health care for all inhabitants, including immigrants.

Situation in Portugal

HIV/AIDS

The first AIDS case in Portugal dates back to 1983. Even though the incidence of AIDS in Western Europe has been decreasing, Portugal has been registering a rapid growth in the epidemic in recent years[1]. According to UNAIDS/WHO (2000), the incidence of AIDS in Portugal, in comparison to other Western European countries, confirms the unfavourable position in which the country is positioned – topping the European ranking for the disease's rate of incidence, followed by Spain, a situation that was maintained in 2002. Paixão (2003) indicates that the rate of incidence of AIDS cases, in 2001, was 105.8 per million inhabitants (257.5 per million inhabitants, HIV non-symptomatic). Still from the total of diagnosed cases in Portugal – 8232 since the beginning of the epidemic until June 2001 – 16% occurred among homo/bisexuals, 50% among intravenous drug users (IDU), 27% among heterosexuals and 0.8% among children, these being infected by their mother; the remaining cases (around 6% of the total) were transmitted either by blood transfusions or by undetermined ways. Over the years, only the homo/bisexuals group has registered a decrease: in 1992 it presented 557 accumulated cases and in 1999 only 74. IDU's and heterosexuals are responsible for the persistence in the increasing tendency, being simultaneously the behavioural risk-groups in Portugal. In 2000, heterosexuals contributed to 33% of the new cases.

According to the Instituto Português da Droga e da Toxicodependência (IPDT 2001, Portuguese Institute for Drugs and Drug Addiction), more than 50% of the new cases of AIDS registered in 2000 have occurred among drug addicts. The majority of those cases were males (87%) and young adults (aged 25–34; 60%). In 2000, 318 drug-related deaths were registered and of these 53% in the Lisbon healthcare legal area. This figure is smaller than in previous years. It is estimated that almost 72% were suspected overdose cases. Between 1983 and 2001, 2210 drug addicts died of AIDS (47% in the Lisbon district), representing 50% of the total of AIDS deaths.

The responsible agents for AIDS are Human Immunodeficiency Virus type 1 and type 2, that is HIV-1 and HIV-2. While the first type is the origin of the most frequent type of AIDS on a global scale, the second type is responsible for more regional cases, basically in Western Africa. One of the issues that differentiate the Portuguese case is the prevalence of infections by HIV-2. Cazein et al. (1996) mention the results of a study carried out in France, between 1989 and 1995, by the European Centre for the Epidemiological Monitoring of AIDS. 22 countries participated in the scheme whose aim was to determine the prevalence of infection by HIV-2 in European countries, comparing it with the infection by HIV-1. Despite the constraints associated with the gathering of the information, this study reveals that HIV-2 is less frequent in Europe, corresponding to only 1% of the total of infections by HIV. The exceptions are Spain, where the second highest figure for infections by HIV-2 was found (3.5% of all positive cases for HIV) and Portugal, where the highest figure was registered, representing 13% of all infected patients that sought sexually transmitted diseases (STD) counselling. In patients co-infected by HIV and tuberculosis, this percentage is higher (29% registered positive for HIV-2); among IDU's, the figure for HIV-2 infections was only 0.5%. Since HIV-2 is historically a typical virus of Western Africa (Ewold 1994), the higher prevalence of these infections in Portugal may be explained by the mobility of the population, specifically the return of ex-colonies' residents and the immigration from African countries.

As referred to by Gomes et al. (2003), in 2002, 45% of the people infected with HIV-2 lived in Lisbon, which is the main area for the immigrant population. From the total of cases notified infected with HIV-2 (342), 78.4% were aged between 25 and 54, which constitutes an older age group than the infection caused by HIV-1 (86.2% aged between 20 and 49). Gomes et al. (2003) suggest that the high age apex may reflect several aspects of the HIV-2 epidemiology, with an emphasis on low heterosexual transmission and low mortality. In other words, despite opportunistic infections and tumours, the HIV-2 infection being similar to the HIV-1 infection, AIDS patients infected with HIV-2 live, generally, longer when compared with AIDS patients infected with HIV-1. Maybe for some of these reasons, in the last ten years, a decrease has been observed: the number of AIDS cases motivated by HIV-2 was between 10% and 12% in the first years of the 90's, whereas in early 2001 this number was only 3.9% of the total number of AIDS cases.

In regard to the aforementioned relationship between HIV and tuberculosis, Portugal is an example of a strong link between these two diseases. Antunes and Antunes (1996) note that in 1994 tuberculosis was evident in 54% of diagnosed AIDS cases, a situation that seems more serious in more urban coastal districts, mainly in Lisbon and Oporto. In Lisbon, 15% of the total of TB cases (1256) were associated with HIV infection; of these, 82%

were among patients aged between 25 and 44 years old, of which 52% were IDU's, 24% homosexuals and 21% homo/bisexuals.

According to Isabel Portugal (2003), in the time period April 2000–December 2001, 9% of the 4164 cases of TB were HIV positive. One relevant fact is that HIV infected patients have an increased risk of acquiring anti-bacillary resistance.

Tuberculosis (TB)

In spite of the remarkable progress in prevention, assessment (screening) and treatment of tuberculosis, the number of cases increased after 1974, when all forecasts indicated the continuation of the decline (9% per year) registered since the late sixties. 1975 is the year for the inversion of this tendency. This is probably one of the consequences of the profound changes that occurred in the aftermath of the April 1974 Portuguese revolution, in particular the return of hundreds of thousands of people from the African ex-colonies, some of them coming from areas with a high prevalence of pulmonary tuberculosis. Immigrants started to concentrate in the metropolitan areas of Lisbon and Oporto, or in other costal sub-regions, worsening the pre-existing situation. Despite some positive structural aspects such as the high rate of vaccinal coverage, the remarkable progress in the country's healthcare coverage and the improvement in the standard of living (housing, nutrition, education, etc.), Portugal still registers worrying levels of pulmonary tuberculosis. In 1994, incidence of TB was the highest in Europe (51/100,000 in adults and 21/100,000 in younger than 15 years). The rate of new cases in 2002 was 39.5/100,000 inhabitants.

Antunes and Antunes (1996) state that in 1994, 75% of the 5619 notified cases in Portugal were among residents of the urban and coastal areas of Lisbon and Oporto, where 50% of the cases were concentrated. There was a higher incidence among male and young adults. These authors identify Oporto as the area having the worst epidemiological situation, mainly detected in poor communities based on fishing and industrial economies. Notwithstanding the decreasing tendency of the last decades, it is the more urbanised districts that present higher levels of incidence.

According to Paixão (2003), tuberculosis is the main opportunistic infection associated with AIDS cases, with relevance for drug addicts, in which over 60% of notified pathologies were TB. According to Portuguese health authorities, the percentage of TB cases linked with HIV infections in 2002 was 15% (669 cases). The groups with a higher concentration of cases were male, aged between 25 and 34.

The risk of dying in Portugal of HIV/AIDS and TB

Sources and methods

The study of HIV/AIDS and TB in mainland Portugal is based on disaggregated death records at the sub-region level (NUT III). These data are not available for higher detail scales on account of the confidentiality associated with this information. The number of deaths was analysed according to sex and age group[2] for a period of five years – 1994 to 1999. Because mortality varies according to age and sex we used an indirect standardised method that eliminates this variation. As a result we reached a value – standardised mortality rate (SMR) – that shows variations in the sub-regions (NUT's III) in relation to a reference value from mainland Portugal corresponding to one hundred.

To calculate the SMRs we followed three steps: 1) we established, for mainland Portugal, the death-rate for each age group, considered as reference rates or standard rates[3]; 2) we calculated the number of expected cases in each NUT III and in each age group[4]; and 3) we calculated the SMRs in groups of municipalities in mainland Portugal, by the relation between expected deaths and observed deaths[5].

Taking into account potential problems resulting from the influence of chance in the considered sample, we calculated a confidence interval (CI) of 95%, according to the method proposed by Jones and Moon (1987)[6].

The maps of SMR values are in accordance with the values for each rate and the limits of the corresponding CIs. The NUT's III were classified into four categories: 1) SMR value greater than 100, with the CI limits also above 100 (SMR significantly increased); 2) SMR value less than 100, as are the limits for the CI (SMR significantly decreased); 3) SMR value less than 100 but CI's include the value 100 (SMR decreased, but not significantly); and 4) SMR value greater than 100, but CI's include the value 100 (SMR increased, but not significantly).

After calculating the SMR's for HIV/AIDS and TB, we selected 18 variables that can be grouped in four categories: 1) variables connected to mortality (two); 2) variables connected to the age structure of the population (six); 3) variables connected to socio-economic structure (eight); and 4) morpho-functional variables (two) (see Table 1).

All information was obtained from Instituto Nacional de Estatística (Portuguese Institute for Statistics). The Institute worked on the mortality data specifically for this study.

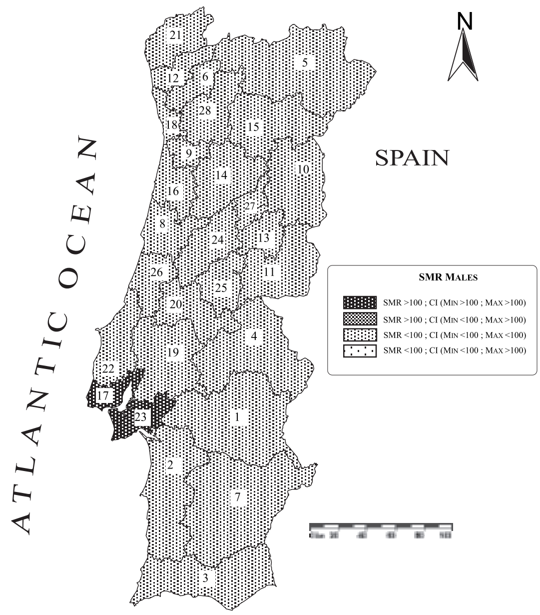

Fig. 1. SMR HIV-AIDS, males (all ages), 1994–1999. Subregions: 1 = Alentejo Central; 2 = Alentejo Litoral; 3 = Algarve; 4 = Alto Alentejo; 5 = Alto Trás-os-Montes; 6 = Ave; 7 = Baixo Alentejo; 8 = Baixo Mondego; 9 = Baixo Vouga; 10 = Beira Interior Norte; 11 = Beira Interior Sul; 12 = Cávado; 13 = Cova da Beira; 14 = Dão-Lafões; 15 = Douro; 16 = Entre Douro e Vouga; 17 = Grande Lisboa (Greater Lisbon); 18 = Grande Porto (Greater Oporto); 19 = Lezíria do Tejo; 20 = Médio Tejo; 21 = Minho-Lima; 22 = Oeste; 23 = Península de Setúbal; 24 = Pinhal Interior Norte; 25 = Pinhal Interior Sul; 26 = Pinhal Litoral; 27 = Serra da Estrela; 28 = Tâmega.

Results

HIV/AIDS SMR spatial distribution

Following the pattern in the rest of the EU, AIDS deaths in Portugal affect predominantly male individuals. Between 1994 and 1999, 3739 and 752 deaths by HIV/AIDS were reported in the male and female population, respectively.

By age group, in both sexes, the 25–34 age group has the most deaths, followed by the 35–44 age group. In some geographical areas HIV/AIDS constitutes one of the main causes of death in these age groups. This fact is more relevant in the metropolitan area of Lisbon where 42% (male) and 28% (female) of reported deaths between 1994 and 1999 in the 25 and 34 age group were caused by HIV/AIDS.

The geographical distribution of AIDS SMR is high in the metropolitan areas. In Greater Lisbon (Grande Lisboa), for example, almost three times more deaths occur than the reference value for mainland Portugal (299.4 vs. 100), followed by the Península de Setúbal (172.1). All other regions of mainland Portugal present values significantly lower than the standard value for mainland Portugal (Fig. 1).

The pattern for women is similar to that for men (Fig. 2). Greater Lisbon (300.5) and the Península de Setúbal (177.1) are risk areas also for women, the first being a sub-region where female mortality was three times greater than the reference value for mainland Portugal. Although there are a smaller number of deaths for women, the deaths have a greater geographical dispersion when compared to men. In addition to the metropolitan area of Lisbon (Greater Lisbon) and the Península de Setúbal, the female population is registering AIDS deaths in the interior, chiefly along the main routes to Spain (Fig. 2).

Geographical distribution for TB

From the joint analysis of the five year investigation period we can notice that the number of deaths

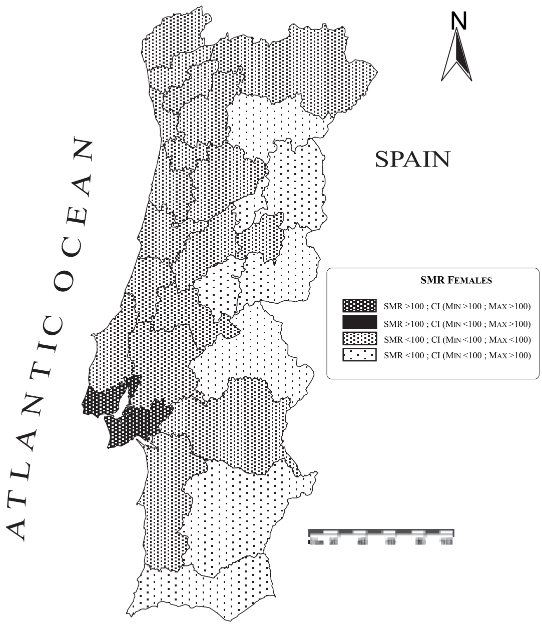

Fig. 2. SMR HIV-AIDS, females (all ages), 1994–1999.

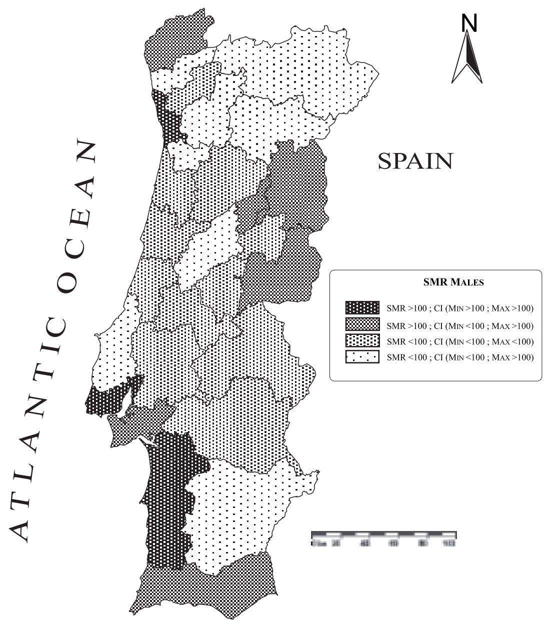

Fig. 3. SMR tuberculosis, males (all ages), 1994–1998.

caused by TB is four times higher for males than for females (1509 and 466 deaths between 1994 and 1999, respectively for males and females). Deaths are more frequent after 55 years of age.

The geographical distribution for this cause of death, in a joint analysis for both sexes, shows Greater Lisbon (Grande Lisboa) as having 1.5 times higher figure than the standard for mainland Portugal.

When considering men, the highest and statistically most significant SMR, occurred in the regions of Greater Lisbon (163.5), Alentejo Litoral (146.7) and Greater Oporto (Grande Porto) (119.4). We should point out that there are other values observed which are slightly higher than the standard value in other coastal urban areas, but which are not statistically significant (Fig. 3).

The analysis for the reported female deaths shows that Greater Lisbon has a significantly higher SMR (107.8). Other areas have a higher value than the mainland, but the differences are not significant statistically, which means that there is not such a strong concentration for females as there is for males (Fig. 4).

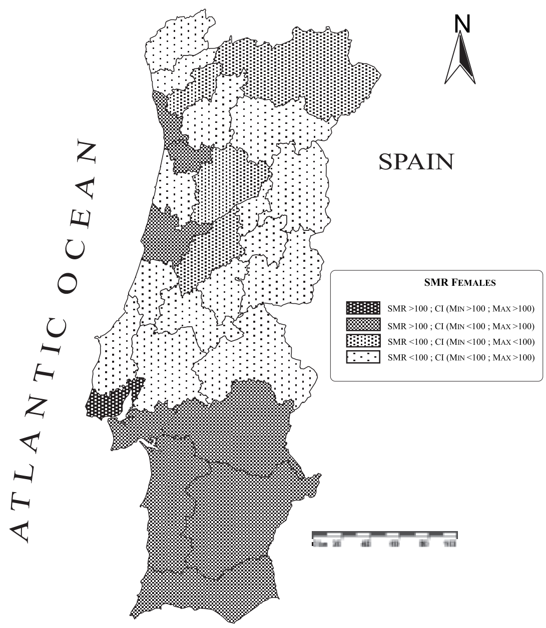

Fig. 4. SMR tuberculosis, females (all ages), 1994–1998.

Cluster and main principal component analysis for males

For the analysis of the main components we took four non-rotated factors, taking into account that the percentage of the variance explained by each one of them must not be lower than the percentage of the variance theoretically explained by each of the 18 initial variables, i.e. 5.6% (Table 1).

We can see that the four factors have almost 86% of the variance in the initial matrix (Table 2). The value for the factor loadings and factor scores are presented in Tables 3 and 4, respectively.

The first factor has about 47% of the variance in the initial matrix, which means that it explains 47% of the total information comprised in the 18 variables initially used. This is the factorial axis of higher explanatory capacity, putting in evidence the structure that most clearly differentiates the sub-regions in mainland Portugal and therefore, it is stressed in the analysis. Attending to the marked set of variables, this factor can be expressed as the Urbanity/Rurality factor (see Tables 3 and 4).

The factor is defined, positively, by a set of variables that differentiate it, highlighting the following: the majority of the resident population being young/adult and adult (aged between 35 and 54 years), predominantly urban, with high purchasing power, mostly in non-manual professions (with an emphasis on professionals, employers and managers) and where AIDS and TB standardised mortality rates are high, specially AIDS SMR. At the other extreme, we show rural areas with aged resident populations, involved in an activity that is predominantly agricultural, with high rates of illiteracy.

After analysing the factor scores we can see that there is a geographical opposition between urban and rural areas. So, areas with positive factor scores include the metropolitan areas of Greater Lisbon and Greater Oporto, and the Península de Setúbal with the highest AIDS and TB SMR's in the country. Further areas with positive factor scores, although with less expression, are the coastal urban areas. Regions with strong negative factor scores include the interior rural areas in the north and centre of Portugal, where the lowest values for AIDS and TB SMR were recorded. The other three factors have less explanatory value, showing only very subtle differences between the sub-regions, and therefore, will not be examined.

After characterizing the first factor extracted, we established a hierarchical ascending classification, in order to identify similar identity geographical groups ("clusters"), which give rise to Fig. 5. The classification suggests the formation of four geographical groups, in which some sub-groups stand out. The first geographical set (Recent Industrial) is composed of sub-regions in the industrialised north of Portugal. These areas have young industrial population who have shown low values for TB SMR, and especially for AIDS SMR. The second group (Rural) is formed of rural areas mostly in the northern and central parts of Portugal. The highly rural population has low purchasing power, high illiteracy and works manually predominantly in agriculture. They do not show any risk of dying of HIV/AIDS, but show some probability of dying of TB. The third group (Transition Rural/Urban) includes urban population with medium purchasing power, medium and high educational level, working in non-manual professions. The fourth group (Urban) is composed of urban areas, with a special emphasis on Greater Lisbon, with high purchasing power, high educational level, working in non-manual professions. The highest value for AIDS and TB SMR was registered here. Previously, we saw that HIV/AIDS and TB SMR's were influenced by the Urbanity/Rurality factor (increasing proportionally). The most positive factor scores are the metropolitan areas of Lisbon and Oporto.

Cluster and main principal component analysis for females

Following the same approach taken with the analysis of males (Table 5 presents the 18 initial variables), we can see that the three factors sum up to almost 83% of the variance in the initial matrix (Table 6). The values for the factor loadings and factor scores are presented in Tables 7 and 8, respectively. The first factor explains almost 48% of the total information comprised in the 18 variables initially used, and is the factorial axis of higher explanatory capacity. Similar to what was observed for men, the first factor is defined negatively, by a set of variables that differentiate population ar-

Table 1. Variables used in principal component analysis (males). Source: INE 1996, 1997, 1998; INE 1997.

Code	Subregion	% APR[a]	% APU[b]	PPI[c]	Tx. Anal[d]	Emd/ sp[e]	G 1/2[f]	G 3/4/5[g]	G 6[h]	G 7/8[i]	G 9[j]	%P 0–24[k]	%P 25–34[l]	%P 35–44[m]	%P 45–54[n]	%P 65–74[o]	%P >=75[p]	AIDS SMR[q]	TB SMR[r]
1	Alentejo Central	36.00	51.00	75.02	16.29	5.21	6.97	23.01	10.17	38.85	19.10	30.68	14.12	13.07	10.93	11.80	6.99	38.82	44.23
2	Alentejo Litoral	34.00	53.00	69.17	20.59	3.42	4.88	19.76	16.32	38.35	20.07	30.49	12.40	14.35	12.45	11.28	6.16	28.11	146.70
3	Algarve	17.00	71.00	106.47	12.83	5.21	8.94	28.45	15.36	34.62	11.85	31.74	13.71	13.85	12.94	10.17	6.23	82.62	120.18
4	Alto Alentejo	43.00	38.00	65.31	17.22	4.31	6.15	25.58	11.60	34.47	20.49	30.07	13.63	12.85	10.82	12.45	8.31	41.76	58.41
5	Alto Trás-os-Montes	69.00	18.00	54.82	14.34	4.12	6.93	17.58	39.31	22.83	12.57	34.41	14.40	11.94	10.47	10.90	6.38	15.32	82.39
6	Ave	4.00	72.00	62.40	6.15	3.70	7.50	18.70	4.25	56.73	12.20	40.09	18.12	14.70	10.74	5.75	2.69	13.17	70.66
7	Baixo Alentejo	4.00	34.00	61.01	19.85	3.38	8.33	21.32	28.52	29.69	11.51	30.66	14.41	13.18	10.70	11.82	7.12	27.65	96.97
8	Baixo Mondego	17.00	64.00	85.74	6.02	10.65	8.95	26.41	11.27	36.19	15.92	32.32	15.52	14.06	12.64	9.39	4.76	20.69	62.24
9	Baixo Vouga	7.00	75.00	75.46	5.01	6.49	5.21	21.71	15.03	34.57	22.17	35.95	16.09	14.08	11.93	7.91	4.05	30.94	57.09
10	Beira Interior Norte	63.00	16.00	60.57	14.42	4.62	11.87	27.08	9.73	37.53	12.24	30.81	13.53	12.43	10.34	12.11	9.66	24.18	101.51
11	Beira Interior Sul	49.00	33.00	71.43	17.14	5.72	9.26	21.03	9.98	48.35	10.36	27.81	12.86	12.43	11.51	13.58	10.38	47.26	129.72
12	Cávado	3.00	61.00	71.21	5.39	5.89	9.77	21.13	8.56	49.19	10.48	41.74	17.65	13.96	10.50	5.81	2.75	16.67	84.09
13	Cova da Beira	48.00	40.00	67.00	13.64	5.01	8.49	22.87	11.54	40.51	15.94	32.54	14.34	14.27	11.60	10.43	6.27	22.81	47.64
14	Dão-Lafões	44.00	28.00	59.98	9.18	4.61	7.73	19.85	23.37	36.38	11.75	36.71	14.51	11.89	11.20	9.48	5.66	27.95	17.94
15	Douro	45.00	22.00	50.87	11.91	4.38	6.38	18.50	24.44	26.57	22.89	36.91	16.47	12.46	9.77	9.47	5.15	16.82	99.16
16	Entre Douro e Vouga	6.00	69.00	69.96	5.05	4.03	9.26	17.57	4.43	62.48	5.72	37.56	17.49	14.84	11.38	6.51	3.50	20.74	79.81
17	Grande Lisboa (Greater Lisbon)	0.00	99.00	185.63	3.02	16.87	17.07	38.06	0.83	31.52	9.96	32.73	15.32	13.92	14.30	8.19	3.84	299.43	163.54
18	Grande Porto (Greater Oporto)	0.00	98.00	131.18	3.04	11.06	13.16	31.83	2.86	42.92	8.28	35.65	17.07	15.19	13.13	6.63	2.94	89.25	119.36
19	Lezíria do Tejo	31.00	49.00	72.14	11.67	4.61	6.77	20.93	10.84	40.85	18.89	31.38	14.81	13.36	12.71	10.32	5.51	48.46	56.95
20	Médio Tejo	36.00	44.00	72.25	8.22	5.37	7.73	22.07	6.00	45.71	14.85	31.79	15.07	13.43	11.07	10.79	6.45	36.58	38.76
21	Minho-Lima	25.00	25.00	58.04	7.56	4.30	8.18	19.24	19.46	43.16	9.05	37.12	14.61	12.85	10.27	9.39	5.94	18.02	107.24
22	Oeste	16.00	52.00	73.39	11.78	3.76	6.92	18.39	17.91	41.21	14.23	33.02	15.01	13.71	12.33	9.64	4.85	54.58	77.03
23	Península de Setúbal	2.00	95.00	111.26	5.29	8.31	9.01	31.10	3.51	41.59	10.61	34.11	14.43	14.37	14.80	7.62	3.26	172.14	105.72
24	Pinhal Interior Norte	51.00	15.00	54.05	10.28	2.68	6.56	18.37	13.32	45.23	15.73	32.16	14.15	12.43	10.60	11.04	8.29	22.13	78.03
25	Pinhal Interior Sul	65.00	10.00	46.27	15.57	2.23	4.15	14.51	25.71	37.48	16.89	28.41	14.51	12.52	9.23	14.29	9.54	11.49	28.00
26	Pinhal Litoral	21.00	63.00	83.01	7.91	4.42	8.66	19.70	8.23	49.33	12.86	34.66	15.53	14.02	12.16	8.58	4.07	24.65	30.10
27	Serra da Estrela	51.00	12.00	52.70	11.08	3.95	7.51	17.82	14.86	42.74	16.28	32.86	14.23	12.64	11.02	10.58	7.61	15.80	112.70
28	Tâmega	9.00	40.00	47.15	8.62	2.22	5.53	14.07	10.42	58.99	10.24	42.15	18.49	13.82	9.19	5.91	3.01	19.97	86.31
	Mean	28.43	48.11	74.77	10.68	5.38	8.14	22.02	13.49	41.00	14.04	33.80	15.09	13.45	11.45	9.71	5.76	46.00	82.23
	St.Deviation	21.83	26.04	29.02	5.01	3.07	2.62	5.41	8.70	9.10	4.38	3.68	1.55	0.90	1.36	2.30	2.19	59.45	36.30
	CV	76.78	54.13	38.82	46.88	57.07	32.18	24.56	64.49	22.20	31.21	10.90	10.24	6.72	11.89	23.73	37.96	129.23	44.15

Notes:
Morpho-functional variables (two): [a]percentage of the population living in predominantly rural areas; [b]percentage of the population living in predominantly urban areas.
Variables connected to socio-economic structure (eight): [c]"per capita" purchasing power indicator (PPI); [d]percentage of male/female population aged 10 and over that can't read and write (illiteracy rate); [e]percentage of male/female population aged 15 and over that graduated from or studies at intermediate or higher education level; [f]percentage of the male/female population in non-manual professional groups – high status; [g]percentage of the male/female population in non-manual professional groups – medium and non qualified commerce and services; [h]percentage of the male/female population working in agriculture; [i]percentage of the male/female population in manual professional groups; [j]percentage of the population in manual and non-qualified professional groups.
Variables connected to the age structure of the population (six): [k]percentage of the population, male/female, in the age groups 0–24; [l]percentage of the population, male/female, in the age groups 25–34; [m]percentage of the population, male/female, in the age groups 35–44; [n]percentage of the population, male/female, in the age groups 45–54; [o]percentage of the population, male/female, in the age groups 65–74; [p]percentage of the population, male/female, in the age groups >=75.
Variables connected to mortality (two): [q]AIDS SMR; [r] TB SMR.

Table 2. Eigenvalues (males).

Factor	Eigenvalue	% total variance	Cumulative %
1	8.4	46.6	46.6
2	4.4	24.6	71.2
3	1.4	7.5	78.7
4	1.3	7.0	85.7

eas that are illiterate, predominantly rural, aged, and involved in agricultural activities, with a low probability of dying of HIV/AIDS. In the opposite extreme, the factor distinguishes variables that show resident population areas that are urban, consisting of young adults (aged between 25 and 54 years) with high purchasing power, high level of education and where SMR's for AIDS and TB are high. This pattern seems to demonstrate the Urbanity/Rurality opposition.

After analysing the factor scores we can see that there is a geographical opposition, with more developed coastal areas (higher purchasing power, younger population, higher level of education, non-manual activities) presenting higher SMR's for AIDS and TB. This association emerges mainly in sub-regions with stronger positive factor scores, such as the metropolitan areas of Lisbon and Oporto. Besides these, there are other coastal urban areas that also present high SMR's for TB (but not for AIDS). All rural areas, especially in the north and centre of Portugal occupy the opposite position. We are only taking this factor into account because of its explanatory capacity, in contrast to the other two.

After characterizing the three factors, we create a hierarchical ascending classification, in order to identify similar identity geographical groups ("clusters") (Fig. 6). The classification suggests the formation of four geographical groups, in which some sub-groups are formed. The first spatial set (Recent Industrial) is made up of spread out industrial implantation areas in the north of Portugal, characterized by with young persons in manual jobs associated with industry. It was established that these areas did not present SMR's for HIV/AIDS and TB

Table 3. Factor loadings (males).

Variable	Factor 1	Factor 2	Factor 3	Factor 4
% APR	–0.83	0.26	–0.16	0.03
% APU	0.92	0.06	0.30	–0.11
PPI	0.83	0.52	0.02	0.06
Tx.Anal	–0.77	0.35	0.06	–0.19
Emd/sp	0.76	0.49	0.00	0.21
G 1/2	0.70	0.41	–0.47	0.08
G 3/4/5	0.67	0.66	0.02	0.04
G 6	–0.71	0.03	0.02	0.58
G 7/8	0.28	–0.65	–0.27	–0.63
G 9	–0.48	0.15	0.73	0.08
%P 0–24	0.40	–0.80	–0.13	0.35
%P 25–34	0.50	–0.77	–0.03	0.21
%P 35–44	0.76	–0.24	0.31	–0.34
%P 45–54	0.69	0.50	0.29	–0.14
%P 65–74	–0.75	0.61	–0.01	–0.18
%P >=75	–0.77	0.51	–0.24	–0.24
AIDSSMR	0.69	0.58	–0.06	0.12
TBSMR	0.37	0.41	–0.37	0.06

Table 4. Factor scores (males).

Code	Subregion	Factor 1	Factor 2	Factor 3	Factor 4
1	Alentejo Central	–0.53	0.48	0.96	–0.66
2	Alentejo Litoral	–0.54	0.72	1.33	–1.10
3	Algarve	0.43	1.01	0.13	–0.15
4	Alto Alentejo	–0.84	0.80	0.93	–0.53
5	Alto Trás-os-Montes	–1.23	0.25	–0.60	2.56
6	Ave	0.81	–1.91	0.14	–0.57
7	Baixo Alentejo	–0.67	0.48	–0.29	0.57
8	Baixo Mondego	0.59	0.29	1.03	0.31
9	Baixo Vouga	0.36	–0.54	2.35	0.86
10	Beira Interior Norte	–0.72	1.00	–1.86	–0.45
11	Beira Interior Sul	–0.69	1.22	–1.78	–1.71
12	Cávado	0.87	–1.51	–0.65	0.64
13	Cova da Beira	–0.28	0.15	0.55	–0.71
14	Dão-Lafões	–0.57	–0.32	–0.38	1.34
15	Douro	–0.79	–0.39	0.68	2.29
16	Entre Douro e Vouga	0.94	–1.62	–1.00	–1.32
17	Grande Lisboa	2.67	2.38	–0.93	1.28
18	Grande Porto	2.05	0.21	–0.33	0.11
19	Lezíria do Tejo	–0.17	0.17	1.23	–0.51
20	Médio Tejo	–0.14	–0.08	0.20	–0.88
21	Minho-Lima	–0.25	–0.50	–1.48	0.66
22	Oeste	–0.03	–0.16	0.62	–0.10
23	Península de Setúbal	1.60	0.73	0.67	–0.36
24	Pinhal Interior Norte	–0.90	–0.03	–0.60	–0.51
25	Pinhal Interior Sul	–1.78	0.12	0.14	–0.21
26	Pinhal Litoral	0.38	–0.65	0.51	–0.77
27	Serra da Estrela	–0.77	0.07	–0.72	–0.12
28	Tâmega	0.22	–2.37	–0.85	0.04

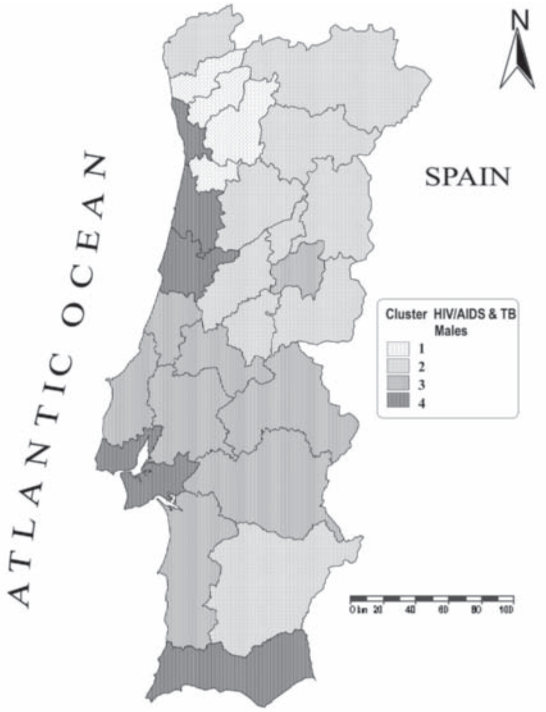

Fig. 5. Hierarchical ascending classification. Clusters, males. The four geographical categories are: 1) Recent Industrial (composed of sub-regions in the industrialised north of Portugal); 2) Rural (formed of rural areas mostly in the northern and central parts of Portugal); 3) Transition Rural/Urban; 4) Urban (composed of urban areas, with a special emphasis on Greater Lisbon).

that can make us regard them as risk areas. The second group (Rural) is formed by rural areas, mostly in the north and centre of Portugal. They are rural areas with low purchasing power, high illiteracy, high numbers of manual workers predominantly in agriculture and aged populations. They are not considered to be risk areas for TB nor HIV/AIDS, although some of them have figures that deserve some attention, especially in interior rural areas, near the Spanish border. The third group (Transition Rural/Urban) is composed of transition areas. It is a wide group of heterogeneous sub-regions. However, one of the common qualities is the low AIDS SMR, although with a tendency to increase in the south (Algarve). In some areas, especially in the south of Portugal, TB SMRs have higher values, exceeding the standard value. Finally, the last group (Urban) is composed of the metropolitan areas of Lisbon and Oporto. These sub-regions can be identified as highly urbanised, with populations with high purchasing power and high levels of education. A high percentage of the population is in the non-manual professions groups, where white-collar workers, professionals and managers are predominant. In these areas we registered the highest figures for HIV/AIDS and TB SMR's. Greater Lisbon stands out as a region where HIV/AIDS SMR is three times higher than the standard value for mainland Portugal. It is therefore a risk area for this disease.

Discussion of results and conclusions

In 2001, Portugal had the highest rate of incidence of AIDS and TB cases in the EU, which is, undoubtedly, worrying. Equally worrying is the fact that the development in the number of diagnosed cases does not follow the Western European pattern, of a decrease in the period between 1992 and 1997. That is, in the beginning of the 21st century, the tendency for a decline observed in the EU is not seen in Portugal. Regarding the number of people infected with HIV, Portugal has 17,858 diagnosed cases, and evidence makes us to believe that this figure is considerably underestimated. Tuberculosis seems to be associated with HIV/AIDS, as is shown in the literature.

The set of factors we studied in this paper (four for men and three for women), explained about 82% and 78% of HIV/AIDS SMR variance, respectively, for men and women[7]. The first factor (Urbanity/Rurality) explains 47% for males and 32% for females, of HIV/AIDS SMR. These same factors have lower explanatory capacity when considering TB, registering 14% and 32% in males and females[8]. This implies that the connection between HIV/AIDS and social, economic and demographic characteristics is stronger, presenting a more significant geographical concentration than TB. Factorial and cluster analyses show that there is a positive association between high educational levels, non-manual jobs and significantly high values for AIDS and tuberculosis SMR's among the resident

Table 5. Variables used in principal component analysis (females). See notes of Table 1 for an explanation about the variables.

Code	Subregion	% APR[a]	% APU[b]	PPI[c]	Tx. Anal[d]	Emd/ sp[e]	G 1/2[f]	G 3/4/5[g]	G 6[h]	G 7/8[i]	G 9[j]	%P 0–24[k]	%P 25–34[l]	%P 35–44[m]	%P 45–54[n]	%P 65–74[o]	%P >=75[p]	AIDS SMR[q]	TB SMR[r]
1	Alentejo Central	36.00	51.00	75.02	22.29	5.90	8.11	38.99	3.70	11.89	37.17	27.74	12.66	12.19	11.42	13.19	9.30	24.72	116.09
2	Alentejo Litoral	34.00	53.00	69.17	27.71	4.19	6.79	45.72	7.17	5.26	34.91	29.01	11.77	13.63	11.81	12.23	8.34	14.95	128.71
3	Algarve	17.00	71.00	106.47	15.58	5.75	8.48	56.01	4.38	5.05	26.02	29.52	13.03	13.35	12.22	11.40	8.70	70.81	122.19
4	Alto Alentejo	43.00	38.00	65.31	25.57	4.88	7.32	42.78	4.82	9.14	35.76	26.59	12.35	12.02	10.91	13.87	11.15	33.59	94.04
5	Alto Trás-os-Montes	69.00	18.00	54.82	21.96	5.77	7.12	34.20	27.74	3.26	27.47	31.32	12.12	11.57	11.18	12.56	8.77	12.44	30.87
6	Ave	4.00	72.00	62.40	12.56	4.44	4.27	19.93	3.06	55.68	16.96	36.88	17.45	14.52	10.88	7.10	4.37	17.01	38.86
7	Baixo Alentejo	4.00	34.00	61.01	26.65	4.92	6.45	33.32	22.12	14.67	23.28	28.33	12.57	11.67	10.62	13.30	10.58	53.22	118.05
8	Baixo Mondego	17.00	64.00	85.74	15.85	10.54	8.54	38.84	6.97	19.89	25.67	28.57	14.37	13.58	12.76	11.06	7.64	19.18	108.11
9	Baixo Vouga	7.00	75.00	75.46	12.50	6.85	8.68	49.84	3.13	5.52	32.74	32.42	15.26	13.84	11.97	9.43	6.38	13.84	57.16
10	Beira Interior Norte	63.00	16.00	60.57	21.28	6.47	12.56	36.90	14.35	10.61	25.28	27.37	12.16	11.30	10.40	13.76	12.90	36.38	76.60
11	Beira Interior Sul	49.00	33.00	71.43	27.61	6.41	7.15	32.04	14.76	22.82	23.13	24.29	11.76	11.46	10.71	15.12	13.68	72.29	85.52
12	Cávado	3.00	61.00	71.21	13.13	6.68	6.95	23.28	9.59	37.37	22.61	38.36	17.05	13.82	10.34	7.25	4.75	22.44	56.46
13	Cova da Beira	48.00	40.00	67.00	23.39	5.39	6.11	29.14	5.53	38.22	20.93	28.28	12.90	12.86	11.70	12.58	9.67	14.51	71.62
14	Dão-Lafões	44.00	28.00	59.98	19.77	5.46	6.38	27.30	31.18	10.40	24.58	32.24	12.98	11.99	11.54	11.13	8.54	9.79	6.28
15	Douro	45.00	22.00	50.87	18.86	5.53	6.71	33.69	17.75	5.46	36.06	33.14	14.04	11.73	10.25	11.56	8.29	52.42	73.21
16	Entre Douro e Vouga	6.00	69.00	69.96	12.18	4.85	4.91	22.83	7.31	49.74	15.11	34.41	16.83	14.46	11.62	7.70	5.36	36.26	104.40
17	Grande Lisboa (Greater Lisbon)	0.00	99.00	185.63	7.55	14.05	14.33	54.49	0.44	7.38	23.12	28.46	14.28	13.79	14.46	10.14	6.81	300.48	170.75
18	Grande Porto (Greater Oporto)	0.00	98.00	131.18	8.43	10.39	10.98	39.63	1.39	28.42	19.38	31.62	16.12	15.13	13.02	8.59	5.44	80.00	105.47
19	Lezíria do Tejo	31.00	49.00	72.14	20.74	5.15	6.77	36.35	7.36	9.78	39.55	28.27	13.50	12.75	12.43	12.04	8.31	33.83	73.43
20	Médio Tejo	36.00	44.00	72.25	18.32	6.12	9.54	41.95	6.57	13.82	27.92	27.93	13.40	12.46	11.49	12.50	9.77	30.10	51.95
21	Minho-Lima	25.00	25.00	58.04	19.09	4.76	5.15	23.84	36.68	13.69	20.53	30.93	13.78	12.30	11.16	11.33	8.93	20.52	69.93
22	Oeste	16.00	52.00	73.39	16.36	4.49	6.71	38.11	8.33	17.42	29.31	30.44	14.18	13.35	12.32	11.04	6.90	56.06	98.33
23	Península de Setúbal	2.00	95.00	111.26	10.66	7.99	9.31	54.36	1.60	13.13	21.42	31.09	14.04	14.93	14.63	8.90	5.03	177.10	115.62
24	Pinhal Interior Norte	51.00	15.00	54.05	22.51	3.13	4.62	27.73	14.87	20.97	31.74	27.75	12.22	11.33	10.49	13.50	12.27	10.24	32.34
25	Pinhal Interior Sul	65.00	10.00	46.27	32.95	2.99	4.55	27.66	33.95	6.85	26.55	24.98	11.22	9.95	9.65	17.02	13.17	32.08	0.00
26	Pinhal Litoral	21.00	63.00	83.01	18.11	5.62	7.38	39.51	7.17	18.13	27.68	31.73	14.99	13.84	12.29	9.77	5.96	33.16	61.47
27	Serra da Estrela	51.00	12.00	52.70	20.07	5.08	6.48	28.45	9.88	28.17	26.92	28.96	11.99	11.95	11.32	12.06	11.55	80.20	92.23
28	Tâmega	9.00	40.00	47.15	15.72	3.09	3.51	19.43	13.57	42.88	20.43	39.55	17.52	13.31	9.49	7.10	4.67	9.19	56.83
	Mean	28.43	48.11	74.77	18.84	5.96	7.35	35.58	11.62	18.77	26.51	30.36	13.81	12.82	11.54	11.33	8.47	48.81	79.16
	St.Deviation	21.83	26.04	29.02	6.16	2.37	2.42	10.28	10.12	14.31	6.28	3.66	1.83	1.26	1.22	2.47	2.73	60.23	38.66
	CV	76.78	54.13	38.82	32.70	39.80	32.98	28.90	87.07	76.21	23.71	12.04	13.23	9.84	10.60	21.77	32.20	123.38	48.84

Table 6. Eigenvalues (females).

Factor	Eigenvalue	% total variance	Cumulative %
1	8.56	47.6	47.6
2	5.09	28.3	75.9
3	1.28	7.1	83.0

Table 7. Factor loadings (females).

Variable	Factor 1	Factor 2	Factor 3
% APR	–0.85	0.24	0.06
% APU	0.95	0.09	–0.11
PPI	0.79	0.52	0.20
Tx.Anal	–0.90	0.18	–0.06
Emd/sp	0.69	0.50	0.31
G 1/2	0.48	0.72	0.15
G 3/4/5	0.41	0.79	–0.32
G 6	–0.69	–0.18	0.36
G 7/8	0.27	–0.76	0.27
G 9	–0.37	0.44	–0.74
%P 0–24	0.44	–0.80	–0.11
%P 25–34	0.69	–0.68	–0.03
%P 35–44	0.92	–0.23	–0.18
%P 45–54	0.74	0.50	–0.03
%P 65–74	–0.78	0.58	0.08
%P >=75	–0.80	0.47	0.22
AIDSSMR	0.57	0.55	0.39
TBSMR	0.57	0.51	–0.02

Table 8. Factor scores (females).

Code	Subregion	Factor 1	Factor 2	Factor 3
1	Alentejo Central	–0.28	0.75	–1.25
2	Alentejo Litoral	–0.25	0.67	–1.86
3	Algarve	0.58	0.90	–0.67
4	Alto Alentejo	–0.69	0.81	–1.13
5	Alto Trás-os-Montes	–0.99	0.07	0.23
6	Ave	0.84	–2.24	0.21
7	Baixo Alentejo	–0.58	0.18	0.70
8	Baixo Mondego	0.65	0.39	0.11
9	Baixo Vouga	0.72	0.05	–1.83
10	Beira Interior Norte	–0.85	0.87	1.00
11	Beira Interior Sul	–0.95	0.73	1.49
12	Cávado	0.76	–1.65	0.06
13	Cova da Beira	–0.37	–0.23	0.66
14	Dão-Lafões	–0.70	–0.49	0.60
15	Douro	–0.59	–0.10	–0.84
16	Entre Douro e Vouga	0.92	–1.62	0.68
17	Grande Lisboa	2.32	2.26	1.93
18	Grande Porto	1.81	0.11	0.71
19	Lezíria do Tejo	–0.20	0.41	–1.62
20	Médio Tejo	–0.19	0.46	–0.22
21	Minho-Lima	–0.58	–0.64	1.15
22	Oeste	0.28	–0.03	–0.80
23	Península de Setúbal	1.71	0.78	0.01
24	Pinhal Interior Norte	–1.26	–0.14	–0.15
25	Pinhal Interior Sul	–2.16	0.24	1.07
26	Pinhal Litoral	0.48	–0.25	–0.84
27	Serra da Estrela	–0.66	0.11	0.67
28	Tâmega	0.23	–2.39	–0.08

population in metropolitan areas, especially in Lisbon. These are areas with high purchasing power, where young and adult populations live (aged between 25 and 54 years).

Geographical distribution for HIV/AIDS varies with gender. That is, for men, death is almost entirely concentrated in highly urbanised coastal areas, specifically in the metropolitan areas of Lisbon and Oporto. For women, we can observe some dispersion, which becomes a problem given the characteristics of the spreading of this type of disease. The increase in the number of hetero-

Fig. 6. Hierarchical ascending classification. Clusters, females (geographical categories as in males).

sexuals infected might produce an increase in the number of registered cases in the interior of Portugal, chiefly in women.

Lack of prevention and low investment in preventive health schemes may pay their highest toll here. If the disease's existing tendency is maintained, we can predict that Portugal will be confronted, in the short and medium term, with an unavoidable increase in mortality, a considerable increase in the number of years lost (taking into account the most affected age groups), a decrease in productivity (caused by the incapacity of the diseased population) and a significant increase in health expenditure, not only because of the increase in the number of patients, but also because of the high number of days HIV patients in Portugal spend in hospital. Not surprisingly, Portugal is the EU country that registers the highest number of days of hospitalisation per year for AIDS patients – 20.7, according to OECD (2000).

We saw that these diseases are concentrated in some urban and suburban areas. However, if we had data on smaller areas, this concentration would probably be still more visible. But the use of small areas could lead to another problem, connected with the stability of the SMRs. Some authors who have studied the agglomeration effects, mainly of HIV/AIDS (Gould 1993; Wood et al. 2000), have concluded that when the disease is detected there might be some migration to areas where the health care may be better or more accessible in geographic and organizational terms. This might partially explain the high level of concentration for both causes of death in coastal areas, especially in Lisbon and Oporto. We have, however, no knowledge of any geographic mobility studies that might test this assumption in the case of Portugal, as was carried out in Canada by Wood et al. (2000).

Taking all these issues into account, the main characteristics and dynamics for the disease emphasize the need, fundamentally, for preventive policies, directed above all to groups/areas of higher risk and vulnerability:

- People aged between 25 and 44 years
- Drug addicts of both sexes
- Heterosexuals
- Metropolitan areas of Lisbon, Oporto and Península de Setúbal
- Poverty and delinquency sources
- Immigrants from high risk areas (African and Eastern European countries)

Preventive policies should aim at a change in risk behaviour and allow for the access to screening and treatment of these diseases in a timely manner and as close as possible to the patient's home. The success of preventive policies depends, essentially, on the involvement and participation of different organizations and social groups which include family, community, health services, schools, cultural organizations, etc.

An increase in AIDS screening, especially in rural areas of the interior, might help to prevent the spreading of the disease. Treatment would profit from the closeness to the family environment, which can diminish the effects of loss of sociability, feelings of stigmatisation as well as decrease the concentration of patients in big cities.

The magnitude of the disease in Portugal and the high number of days of hospitalisation also demonstrate that there is a lack of organizations providing assistance to AIDS patients, a deficiency that should be addressed urgently. It is necessary to choose care over cure, with foreseeable consequences for a better cost/benefit ratio.

Finally, attention should be paid to the urgent improvement in the quality of the data. Only with systematic gathering of reliable information can we improve knowledge of the disease and hence, guide subsequent activities at different levels of intervention: prevention, care and treatment of the disease.

NOTES

[1] The data that have been published about this subject differ, according to the sources. The Centro de Vigilância Epidemiológica das Doenças Transmissíveis (Centre for Epidemiologic Vigilance of Transmissible Diseases) refers that between January 1st 1983 and September 18th 2002, 9558 cases of AIDS were reported, 1893 cases with complexes related to AIDS and 9475 cases of non-symptomatic carriers, which amounts to 20,926 infected individuals. In 2000 UNAIDS/WHO already reported the double of that figure of AIDS cases in Portugal.

[2] Seven age groups were considered: 0–24; 25–34; 35–44; 45–54; 55–64; 65–74; >= 75.

[3]

$$\text{Reference Rates} = \frac{\text{total of observed cases in mainland Portugal, during the considered period by age group}}{\text{number of inhabitants in mainland Portugal (estimates from 1996) per age group}}$$

[4] Expected cases = Reference rate * number of people in each NUT III, per age group. It is the number of expected deaths if the reference rates in each age group were applied to the population in each NUT.

[5]

$$\text{SMR} = \frac{\text{number of cases observed in each NUT III}}{\text{total of expected cases in each NUT III}} * 100$$

[6]

$$\text{CI} = \frac{\text{observed cases} - 2\sqrt{\text{expected cases}}}{\text{expected cases}} * 100$$

$$\text{to} \quad \frac{\text{observed cases} + 2\sqrt{\text{expected cases}}}{\text{expected cases}} * 100$$

[7] These percentages are given by communalities. The communality of a variable is the proportion of variance explained by the factors that were extracted and used in the analysis.

[8] Again, these proportions are given by communalities.

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