

Diabetes: Socioeconomic Inequalities in the Portuguese Population in 2014

Diabetes: Desigualdades Socioeconómicas na População Portuguesa em 2014



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ABSTRACT

Introduction: Diabetes is a major public health problem and it is related to socioeconomic factors. The aim of this study is to describe socioeconomic inequalities in the distribution of diabetes in the population with 25 years or more, resident in Portugal in 2014.

Material and Methods: Data from the Health National Survey 2014 was analysed, n = 16 786. We estimated the prevalence of diabetes in the population and stratified by socioeconomic variables namely educational level and income. The extent of socioeconomic inequalities was assessed using concentration index and the relative index of inequality.

Results: Diabetes was found to be concentrated among the people with lower educational levels (concentration index = -0.26) and lower income quintiles (concentration index = -0.14). Relative index of inequality also showed a lower degree of inequality among the most educated (0,20; CI 95% = [0,12; 0,32]) and with higher income (0,59; CI 95% = [0,48; 0,74]).

Discussion: Distribution of diabetes is associated with education and income. Previous studies have shown that although income might reflect lifestyle patterns, education reflects better social factors that are important for establishing healthier behaviours. Also, the National Health Service, of universal coverage and free of charge, might have contributed to reduce inequalities in the access to health by those with the lowest income.

Conclusion: Supporting 'Health in All Policies' might reduce inequalities, namely by improving population educational level and actions that promote health literacy.

Keywords: Diabetes Mellitus; Healthcare Disparities; Literacy; Portugal; Socioeconomic Factors

RESUMO

Introdução: A diabetes é considerada um dos maiores problemas de saúde pública e está associada a fatores socioeconómicos. O objetivo deste estudo foi descrever as desigualdades socioeconómicas na distribuição da diabetes na população com idade igual ou superior a 25 anos, residente em Portugal em 2014.

Material e Métodos: Foram analisados dados do Inquérito Nacional de Saúde de 2014, n = 16 786. Calcularam-se estimativas da prevalência da diabetes total e estratificada por variáveis de caracterização socioeconómica designadamente o nível de escolaridade e o rendimento. O grau de desigualdade socioeconómica foi estimado através do índice de concentração e do índice relativo de desigualdade.

Resultados: A diabetes concentrou-se na população com menor nível de escolaridade (índice de concentração = -0,26) e nos quintis de menor rendimento (índice de concentração = -0,14). O índice relativo de desigualdade evidenciou menor desigualdade nos grupos com um maior nível de escolaridade (0,20; IC 95% = [0,12; 0,32]) e com maior rendimento (0,59; IC 95% = [0,48; 0,74]).

Discussão: A distribuição da diabetes está associada ao nível educacional e ao rendimento. Estudos anteriores mostraram que, apesar do rendimento poder refletir o padrão de vida das pessoas, a educação reflete o contexto social imediato em que o indivíduo se integra e que contribui para adotar estilos de vida mais saudáveis. Ainda, o Serviço Nacional de Saúde, por ser universal e tendencialmente gratuito, pode ter contribuído para reduzir desigualdades no acesso à saúde por grupos de menor rendimento.

Conclusão: Integrar a 'Saúde em Todas as Políticas' pode reduzir as desigualdades, nomeadamente através da melhoria do nível educacional da população e do desenvolvimento de ações que promovam a literacia em saúde.

Palavras-chave: Diabetes Mellitus; Disparidades em Assistência à Saúde; Factores Socioeconómicos; Literacia; Portugal

INTRODUCTION

Diabetes is a major public health problem worldwide. A prevalence rate of 9.3% has been found in people aged 15 or over, according with the Portuguese 2014 National Health Survey.¹ An estimated 11.7% prevalence of type-2 diabetes in people aged 20-79 and a 5.1% rate of undiagnosed cases has been found in the population-based 2009 PREVADIAB study.² A diabetes estimated incidence rate of 6.4 / 1,000 has been described by a study based on data from the *Rede Médicos Sentinela* Portuguese network.³ An increasing trend has also been found in a study carried out

by Sousa-Uva *et al.*⁴ showing a 4.29% annual increase in the incidence rate, with an estimated 972.77 new cases per 100,000 for the 2022-2024 period.

Diabetes is among the health conditions involving higher costs to the Portuguese National Health Service [*Serviço Nacional de Saúde* (SNS)] and its prevention and control are the main targets of a priority program.⁵ Between 8 and 10% of the national 2014 total healthcare expenditure were attributable to diabetes, according with the Portuguese *Direção Geral de Saúde* (DGS).⁶ Prevention programs

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aimed at the reduction of direct and indirect diabetes costs and focused on the most vulnerable populations have been promoted by the World Health Organization (WHO).⁷

The impact of biological, social, cultural and economic factors is shown by different diabetes prevalence rates found among the countries.⁸ Different studies have shown that diabetes is associated with low socioeconomic status (SES) groups, as well as with the presence of health inequalities.⁹⁻¹¹ Health inequalities were defined as “any differences in health status and health determinants across different population groups” by the 2012-2016 Portuguese National Health Plan (*Plano Nacional de Saúde 2012 – 2016*)¹² and the presence of avoidable health inequalities was suggested, namely regarding those associated with socioeconomic factors such as income, education, lifestyle and access to healthcare services with a relevant influence on health inequalities. The presence of a social gradient in health is well documented and improvements in health status has been found as we ascend the ranks of socioeconomic status in society.¹³ Income and education are particularly relevant to ranging individuals in socioeconomic terms and to the assessment of distribution of health indicators along these ranges.¹⁴

The concentration index and the relative index of inequality (RII) have been recognised as most appropriate for the assessment of health inequalities¹⁵ as they comply with the three main criteria required for an accurate measurement, namely (i) expressing the extent of socioeconomic inequalities, (ii) using the information regarding the whole population and (iii) showing to be sensitive to the population redistribution within the study groups. These indices comply with validity, accuracy and flexibility criteria, for being regression indices, therefore allowing for a more accurate identification of the contribution of the socioeconomic gradient to the analysed health indicators.^{13,15,16} The assessment of these indicators has been extensively described by different studies.¹⁶

Other studies have used these indices to estimate the range of inequalities in the prevalence of diabetes and in other chronic health conditions.^{9,11,17} Inequalities in some health indicators have already been measured in Portugal by using these indices,¹⁸ even though to the best of our knowledge inequalities regarding the prevalence of diabetes have not yet been assessed in Portugal. This is the first Portuguese study on socioeconomic inequalities regarding the distribution of the disease using representative data of the Portuguese population.

This study aimed at the identification of socioeconomic inequalities in the 2014 distribution of diabetes within the Portuguese adult population and at the estimation of (i) the self-reported prevalence rate of diabetes by gender, age group, education and income, (ii) the concentration curve and related concentration index and (iii) age and gender-adjusted relative index of inequality.

MATERIAL AND METHODS

This was an observational and cross-sectional study based on data from the 2014 Portuguese National Health Survey (INS 2014) carried out by the *Instituto Nacional de Estatística* in cooperation with the *Instituto Nacional de Saúde Doutor Ricardo Jorge*. The Portuguese population aged 15 or over, living in private households, was the target population of the survey and a group of 18,104 participants selected through a probability multistage sampling procedure stratified by NUTS II region (2002) was analysed; data collection was carried out between 10 Sep and 15 Dec 2014 based on computer-assisted personal interviews / CAPI or computer-assisted Web interviews / CAWI, with an 80.8% response rate nationwide.¹ Further details on the questionnaire, sampling selection and fieldwork procedures are available from the methodological document¹⁹ as well as from the INS 2014 survey report.¹ Considering the low incidence and prevalence of diabetes in people aged under 25, the analysis was restricted to people aged 25 and over and 16,786 participants were included in this study. The estimated prevalence rate of self-reported diabetes was calculated regarding the whole group of patients and by specific groups defined by socioeconomic variables (gender, age group, region, education and income). Standard prevalence rates were directly obtained for comparisons between age groups, considering the 2014 Portuguese population as standard population. The concentration curve,^{13-16,20} concentration index^{13-16,20} and the relative index of inequality¹³⁻¹⁶ were used to estimate the level of socioeconomic inequalities in the prevalence of diabetes.

The cumulative percentage of patients with diabetes (y-axis) according with the deciles of education or income (x-axis) is represented by the concentration curve, in ascending order (ranging from the poorest to the best situation), with ‘equality’ corresponding to the diagonal line (45°). A higher ‘disease burden’ corresponds to the deciles with the poorest socioeconomic status, when the curve is above the diagonal line. The concentration index can range between -1 and 1 and a higher absolute value of the index corresponds to a higher degree of inequality. A negative value of the index is shown with the curve over the equality line, with higher concentration of the disease in the deciles with lowest socioeconomic status.

The relative index of inequality is obtained by the riddit score of the socioeconomic variable¹⁶ assigned by the age-adjusted binomial regression model with diabetes as dependent variable.

The analysis of inequalities has been stratified by gender, due to the differences between men and women regarding the socioeconomic status described by another study.⁹ All the estimates were weighted according with the sampling design. Statistical treatment and analysis were developed using Stata software, version 11.

RESULTS

Description of the participants

A 51.4% percentage of female participants were included in the study, 63.1% of the participants had basic education and only 18.3% had a graduation, mostly women. A percentage of 21.2% of the population aged 25 and over were in the highest quintile of income while 18.9% were in the lowest (Table 1). Significant gender differences were found in population distribution according with the quintiles of income, with a higher percentage of men in the highest quintile.

Prevalence of diabetes

An estimated 10.6% prevalence rate of diabetes has been found in general population (95% CI = [9.9%; 11.3%]), with similar rates found in male (10.9%, 95% CI = [9.9%; 11.9%]) and female patients (10.4%, 95% CI = [9.6%; 11.3%]). A significantly increased prevalence rate has also

been found regarding the age, from 0.67% (95% CI = [0.34; 1.33]) in the 25-34 age group to 23.4% (95% CI = [21.7%; 25.0%]) in the 65 plus age group and statistically significant gender differences were found regarding education (Table 2). The highest prevalence rate of diabetes has been found in participants with the lowest education – up to the lower secondary education, in both genders (14.4 - male and 15.2% - female). Upon age-adjustment of the prevalence, the difference between the extreme groups of education remained, even though it has decreased.

As regards income, the prevalence rate of diabetes ranged between 6.7 and 15.0% and was lowest in the quintile with the highest income and highest in the second quintile. This pattern was the same for both genders. Upon age-adjustment, a reduction in the difference of prevalence rates between the quintiles of income has been found and the prevalence rate of diabetes in the highest income quintile has increased to the prevalence rate found in the

Table 1 - Distribution of the population living in Portugal, according with education and quintiles of income, stratified by gender

Education*	Men	Women	Total
Pre-school / Basic (up to 9 th grade)	66.16	63.52	64.74
Secondary / Post-secondary	17.95	16.17	16.99
Higher	15.89	20.31	18.27
Income (1)*			
1 st quintile (lowest)	16.78	20.85	18.97
2 nd quintile	18.35	20.42	19.46
3 rd quintile	19.18	20.87	20.08
4 th quintile	22.12	18.68	20.27
5 th quintile (highest)	23.57	19.18	21.21

*p < 0.001

(1) The quintiles of net monthly income per adult equivalent were defined according with the methodological manual of the European Health Interview Survey36

Table 2 - Prevalence rates of diabetes (gross and standard) and confidence intervals according with education and income, stratified by gender

	Men		Women		Total	
	Gross	Standard	Gross	Standard	Gross	Standard
Education						
Preschool / Basic	14.4 [13.1; 15.9]	11.9 [10.8; 13.2]	15.2 [13.9; 16.9]	12.1 [11.0; 13.3]	14.8 [13.8; 15.8]	12.0 [11.2; 12.9]
Secondary	4.0 [2.7; 5.7]	8.1 [5.5; 11.7]	2.9 [1.9; 4.6]	4.7 [2.8; 7.8]	3.4 [2.5; 4.7]	6.3 [4.6; 8.5]
Higher	3.9 [2.6; 5.9]	6.4 [4.3; 9.3]	1.6 [1.0; 2.4]	3.6 [2.3; 5.8]	2.5 [1.8; 3.4]	4.9 [3.6; 6.6]
Income						
1 st quintile (lowest)	12.8 [10.2; 15.8]	12.1 [9.8; 14.9]	12.4 [10.6; 14.6]	11.6 [10.0; 13.5]	12.6 [11.0; 14.4]	11.9 [10.4; 13.5]
2 nd quintile	14.1 [11.6; 16.9]	12.1 [10.0; 14.5]	15.7 [13.4; 18.2]	13.7 [11.7; 16.1]	15.0 [13.3; 16.8]	13.0 [11.5; 14.6]
3 rd quintile	10.3 [8.2; 13.0]	11.0 [8.9; 13.5]	10.1 [8.4; 12.1]	10.1 [8.4; 12.0]	10.2 [8.8; 11.8]	10.5 [9.1; 12.1]
4 th quintile	10.3 [8.5; 12.4]	10.4 [8.7; 12.4]	8.1 [6.4; 10.1]	9.8 [7.9; 12.2]	9.2 [7.9; 10.7]	10.1 [8.8; 11.6]
5 th quintile (highest)	7.9 [6.4; 9.8]	8.9 [7.3; 10.8]	5.3 [3.9; 7.2]	6.3 [4.7; 8.4]	6.7 [5.6; 7.9]	7.5 [6.3; 8.8]

remaining groups of income.

Inequalities in the distribution of diabetes according with socioeconomic indicators

A 14.6% percentage of the patients with diabetes were in the decile with the lowest education, as found by the analysis of the concentration curves (Fig. 1) showing the cumulative percentage of patients with diabetes (y-axis) according with the education deciles (x-axis). In addition, only 2.5% of patients with diabetes were in the decile with highest education.

An 11.3% percentage of the patients with diabetes were in the decile with the lowest income and only 5.8% in the decile with the highest.

A higher concentration of the prevalence of diabetes was found in the population with the lowest education (concentration index = -0.25) (Table 3). No significant gender differences in the concentration index were found and the highest estimate in absolute terms was found in female patients (-0.29 vs. -0.23, $p = 0.1835$).

Lower income-based concentration index values were found in both genders, in absolute terms and higher 'disease burden' was found in the quintile with the lowest income.

Age-adjusted RII showed inequalities in favour of the groups with higher education and income [0.20 (95% CI = [0.12 - 0.32] and 0.59 (95% CI = [0.48 - 0.74])], respectively (Table 4).

DISCUSSION

An approach of the prevalence rate of diabetes in both genders has been found in this study, unlike what had been previously described.² This could relate to the fact that increasingly more male patients were diagnosed with diabetes, as well as to the higher awareness of health issues found in male patients and/or to a real increase in the number of cases in this population.³ In fact, no significant gender differences in the prevalence of diabetes have been found worldwide and even an approach is estimated over time.²¹

The prevalence rate of diabetes in the Portuguese population is significantly associated with education and income, even though different degrees of association have been found. Other studies have already found this association in different European countries.^{10,22} One study carried out in the United Kingdom also found a negative association between diabetes and income and/or education,

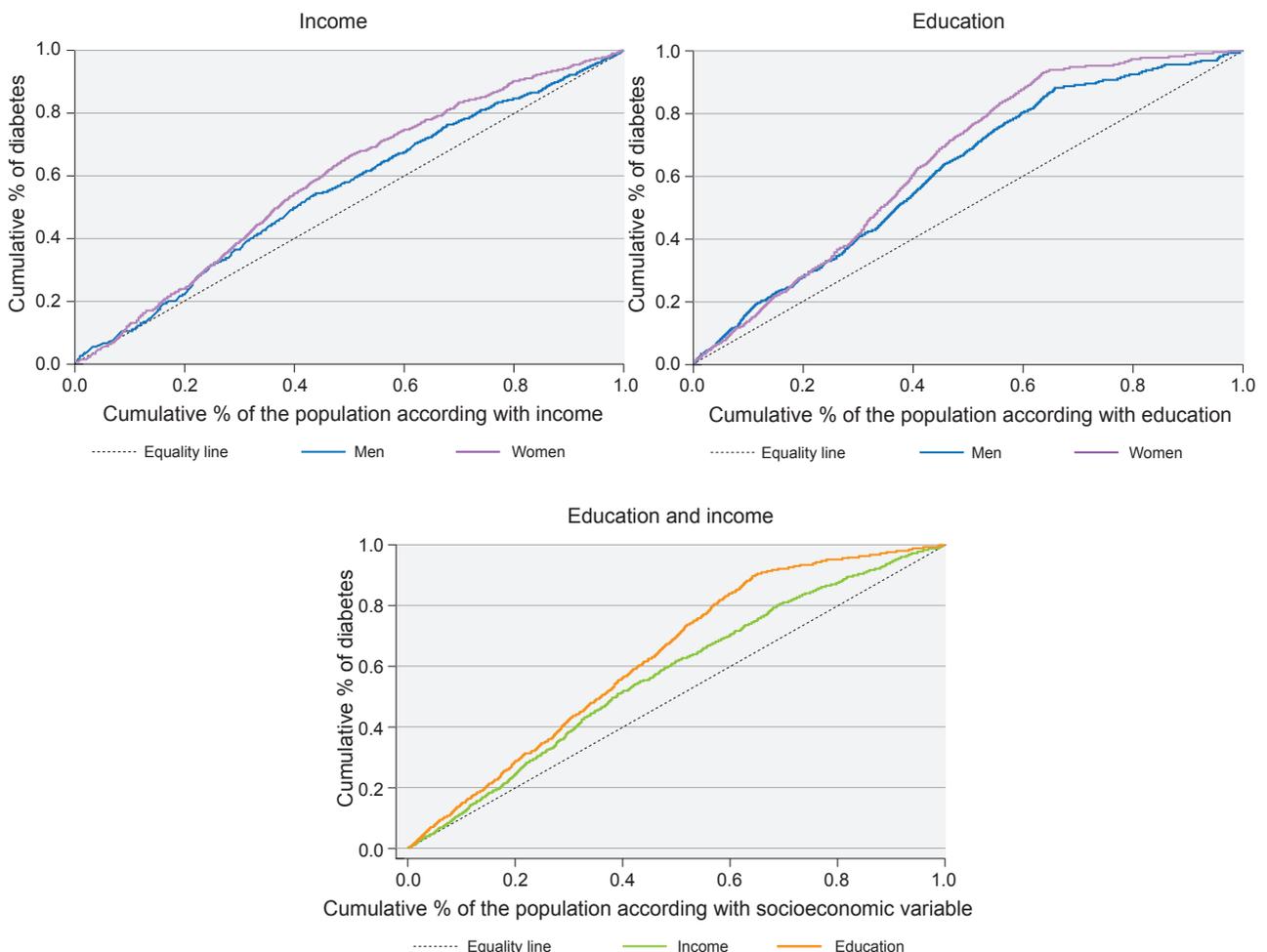


Figure 1 – Concentration curves according with education and income, by gender and for the total population

Table 3 - Concentration index according with education and income, stratified by gender

	Concentration index	95% CI
Education		
Male	-0.23	[-0.28; -0.18]
Female	-0.29	[-0.32; -0.24]
Total	-0.25	[-0.28; -0.22]
Income		
Male	-0.10	[-0.16; -0.05]
Female	-0.16	[-0.21; -0.11]
Total	-0.14	[-0.17; -0.10]

even though only in women.¹¹ Education and income were associated with diabetes in our study, even though with no statistically significant gender differences. Some authors have described that education is associated with better health indicators, due to the acquisition of knowledge promoting the access to information and resources that subsequently make the adoption of healthier behaviour and lifestyle easier.²³⁻²⁵ Winkleby, for instance, analysed the way education, income and occupation relate to risk factors for cardiovascular diseases²⁶ many of these common to diabetes. A North-American study analysed the impact of higher education in the reduction of the risk of diabetes²⁷ and another study carried out in Lithuania has found that holding a graduation is associated with a lower prevalence of risk behaviours for certain diseases.²⁸ A different study also found a 50% increased risk of diabetes in people with less than 12 years of education and therefore the presence of higher education is desirable in order to reduce the risk.²⁹

According with Heidi *et al.*,³⁰ education has a direct and also indirect literacy-related impact on health status. Health literacy or 'the degree to which an individual has the capacity to obtain, communicate, process and understand basic health information to make appropriate health decisions'³¹ is a possible mechanism explaining for the relationship between education and health inequalities. An association has been found in different studies (i) between poor health literacy and lower knowledge on diabetes,³² (ii) poor unintentional adherence to diabetes therapy³³ and it has also been considered as a barrier to the access to healthcare services and information as well as to prevention measures.³⁴

Income has also been associated with inequality, even though with a lower impact. Marmot has considered that, even though the access to material conditions is determined by income, social factors such as the social status and immediate social context in which the patient is integrated can have a higher influence on health status. In addition, education is possibly a better indicator for the assessment of these social factors.³⁵ In fact, it seems reasonable that the effects of education on diabetes are higher than those related to income.

Table 4 - Relative index of inequality according with education and income, stratified by gender

	Relative index of inequality	95% CI
Education		
Male	0.34	[0.19; 0.61]
Female	0.11	[0.05; 0.21]
Total	0.20	[0.12; 0.32]
Income		
Male	0.69	[0.50; 0.95]
Female	0.51	[0.38; 0.69]
Total	0.59	[0.48; 0.74]

Considering that the SNS is universal and tending towards free-of-charge healthcare, income should not heavily impair the use of healthcare. The increased prevalence of self-reported diabetes found between two consecutive INS surveys (2005 and 2014) potentially correspond to the effort developed by the public services aimed at the identification and control of patients with diabetes through a specific program⁵ rather than entirely to a real increase in prevalence. In fact, data suggested that universal and free-access healthcare services can have an impact on reducing inequalities and the negative effect of the lowest income.

The effects of education and income will be supplemented and detailed with the adoption of inter-sectorial and integrating public health approaches such as 'Health in All Policies' ('*Saúde em Todas as Políticas*'). This approach will lead to improvements in the education level of the population in the long-term, even though the development of actions aimed at increasing people's health literacy is crucial in the short and medium-term.

Limitations

The limitations of the study mainly regard the fact that this was a cross-sectional study based on self-reported data, with the biases usually associated with questionnaire-based surveys. The interpretation of the participants regarding the disease must be considered as undiagnosed cases may potentially have been missed, leading to an underestimated prevalence of diabetes in the Portuguese population. It should also be mentioned that the type of diabetes was not clearly asked by the questionnaire. These issues also add some weakness to the 'income' indicator, as an inaccurate income may have been described by respondents. Finally, the concentration curves do not allow for an adjustment to confounding factors and the differences regarding income and education may have been overestimated when this methodology was applied.

CONCLUSION

This is the first Portuguese study with a representative sample of the population aimed at the assessment of

socioeconomic inequalities in the prevalence of diabetes using the concentration index and the relative index of inequality. The results showed the effect of education and income on the prevalence of diabetes. Higher inequalities in the prevalence of diabetes have been found regarding education when compared to income, which can be explained by the fact that the impact of income could have been minimized by the presence of the Portuguese universal and tending to become free-of-charge healthcare system. The results also suggested that the focus on improved levels of education and health literacy can produce a favourable effect on the adoption of healthier behaviours and subsequent reduction in disease burden.

HUMAN AND ANIMAL PROTECTION

The authors declare that they followed procedures were

according to regulations established by the Ethics and Clinical Research Committee and according to the Helsinki Declaration of the World Medical Association.

DATA CONFIDENTIALITY

The authors declare that they have followed the protocols of their work centre on the publication of patient data.

CONFLICTS OF INTEREST

The authors declare that there were no conflicts of interest in writing this manuscript.

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