

**Is there a link between education, risk perception, and health outcomes in diabetes in the context of primary intervention among the elderly population?**

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**Preliminary version**

**Paper to be presented at ALTEC conference**

**27-31<sup>st</sup> October 2013**

Porto

# Is there a link between education, risk perception, and health outcomes in diabetes in the context of primary intervention among the elderly population?

## Abstract

**Background:** the association between education and health outcomes is under-analyzed in a primary prevention context, particularly regarding the elderly population.

**Objective:** To examine among the elderly, one of the groups more at risk of developing diabetes, whether there is a link between education and health outcomes. If this link is confirmed, exploratory explanations are pursued. These focus on preventive behaviors and risk perceptions as suggested by the literature.

**Methods:** An observational cross sectional study was conducted in urban vulnerable areas of Lisbon, Portugal in January-February 2013. Collected data concerned the awareness of the risks associated with diabetes and related prevention habits of the elderly (such as adoption of risk behavior and health screening habits). Demographic data including education levels, age and gender were collected as well. A final sample of 356 subjects was gathered.

**Results:** Demographic analysis of the sample indicates that it is composed by the same age strata as the general diabetic at-risk population in Portugal. Risk of developing diabetes was found to correlate significantly and negatively with education ( $p < 0,01$ ,  $r = -0,265$ ). Concerning prevention behaviors, all subjects scored low on behaviors that are associated with the reduction of risk, the so-called modifiable risk behaviors. The effect of education on the whole set of prevention behaviors is limited. Results also show that education does not seem to have a role in a greater health screening regarding diabetes. Rather it is when the subjects perceive that they are at risk that they engage in health screening practices, doing adopt more modifiable risk behaviors. Risk perceptions are, however, influenced by education levels. All subjects scored high on the extreme complications associated with diabetes, e.g., risks that are extremely high and directly observable while they scored low on risk factors (long-term, not directly observable risks). Subjects with education scored higher than analphabets on the pathophysiology of diabetes (observable risk but of moderate intensity). Subjects scored low on awareness on risk factors.

**Conclusions:** Formal education levels impact health outcomes concerning diabetes. Risk behaviors on diabetes do not seem to be associated with educational levels. Education plays a role in risk perceptions but its real impact needs further research. The relationship between risk perception and preventive behavior (among which modifiable risk behaviors) is complex, and it is sensitive to different risk conditions (being at risk or not).

## 1. Introduction and objectives

The elderly, adults aged 65 years and older, represent the age group with the lowest formal education levels (1-2). They also have the highest proportion of risk of chronic illness of any age-group. Change in behavioral habits is effective in reducing the risk of developing this pathology among older adults (3) but the elderly are known to resist change (4). In this context, they comprise a vulnerable population that is most likely to be negatively affected by limited education levels (5). But whether and how this relationship applies remains poorly understood in a primary intervention context regarding the elderly population. In this scope, understanding the relationship between risk perceptions and preventive behavior is particularly important because of the known knowledge gap in the context of primary intervention, particularly concerning non-communicable diseases (6). Given the abovementioned knowledge gap and the role of education in reducing poor health outcomes, research on this issue in a primary intervention context can be useful for the design of health prevention oriented programs.

Significant differences in health status due to limited education among older adults are well documented in the context of secondary and tertiary intervention (7-14). Although scarce, new concerning evidence shows that limited education levels can increase the risk of poor health outcomes in the context of primary intervention (15). For example, Sabates and Feinstein (16) show that people with poor education levels use less preventive measures, leading to higher mortality rates. Yet, despite calls for a better understanding of the relationship between education and poor health outcomes in the context of primary intervention, reckoning of a direct link is unclear as it is the variables that explain it (16-19).

In trying to identify this link, e.g., the role of education and health outcomes, previous studies examine the role of genetic factors, anthropometric data, life style effect (20-23) but not the effect of education in the risk of getting the disease. Perceiving the effect of education in the risk of getting the disease seems relevant since obesity and life style are found to be risk factors associated with low social economic and educational background, and thus may contribute to increased risk of getting the disease (24). Yet, the link between education and risk to get diabetes remains unexplored, and it is focused in this study.

The variables that compose the link between education and health outcomes within a primary prevention context also require to be analyzed. In this context, the role of risk perception might be critical, but its relationship with preventive behaviors – as well as with other variables, such as education - remains unclear. The greater number of studies focused on secondary and tertiary intervention, have shown that changes in health outcomes are associated to a multifaceted set of factors such as knowledge, awareness of risk, costs (25-26), and that possibly the link that connects education with preventive behavior is more complex and nonlinear than expected (27). Studies that can help us gain a better understanding of the knowledge gaps through which people with different

lifestyles – particularly vulnerable populations such as the elderly - apprehend risks are rare, and this study contributes to this literature (28).

Therefore, the purpose of this study is threefold. To examine whether there is a statistical link between education and the risk of getting diabetes. A better understanding of the link between limited education and health outcomes might be of help to understand the specific needs of at-risk groups, which is essential for the design of health primary intervention programs. Second, examine whether education is associated with preventive behavior. By examining these variables simultaneously, one expects to gain a better understanding of how complex interdependences between these variables work in different settings. This might help us to design health intervention programs more specific to distinct contexts. Third, assess whether there is a social dimension in risk perception of elderly people. An understanding of the knowledge gaps and on how the mechanisms of apprehension of risk are affected by education levels may be helpful in better define targets of intervention; thus, potentially supporting the effectiveness of tools such as scoreboard risk or campaigns used to raise awareness.

## 2. Research methods

To examine the relationship between education and risk perception on diabetes, the analysis focuses on elderly people in urban contexts. Focusing the analysis on at risk populations such as the elderly in urban contexts is critical; studies demonstrate that diabetes is a disease that affects increasingly large cities in China, India, UK and Mexico. The same studies have shown that without prevention programs, the rate at which this disease affects people tends to increase (e.g., 6). Diabetes, in addition to being prevalent, prevention of chronic diseases requires the adoption of habits of self-care that have standard definitions. A proxy used to measure general knowledge is the level of formal education, known to be highly correlated with health literacy (29). Education levels are used in this study to assess whether there is a link between education and risk of getting the disease. In this framework, a test on awareness of risks associated with diabetes is also applied.

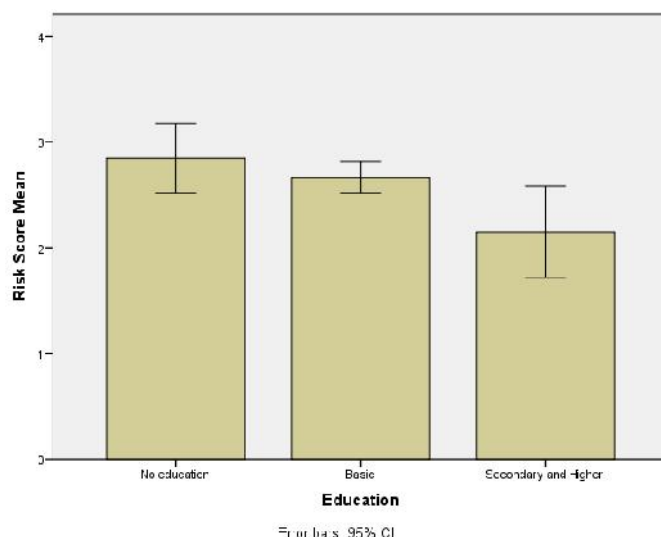
In order to adjust the questions to the target population, a team of 9 nurses and 2 nutritionists from *Misericórdia* that carry out prevention/education programs to elderly populations for several years (each of these nurses has seen more than 4000 patients of this age) were extensively consulted. Based on these consultations, a set of questions regarding risks associated with diabetes was prepared. The questions focused on risk factors associated with diabetes, pathophysiology and extreme complications associated with diabetes (30). Based on the literature on risk perception regarding knowledge gaps amongst low education population (31) and the comments from the nurses, it is expected that people would know more on consequences of the diseases, e.g., the extremely high risks associated with diabetes that are directly observable. It was also expected that people with low levels of education would have substantial difficulties in identifying risk factors because the latter are not directly observable.

### 3. Results

Our sample consists of 356 subjects and is mostly comprised by elderly subjects ( $M=62, 25, SD=15, 64$ ). The majority of the subjects has basic education as the highest educational attainment: 16% of the subjects are illiterate, 73% have basic education and 10,7% secondary and higher education. Based on the report *Dados Epidemiológicos Sobre Diabetes* [Epidemiologic data on diabetes] (31) we confirm that our sample is representative of the overall Portuguese population at risk of having diabetes. A risk assessment of the subjects performed in collaboration with the nurses from *Misericórdia*, according to a standard scale used by the medical community in general shows that 19,4% scored very low in the risk of getting diabetes, 30,1% scored low, 21,1% average and 27,3% high and 2,1% very high. According to the nurses assessment, 15,04% of subjects are expected to get diabetes, a value similar to the incidence of diabetes in Portugal in 2010, of 12.4%. In Portugal, diabetes affects people with ages between 20 and 79 years old, corresponding to approximately 991 thousand individuals (the Portuguese population is about 11 million).

In Figure 1 we show the existence of a statistical link between educational levels and risk of getting diabetes. It is found that populations with no level of formal education levels have a higher risk of getting diabetes than those with basic and secondary/higher education. The estimate difference of the risk of getting diabetes between those without education and those with secondary and higher education is 20%. Subjects holding a higher education degree had an average decrease in risk of 1 point in a 5-point scale, which can be considered as a large effect. This is new finding because the literature does not consider this type of health outcome, usually measured by mortality rates. The following results represent exploratory attempts to understand this link.

**Figure 1: Relationship between education and risk of getting diabetes**



The first explanation explored for this link is the relation of education with preventive behaviors. Yet, as shown on Table 1, most of the preventive behaviors are considered to be independent of the education level. Only the level of physical activity ( $p < 0,001$ ) and daily water consumption ( $p < 0,05$ ) were shown to differ between the different education levels. Both these variables were also found to be correlated between them ( $r = 0,131$ ;  $p < 0,05$ ) probably explained by the fact that people who do more exercise also tend to drink more water because of exercising. This suggests that education is less likely to be the most critical variable in this comparison. However, the relationship between education and prevention behaviors has to be considered as weak, as educational levels are just significant for 2 of the 7 preventive behaviors under analysis.

**Table 1: Relation between education levels and the adoption of risk modifiable behaviors**

<i>Risk modifiable behaviors</i>	<i>P-Value*</i>
Level of physical activity	<0,001
Number of daily meals	0,068
Units of fruit eaten daily	0,228
Eats fiber with sugar	0,582
Units of vegetables eaten daily	0,836
Daily water consumption	0,006
Other drinks	0,769

\* Fisher's exact test was used.

A second possible explorative analysis to explain the link between educational levels and risk of getting diabetes was focused on how risk is perceived by the elderly population at risk with different levels of education. Table 2 shows that no differences were found regarding educational levels in relation to risks on extreme complications of diabetes and to risk factors associated with diabetes. From the interviews with the subjects, it was expected that the population with no education or with basic levels of education were well aware that diabetes can cause death or the amputation of a leg. All, subjects scored high on the perception of risks on extreme complications of diabetes. Inversely, all the subjects scored low on risk factors, independent of education levels, a result also validated by the interviews. It is in the risk perceptions associated to pathophysiology that differences between those more educated and those less educated or without education emerge (see Figure 2). These results suggest that education levels play a role in risk perceptions concerning diabetes but that this role is somewhat limited, and knowledge gaps remain even amongst the more educated.

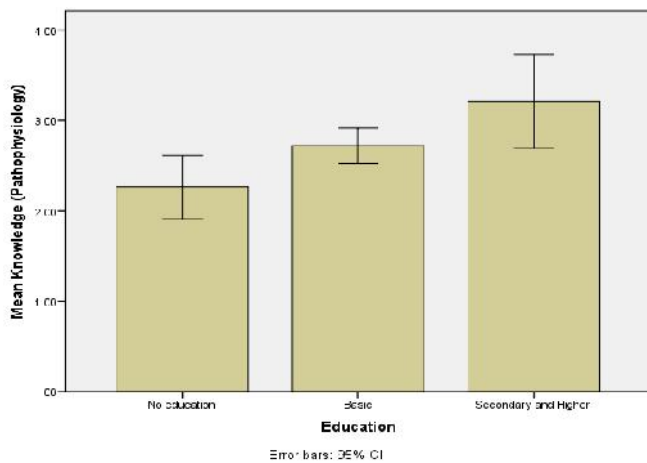
**Table 2: Perceptions on risk among different education group strata**

Variable	(I) education	(J) education	P-Value*
Risk perceptions on extreme complications of diabetes	No education	Basic	0,716
		Secondary and Higher	0,231
	Basic	No education	0,716
		Secondary and Higher	0,385
	Secondary and Higher	No education	0,231
		Basic	0,385
Risk perceptions on Pathophysiology	No education	Basic	0,079
		Secondary and Higher	0,006
	Basic	No education	0,079
		Secondary and Higher	0,139
	Secondary and Higher	No education	0,006
		Basic	0,139
Risk Factors associated with diabetes	No education	Basic	0,775
		Secondary and Higher	0,229
	Basic	No education	0,775
		Secondary and Higher	0,337
	Secondary and Higher	No education	0,229
		Basic	0,337

Commented [H1]: Note at the end of this table explaining what (i) education and (j) education are is absolutely vital!!!

\*Tukey's HSD test for pair-wise comparisons was used. Note: (I) Education and (J) Education indicate which pair is being compared.

**Figure 2: Differences between education levels and perceptions on risk**



A third possible exploratory explanation for the link between educational levels and risk of getting diabetes was performed regarding health screening. The education level was found to not differ significantly amongst the non-health screening and health screening groups of subjects ( $p=0,832$ , Kruskal-Wallis test). These results indicate that the link between education levels and prevention of a disease such as diabetes is complex. This is confirmed by the fact that no significant differences were found between the risk-aware and the non-risk-aware subjects on most prevention-related variables, except for physical activity level and type of drinks consumed ( $p<0,05$ ).

Yet, significant differences were found between the screening and non-screening groups regarding their risk scores ( $p<0,001$ ), with the group of subjects who perform health screening having a higher mean score on the risk scale. Moreover, subjects who perform regular health screening (at least once a year) have more preventive behaviors when compared to subjects who disregard health screening. Specifically, they eat more often each day ( $p<0,005$ , with 95 subjects on the health screening group having 5-6 meals each day, versus 2 subjects on the non-health screening group), eat more units of fruit each day ( $p<0,05$ , 16 subjects on the  $>5$  category for the health screening group versus 2 subjects on the non-screening group), and drink more water ( $p<0,005$ , 39 subjects on the  $>1,5L$  category for the health screening group, versus 10 subjects for the non-screening group).

The fact of being at risk associated with health screening behavior leads to more prevention independently of education levels. The explanation of the link between education levels and risks of getting diabetes remains to be explored in future studies with a greater sample. As this is an exploratory observational study, it is not possible to single out the effect of each variable and establish a cause-effect relationship. Future studies are needed to better assess this relationship, but at this stage, it is possible to confirm the existence of an association between limited education and risk of getting the disease.

### **3. Discussion and conclusions**

This study focuses on the elderly population, an age strata with the highest incidence of diabetes among all age strata. A 2011 report indicates that 27% of the Portuguese population in the 60-75 year-old strata is afflicted with diabetes, with a prevalence of 13% in the 40-59 year-old strata and 2% in younger subjects (31). These, as other reports emphasized that patients' educational levels must be considered in the care and information of patients with chronic diseases such as diabetes (e.g, 18). However, this is the first study, to the best of our knowledge that empirically demonstrates the link between educational level and risk of getting diabetes.

Despite the existence of a correlation between education levels and risk of getting diabetes, a significant relationship between risk perception associated with diabetes and preventive behavior was found to be limited. These results need to be interpreted carefully. It could be argued that as this population does not know much on risk factors there is no association between perceptions on risk factors and prevention. Alternatively,



it might be suggested that perhaps there is a greater level of complexity at stake (see 27). The analysis shows that people more at risk of having diabetes go engage more often in health screening, and that those that engage more in health screening are the ones doing more prevention. In other words, people almost do not do prevention, they do it only when they are at risk. The prevention behaviors of those more educated are indistinguishable of those less educated. This suggests that there is an important gap at this level and that there is need for risk education concerning diabetes, which is known to be successfully carried out through campaigns, namely with regard to risk factors as a recent study in China has shown (31). The fact that no relation was found between education and preventive behavior may also be related with lack of health literacy. A recent study demonstrated that health literacy is positively correlated with the adoption of risk modifiable behaviors (32), leading us to argue that educated and less elderly educated people at risk continues to lack health literacy.

While exploring how education levels affect the risk of getting diabetes, it was found that the impact of education on perceptions and on behaviors is dissimilar highlighting the complexity of this relation. This complexity is further underlined by the fact that no correlation was identified between risk awareness, preventive behaviors and health outcomes. This complexity at the level of primary intervention might be associated with the fact that these variables might correlate with each other in some settings but not in others, as suggested by studies focused on secondary and tertiary intervention (e.g. 28). One of the boundaries conditions found in the latter studies, concerns the need for health awareness programs for the minorities.

In addition to these results, this study also presents preliminary evidence of new ways to assess risk perception associated with diabetes for elderly people. This study indicates that typologies of risk perception (risk factors, pathophysiology and the consequences and the diseases) could be taken into account. By using these typologies, a better understanding on how risk perceptions are structured can be achieved. The same holds true regarding the creation of design scales that capture differences and similarities in this population in this group and consequently design more effective prevention programs.

On what concerns the study limitations. First, the generalizability of our findings cannot be easily discerned. For this reason larger scales trial as well as trials that identify better differences across groups with different educational levels to test the relationship between awareness of risks and preventive behavior is needed. Yet limited educational levels especially among the elderly population must be considered in patient education. By studying this relationship, some of the most promising areas for intervention research start to be highlighted as well as important gaps in our current understanding of the pathways linking education and health.

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