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RESEARCH ARTICLE

Social inequalities in health. The case of Diabetes Mellitus: cross sectional study among the Galician population

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ABSTRACT

The relationship between social circumstances and health is widely assumed by the scientific community. It can be said that inequality is cause and effect of the disease. This work adds to the epidemiological work on Diabetes Mellitus (DM), but in this case, it emphasizes the influence of social factors. The objective is to illustrate how diabetes mellitus impacts on the population, according to their socioeconomic conditions. First, this paper reviews most recent theories supporting the association between social factors and disease. Also, to achieve the purposed goals, an exhaustive exploitation of secondary data has been carried out. Data were mainly gathered from the National Health Survey, carried out by the Statistics National Institute on a sample of 37.500 individuals, in Spain, in year 2017. Besides, an *ad hoc* survey among the diabetic population was carried out in the Galician region, at the northwestern Spain, Sample size was fixed, in this case, on 512 diabetics. From these collected data, statistical tests were performed, such as contingency tables and other association tests, to check the relationship between the dependent variable prevalence of diabetes and explicatory variables social class, family income and educational level. Among the results, we can indicate an inverse relationship between social class and the prevalence of diabetes, which is higher among people with fewer resources and, especially, with a lower educational level.

Keywords: Diabetes, prevalence, inequalities, health, social class

1. Introduction

At present it is well known that health is conditioned or characterized by factors that belong to other areas, not exclusive to Medicine. Since the disease is considered not only a physical and mental imbalance, but also a social one, the fight against the disease inevitably needs other disciplines, in addition to the exclusively biomedical ones, that help to interpret the different dynamics related to health, considering all those behaviours, attitudes and cultural representations that condition the experience of living the disease, as well as the possibilities of contracting it.

The relationship between social determinants and disease is a relatively recent concern for Medicine, however, in recent decades the studies that address this issue are already innumerable. This work represents a new contribution to the production in the field of Health Sociology, while it contributes to a better knowledge of a specific disease: diabetes mellitus, an old acquaintance, however, of high prevalence, especially in the developed world, where it has already been placed among the leading causes of death¹.

The consensus regarding higher prevalence and incidences of Diabetes Mellitus (hereinafter DM) among people from lower social strata is practically unanimous². In France, Arnaud *et al.*³ show much higher prevalence among the homeless. Jaffiol *et al.*⁴, also in France, associated excess risk in the most socially disadvantaged people with malnutrition. Dennis *et al.*⁵, in Brussels, find an 8 times higher risk of suffering from DM1 in people of lower status. Nicklett⁶ describes socioeconomic factors as good predictors of risk, which act independently of deterioration due to age. In China, Zhang *et al.*⁷ likewise found a higher probability of contracting the disease the lower the income.

There are studies that coincide in pointing out, as a risk factor, poverty in general, and not high individual income⁸, and especially the physical state and social status of the neighbourhoods of residence^{9,10,11,12}. Elgart's *et al.* study¹³, in Argentina, shows an association between low economic positions and the presence of DM and its complications, which is related to the economic pressure that the country is experiencing. For Dijkstra *et al.*¹⁴, spatial variability is associated with the consumption of medications among other variables such as the number of inactive people or income level.

Pipper *et al.*¹⁵ found that low-status DM patients in North Carolina had worse metabolic control of the disease.

And although there is evidence that there is no relationship between social status and DM1^{16,17}, this

is not the case with DM2, where the greater risk of contracting DM has been amply demonstrated in the most disadvantaged groups, especially in minority ethnic groups or immigrants. Campbell *et al.*¹⁸, who investigate a population of native Amerindians in Colombia, conclude that ethnic differences are not due, as described, to genetic factors, but rather to environmental, cultural, social, and economic factors. And McKinlay *et al.*¹⁹, in Boston, reached the same conclusion, stating that paying attention to biological determining factors distracts from the really significant ones, such as social position.

Studies that analyse this relationship have been carried out for decades, Staines *et al.*²⁰ found higher prevalence among the immigrant population in Pakistan, and more recently, in Australia, Abouzeid *et al.*²¹ found a higher prevalence in the entire immigrant population regardless of the social stratum they belong to. Afaible-Munsuz *et al.*²² describe cultural assimilation as a risk factor among Mexican immigrants in Sacramento (California).

But this association does not have the same direction in all countries, just as in developed countries DM is more prevalent among the lower social strata, in the most disadvantaged countries the prevalence is higher among the upper strata, as demonstrated Pudubu *et al.*²³ and Ploubidis *et al.*²⁴ in Sri Lanka and Kenya, respectively. In India, Deepa *et al.*²⁵ speak of an increasing trend in prevalence in high strata, greater than that shown in the middle and low strata.

In Spain, Espelt *et al.*²⁶ state that there is consistent evidence of differences in prevalence, incidence, and even mortality based on status. For this author, inequalities were already present in the nineties, but they have been increasing, especially among women. Costa and Gil²⁷ also find a higher proportion of diabetics in the lower scales of the social pyramid. The economic situation is also related to the prevalence of the most common complications such as retinopathy²⁸ or nephropathy²⁹.

Ricci-Cabello *et al.*³⁰ study the possible existence of inequalities in the prevention, diagnosis, treatment, and control of DM in OECD countries with universal health services, through a review of the most relevant literature up to 2007, finding consistency between the studies that show the existence of inequalities in treatment, metabolic control and use of health services, as well as in the diagnosis and general control of the disease.

Karter and Ferrara³¹ refer to the economic barriers faced by those diabetics who must pay for the necessary material for self-control of their disease. But as Hausser *et al.*³² despite equal access to

resources for diabetic patients, a social gradient persists in diabetes care.

Another of the determinants of the risk of contracting DM, closely related to the social stratum, is the level of studies reached. Abby and Ershow sure, in their research in Maryland, that to reduce³³ in their research in Maryland, NHSure that to reduce the incidence it is necessary to focus future challenges on literacy; and for their part, in New York, Tabaei et al.³⁴ relate the high incidence found with a low level of education. In Korea, Lee et al.³⁵ found the highest risk among women with the lowest educational level.

In Europe, Espelt³⁶ found an inverse relationship between educational level and the prevalence of DM2. And in the United Kingdom, Kellar and Manson³⁷ found that diabetics who dropped out of school before the age of 19 understand the results of their measurements worse and, therefore, have poorer control of their disease.

Finally, it should be noted that language barriers also contribute to increasing the risk among immigrants, since they translate into poorer access to health and education services^{38,39}. The lack of studies, as well as language difficulties, also carry a higher risk of death among diabetics⁴⁰.

2. Goals

The main objective of this work is to know the social impact that Diabetes Mellitus has on the population, showing how the disease affects unequally depending on the sociodemographic circumstances, analysing the relationship between the state of health and these circumstances. The aim is to

determine whether there is social inequality between the diabetic population and the general population based on the main sociodemographic variables, especially social status and the level of studies achieved.

Thus, as specific objectives we set:

- Know the relationship between the prevalence of DM and the state of health with social class.
- Know the relationship between the prevalence of DM and the state of health with the level of studies.
- Know the relationship between the prevalence of DM and the state of health with income levels.

3. Methods

To test the hypothesis of a higher prevalence of DM among the most disadvantaged social groups, a cross-sectional study was proposed, which collected, on the one hand, secondary data, obtained from the National Health Survey (hereinafter NHS). This survey was carried out by the Spanish Ministry of Health in collaboration with the Statistics National Institute. In 2017, provides the largest sample both for households, 37,500 distributed throughout the Spanish territory, and for people with DM in Spain, around 2,500, selected in such a way that they represent to the 3 million people with DM residing in Spain.

On the other hand, primary data were obtained, generated from the survey carried out in Galicia among the diabetic population (217,000 in year 2017). Technical information is shown in table 1.

Table 1. Technical data of the survey carried out on the diabetic population in Galicia

Population	>De 200,000
Confidence interval	95.5% (Z=1.96)
Sample error (e)	4.3 %
Sample size (n)	512

The inclusion criteria were suffering from DM and living in Galicia. Both sex and any age were included. In case of selected individual under 18 years old, questionnaire was answered by father or mother.

The sample size was estimated with the formula

$$n = \frac{Z^2 p (1-p)}{e^2}$$

The data was collected through a questionnaire designed *ad hoc* for a telephone survey, previously authorized by the interviewed.

For the analysis under the assumption of the existence of a relationship between the state of health (dependent variable) and socioeconomic factors (independent variables), the following

variables are used, obtained through the survey described above:

- Changes in treatment
- Prevalence of other diseases
- Hospital admissions
- Number of diseases
- Need for glucagon
- Hipoglicemia

From these variables, the variable "objectively considered state of health" was constructed, through a hierarchical segmentation analysis, this new variable was categorized on a 5-position Likert scale ranging from "very good state of health" to "very bad state of health", and at whose extremes

are the cases with the worst and best scores in the variables that the analysis takes into account, those mentioned above. The variable called "objective health status" was related to the following independent variables:

- Social class
- Level of studies
- Income

It is necessary to clarify regarding the variable "social class", which has been constructed in the survey carried out in Galicia with identical categories to those used by the National Statistical Institute, according to the classification of socioeconomic levels of the Spanish Epidemiology Society, which inspired by Goldthorpe's scheme⁴² based on occupation, it establishes the following categories:

- Social Class I: Directors and managers of establishments with 10 or more employees and professionals traditionally associated with university degrees
- Social Class II: Directors and managers of establishments with less than 10 employees, professionals traditionally associated with university degrees and other technical support professionals, athletes and artists
- Social Class III: Intermediate occupations and self-employed workers

- Social Class IV: Supervisors and workers in qualified technical occupations.
- Social Class V: Skilled workers in the primary sector and other semi-skilled workers
- Social Class VI: Unskilled workers

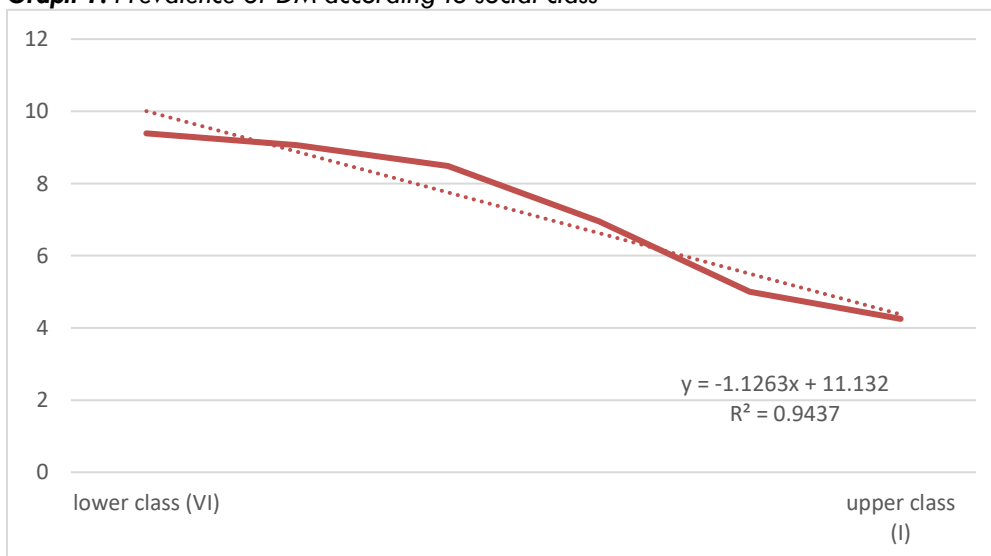
And one last reference regarding the methods of analysis: the most used here, the comparative one. To a large extent, the working hypothesis is contrasted through this method, since the differences between the general population and the diabetic population are sought. The statistical analysis to contrast the associations was based on contingency tables, bivariate regression, and hypothesis contrast such as Pearson's Chi-square test. All these tests were carried out using IBM SPSS Statistic 25 software.

4. Social impact of diabetes mellitus

4.1. The relationship between Diabetes Mellitus and social class

In recent years, the importance given to the issue of inequalities in the field of health has encouraged surveys to collect data that allow testing the hypothesis of their increase, even despite economic progress and improved quality of life at all levels in the developed world. Thus, in the case of Diabetes Mellitus, as in that of other diseases, we can observe a higher prevalence among the lowest social strata.

Graph 1. Prevalence of DM according to social class



Source: NHS, 2017

A first analysis carried out based on the NHS, 2017 and through a contingency table, represented in Graph 1 with the regression function, shows an inverse relationship between the prevalence of DM and social class. In view of the data, it can be

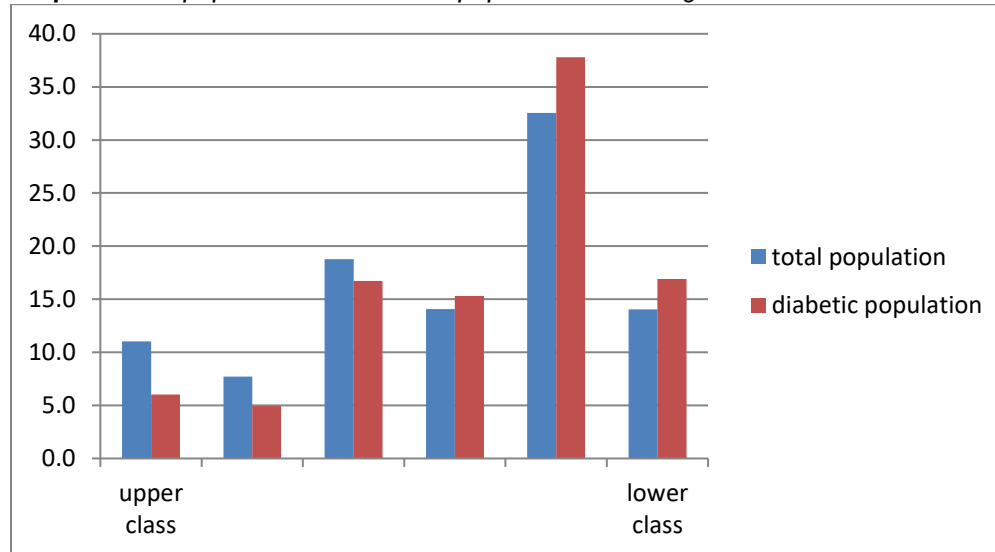
assumed with a high degree of significance that the fact of having or not having Diabetes Mellitus is related to social class. The negative sign of β informs that it is an inverse relationship, as we

ascend in status, the probability of suffering from DM decreases.

The NHS makes it possible to establish the differences between the general population and the diabetic population. The contingency table that we represent in Graph 2 confirms the relationship between social class and disease. While among the

general population the percentage of the population in the most favoured class exceeds 10%, it barely reaches 6% among the diabetic population. Likewise, the percentage of the general population in the most disadvantaged class is below that of the population with diabetes in this same social group.

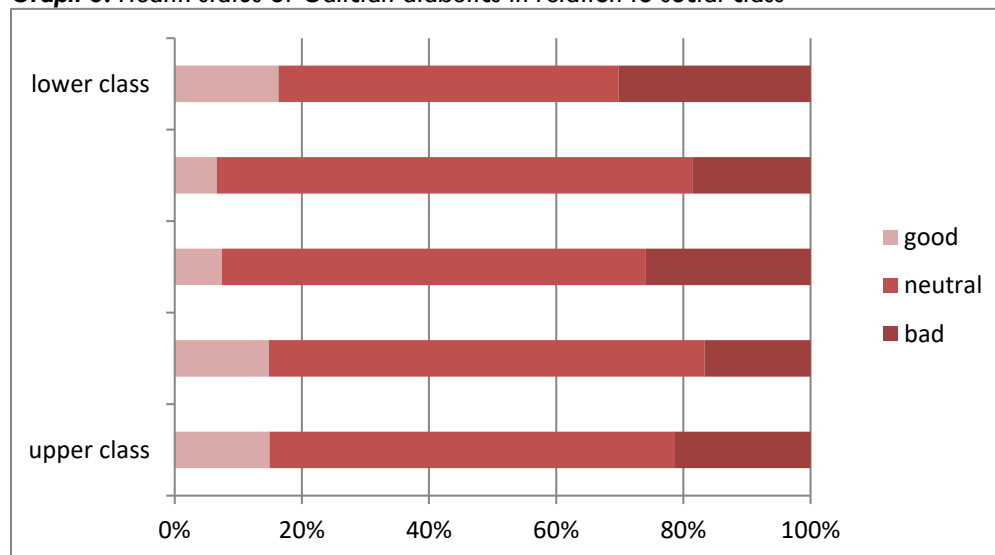
Graph 2. Total population and diabetic population according to social class



Source: NHS, 2017

The survey carried out on the diabetic population in Galicia provides new information by relating the state of health of diabetics with the social class to which they belong.

Graph 3. Health status of Galician diabetics in relation to social class



A third of the population with diabetes in Galicia presents a state of health considered objectively bad, with a greater number of hospitalizations, a greater number of concomitant diseases or a higher frequency of hypoglycaemia. In the case of the

upper-class group, only one in four is in the group with the worst state of health.

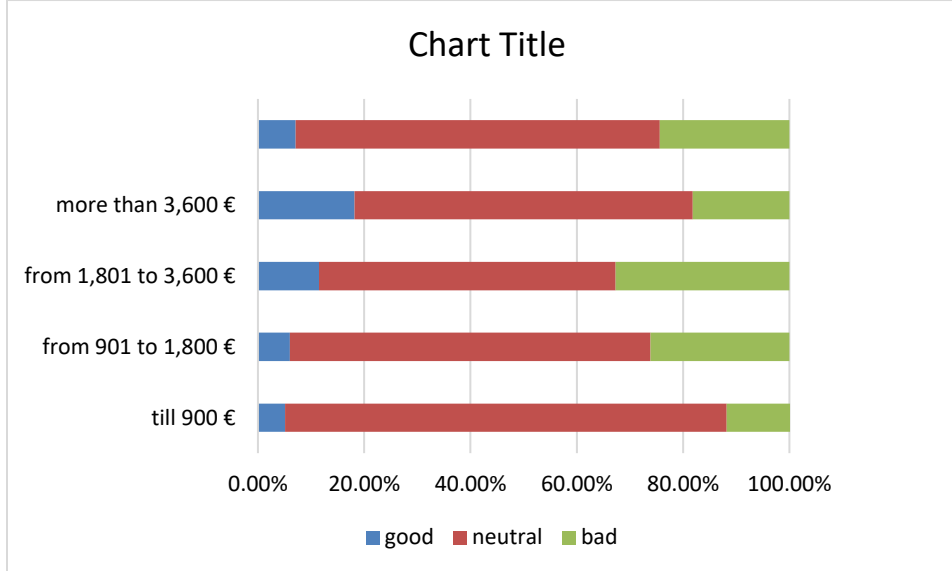
4.2. Relationship between Diabetes Mellitus and income

The level of income is directly related to occupation, and with respect to this variable it can be observed that the percentage of people with higher incomes is higher among the general population than among diabetics: while in the general Galician population the percentage of households that exceed €3,000 in income is more than 22%, in the case of the

diabetic population, less than one household in ten exceeds that income.

In the survey carried out on the diabetic population in Galicia, by relating the variable "objective health status" with income, we observed through a contingency table that among diabetics with higher incomes, there are more people with a good health status, and on the contrary, among diabetics with less income, there are more diabetics with worse health status.

Graph 4. Health status of Galician diabetics in relation to the monthly household income

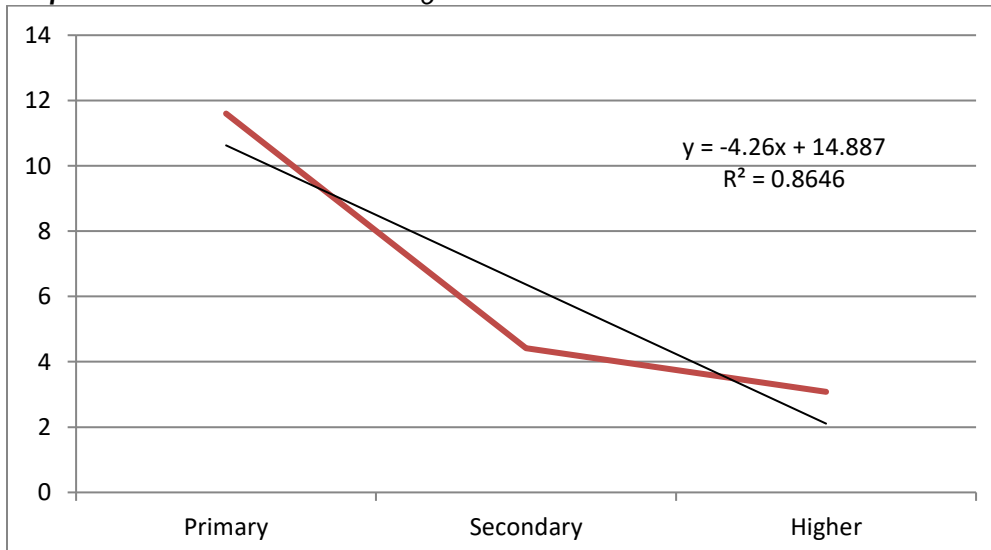


4.3. Relationship between Diabetes Mellitus and educational level

As in the case of the social class variable, when relating the prevalence of DM with the level of

studies, an inverse relationship is evident: as the educational level increases, the prevalence of diabetes decreases.

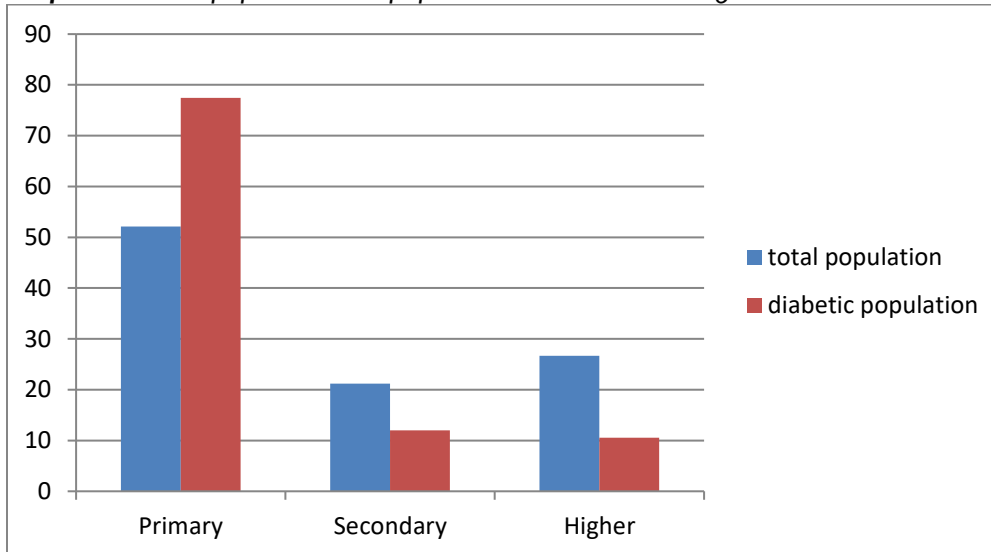
Graph 5. Prevalence of DM according to educational level



Source: NHS, 2017

The comparison between the population with DM and the general population in relation to the level of studies yields results in the same direction.

Graph 6. General population and population with DM according to educational level



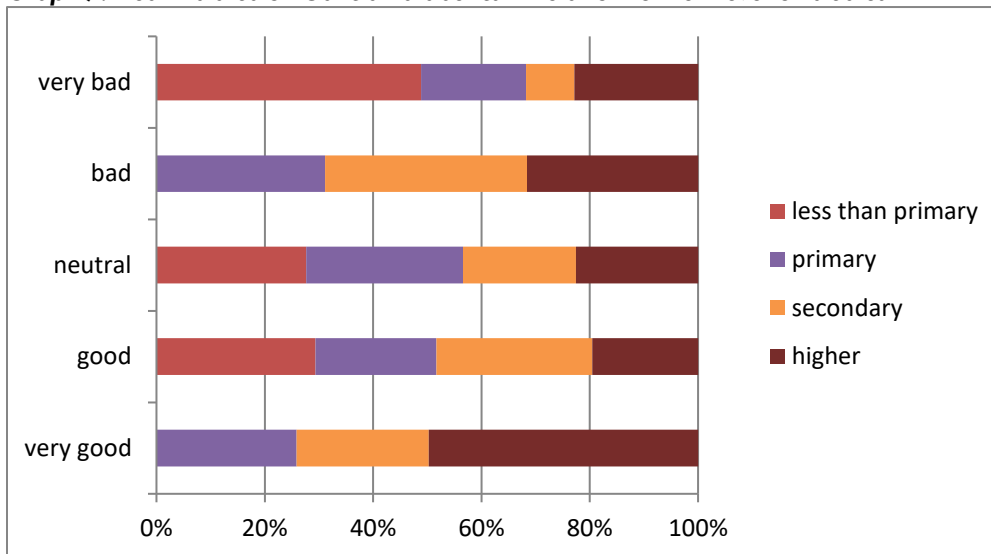
Fuente: NHS, 2017

At the lowest levels of studies, the proportion of the population with diabetes is higher, contrary to what occurs in the group with more studies.

A similar result could be obtained from the survey

carried out in Galicia, also from this we can know if a better or worse state of health is also associated with the level of studies attained.

Graph 7. Health status of Galician diabetics in relation to their level of studies



Almost half of the diabetics who report a very good state of health have higher education, and the opposite occurs in the case of diabetics who declare the worst state of health, more than half have no studies. The chi-square test confirms the association

between both variables, and its value (0.071) can be considered significant for a confidence interval of 93%. With this level of confidence, the hypothesis of association between both variables can be accepted.

Table 2. Pearson chi-squared: educational level*diabetes

	Value	df	Asymptotic (bilateral) significance
Pearson Chi-squared	19,789	12	,071
likelihood ratio	21,909	12	,039
linear by linear association	1,915	1	,166
N valid cases	504		

5. Conclusion

The hypothesis raised at the beginning of this work suggested the idea of the relationship between the presence of diabetes and socioeconomic factors, as other authors proved previously⁴³. Throughout the entire analysis, it has been possible to prove the influence of social circumstances on the prevalence of the disease. The data have been able to show some differences based on social class, income and the level of studies attained. It has also been possible to verify a worse state of health among people from the lowest social strata.

There are fewer households with diabetics that have an income of less than a thousand euros than households among the general population with this level of income, but this data is consistent with the statement that DM, especially DM2, is not a disease that affects the people from the most disadvantaged classes, data from less developed countries confirm low prevalence of the disease, which increases mostly in countries with emerging economies, with high upward social mobility, in which the middle class is experiencing the greatest increase, adopting habits and ways of life similar to those that prevail in this social stratum of the

countries with the highest degree of development.

Finally, it should be noted that, as usual, this research suffers from some limitations, the main one being that the information used comes from surveys, which, although representative of the universes from which the samples are drawn, must be taken into account. take into account the margins of error to which the data obtained are subject.

Another limitation has to do with the variables that have not been taken into account in this work, but explain to a large extent the presence of the disease, such as age or sex. These variables have not been considered as their relationship with the disease can be better explained by biological rather than social issues.

But limitations are always an open door, an invitation to continue delving into the same line of research, thus, in future research the number of variables involved in the probability of contracting the disease will be expanded, to consider them together.

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