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***Cardiovascular and diabetes future risks in Primary Health Care,
study in Centre Portugal***

***Risco futuro de doença cardiovascular e de diabetes em
Cuidados Primários no Centro de Portugal***

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***Cardiovascular risk and diabetes risk in Primary Health Care,
study in Centre Portugal***

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ABSTRACT

Introduction: Cardiovascular diseases are the first cause of death worldwide. Type 2 diabetes is an increasingly prevalent disease with severe cardiovascular outcomes. There is scarce data relating the future of diabetes and cardiovascular risk, simultaneously. This project aimed to study the relationship between diabetes and cardiovascular risk, using FINDRISC and Framingham risk score, in the Portuguese primary health care population in central Portugal.

Methods: Cross-sectional observational study of anonymous data for sex, specific site of residence and age of FINDRISC and the Framingham risk, from three randomised Primary Health Centre Clusters in central Portugal. Data were retrieved from the clinical records software, in 2014 and 2019, for the population aged between 40 and 65 years old living in three Administrative Primary Health Centre Clusters. Descriptively and inferentially study of variables was made with non-parametric tests and Spearman correlation, a $p < 0.001$ being defined for difference.

Results: Data from 2014 and 2019 showed no difference for sex and age. The majority of the population in both years had a low cardiovascular risk level. In 2019, the high cardiovascular risk made its debut. A decrease in very low risk from 2014 to 2019 (8.9% to 6.9%) was noticed. For FINDRISC, a decrease in very low risk was found from 2014 to 2019 (38.2% to 18.2%). Oppositely, an increase in low, moderate and high risk was observed in this period. Very high risk was the least frequent risk in both years. The correlation between diabetes and cardiovascular risks reveals a weak, yet significant relation, similar in both years ($\rho = 0.09$, $p < 0.001$ in 2014 and $\rho = 0.091$, $p < 0.001$ in 2019). The correlation between calculated frequencies for each one of the risks in the two years was important and significant, FINDRISC being the one with the highest value ($\rho = 0.538$, $p < 0.001$ for Framingham risk and $\rho = 0.706$, $p < 0.001$ for FINDRISC). The calculated frequency of Framingham risk and FINDRISC' questionnaires being filled by each year, showed a very small proportion in 2014 and a much greater one in 2019, still falling short from what was expected. A growth dynamic of + 71.3% for Framingham risk and of + 86.8% for FINDRISC was observed from 2014 to 2019.

Discussion:

The study intended to raise awareness about cardiovascular and diabetes risks, both in a 10 years future lifespan, with the purpose of leading to the reinforcement of earlier individual prevention programs.

Despite the impressive fulfilling of both risks by doctors, such a task still has an enormous growth potential. Professionals should be motivated to enable their patients towards the achievement of a healthier life-style, thus reducing comorbidities and mortality due to cardiovascular diseases and diabetes.

Conclusion: General Practitioners/Family Doctors in central Portugal should be motivated not only for the filling of FINDRISC and cardiovascular risk' questionnaires, but also to the enablement of their patients' health style. More studies using a similar methodology should be encouraged.

Key words:

Cardiovascular Risk, Framingham Risk, Diabetes Risk, FINDRISC, General Practice, Primary Care.

RESUMO

Introdução: As doenças cardiovasculares são consideradas a primeira causa de morte, a nível mundial. A diabetes mellitus tipo 2 é uma doença de prevalência crescente, associada a consequências cardiovasculares bem documentadas. Existe informação escassa quanto à relação entre o risco futuro de doença cardiovascular e de diabetes, em simultâneo. O presente estudo pretendeu analisar o risco de diabetes e de doença cardiovascular, com recurso ao FINDRISC e Framingham risk score, no seio da Medicina Geral e Familiar na região centro de Portugal.

Métodos: Estudo observacional transversal dos dados obtidos em anonimato quanto ao sexo, idade e local específico de residência, no Agrupamento de Centros de Saúde, para FINDRISC e Framingham risk. Para tal, foram selecionados 3 Agrupamento de Centros de Saúde na área geográfica da Administração Regional de Saúde do Centro. Os dados foram coletados a partir do programa de registos SClinico, nos anos de 2014 e 2019, sendo a população entre os 40 e 65 anos de idade a escolhida. Foi feita uma análise descritiva e inferencial por testes não paramétricos e correlação de Spearman, definindo-se para significado o $p < 0.001$.

Resultados: Não se verificaram diferenças quanto à idade e sexo em ambos os anos avaliados. A maioria da população tinha risco cardiovascular baixo, em ambos os anos de estudo. Em 2019, o risco cardiovascular alto teve o seu aparecimento. Para o FINDRISC, entre 2014 e 2019, pôde constatar-se uma ligeira descida do grau muito baixo risco (38.2% to 18.2%), em oposição aos restantes riscos. O risco muito alto foi nos dois anos de observação o menos encontrado. A correlação entre diabetes e o risco cardiovascular foi baixa, ainda assim significativa, semelhante em ambos os anos ($\rho = 0.09$, $p < 0.001$ em 2014 e $\rho = 0.091$, $p < 0.001$ em 2019). A correlação entre as frequências em cada ano foi importante e significativa ($\rho = 0.538$, $p < 0.001$ para Framingham risk e $\rho = 0.706$, $p < 0.001$ para FINDRISC). Os números absolutos e frequência revelam um crescimento evidente entre ambos os anos, ainda assim inferior ao desejável, com uma dinâmica de crescimento de +71.3% para o Framingham risk e de 86.8% para o FINDRISC.

Discussão:

Este estudo visava conhecer o estado de preenchimento do risco a prazo de 10 anos de diabetes e de doença cardiovascular e assim consciencializar, com o propósito da possível melhoria a nível de programas de prevenção individuais precoces.

Um incremento no preenchimento do programa de registos pelos médicos de Medicina Geral e Familiar será fator de redução da incidência de riscos para ter doença, almejando-se ainda maiores valores atualizados de riscos. Assim, os profissionais deverão continuar a ser motivados no sentido da educação dos seus pacientes, incentivando-os à adoção de estilos vida mais saudáveis. Desta forma, a incidência de doença e as consequências em saúde das doenças cardiovasculares e diabetes poderiam ser mitigadas.

Conclusão: Os médicos de Medicina Geral e Familiar da região central de Portugal continental devem ser instigados não só a preencher os questionários do FINDRISC e do risco cardiovascular na sua prática clínica, como também a realizar a educação dos seus doentes para a adoção de estilos de vida mais saudáveis. Estudos com recurso à presente metodologia deverão ser fomentados.

Palavras chave:

Risco cardiovascular, Risco de diabetes, Medicina Geral e Familiar, Cuidados de Saúde Primários, FINDRISC, Framingham risk

INTRODUCTION

The relationship between diabetes and cardiovascular disease has been confirmed in several reports. (1),(2),(3),(4),(5) In fact, Larsson et al studied the association of type 2 diabetes mellitus with an increased risk of heart disease, heart failure, ischemic stroke and aortic valve stenosis. (1) It is well known that cardiovascular disease is the main cause of death among patients with type 2 diabetes mellitus. (2)

Data relating the risk of developing type 2 diabetes mellitus and the cardiovascular risk, simultaneously, are scarce. López-González AA et al selected patients from Mediterranean Spain who had not been previously diagnosed with diabetes, in order to study the relationship between diabetes and cardiovascular risks. A slight relation between the two risks was found, with more studies being necessary to support such relation. (6) Fahim Abbasi et al studied the possibility of an augmented risk of type 2 diabetes mellitus and cardiovascular disease in apparently healthy individuals who were submitted to an oral glucose test. An increased risk to develop T2DM and/or CVD was found by using a blood plasma glucose concentration highest than 154.8mg/dL, being observed particularly in individuals identified as having an impaired fasting glucose. (7)

Cardiovascular predictor models, based on risk factors, are considered important tools for prevention management and prediction of cardiovascular outcomes. (8) Age, gender, ethnicity, smoking, lipid levels, hypertension, diabetes, obesity, diet, physical activity, alcohol consumption and psychosocial factors can determine an increased risk of developing cardiovascular disease. The 10-year Framingham risk score is probably the most widely used, with age, gender, blood pressure, total cholesterol, high-density lipoprotein (HDL), diabetes and smoking being the risk factors taken into account. (8),(9) This score is divided into three different levels: low, moderate and high. Several other modified versions of the 10-year Framingham Risk calculator equation are used in the identification of high risk population in clinical practice, such as QRISK model, ASSIGN, Reynold Risk and Atherosclerotic Cardiovascular Disease (ASCVD) risk score calculator. (10),(8)

Diabetes is a silent condition and its diagnosis is frequently made in routine medical work outs with blood tests ordered out of context. In most cases, the intermediate hyperglycaemia precedes diabetes in the form of impaired glucose tolerance, impaired fasting glucose or both and it can be detected by a blood sample. (11) The goal is to establish a diagnosis before the macro and microvascular complications settle down, as a tertiary preventive health care attitude. (12) Diabetes risk scores have been drawn and validated, in order to select individuals at high risk to develop diabetes, Finnish Diabetes Risk Score (FINDRISC) being one of them

widely used. (13),(14) FINDRISC is based on filling an 8 topics questionnaire for age, body mass index, waist circumference, physical activity (more than 30 min every day, including time spent on common daily life activities), daily consumption of vegetables, fruits and berries, use of hypertension medication, history of high blood glucose (for example: on a check-up routine, during pregnancy or illness) and family history of type 1 or 2 diabetes mellitus. FINDRISC is subdivided into 5 categories, from very low to very high levels of developing type 2 diabetes mellitus in 10 years. (6),(11). It has not yet been validated for the Portuguese context, but it has been set in the clinical software used in General Practice/Family Medicine. (13)

Some of the risk factors taken into account in the Framingham risk Score and FINDRISC overlap. Diabetes is part of the Framingham 's criteria, and it is worth noticing the majority of the included risk factors are modifiable. The study of such association might lead to the reinforcement of earlier prevention programs and consequently to the reduction of comorbidities and comorbidities due to cardiovascular diseases and diabetes. This project aimed to study the relationship between the diabetes and cardiovascular risk, using FINDRISC and Framingham risk Scores, in the Portuguese population, since no studies in the Portuguese review literature were found.

METHODS

An observational cross-sectional study was performed studying anonymous data gathered by the informatics computer services of the central of Portugal National Health Service Administration, after an ethics consent was granted. Data for sex, specific site of residence and age was gathered in anonymity. In the Portuguese National Health Service there are 5 main health regions and inside them several Administrative Primary Health Centre Clusters exist. Data from FINDRISC and the Framingham risk of 2014 and 2019 has been collected from all the population aged between 40 and 65 years old and living in three Administrative Primary Health Centre Clusters randomly selected to represent the population from the sea-shore to the border with Spain, in the Centre Health Region of the National Health Service. Both FINDRISC and Framingham risk are part of medical records software used in the Portuguese Primary Care, the SClínico, which is filled in when a General Practitioner/Family doctor assesses them. Part of the data is automatically filled in, with the remainder being registered by the clinician. Data was received in an Excel file later up-loaded in a SPSS vs 21 to be studied descriptively and inferentially by non-parametric tests and Spearman correlation, with a $p < 0.001$ being defined for difference.

RESULTS

Data from the Administrative Primary Health Centre Clusters of Baixo Mondego, Cova da Beira e Pinhal Interior Norte were studied.

In 2014, 230821 individuals, aged between 40 and 65 years, were reported, 112874 (48,9%) males, the youngest population representing 40.3% and the oldest 21.3%. The 2019 data reported 217636 individuals, 104983 (48.2%) males, the youngest representing 40.4% and the oldest 21 %, according to table 1.

Table 1: Distribution by Administrative Primary Health Centre Clusters of sex and age in 2014 and 2019.

2014		Baixo Mondego N (%)	Pinhal Interior Norte N (%)	Cova da Beira N (%)	Total N (%)
Sex	Male	71193 (48.2)	24291 (50.2)	17390 (49.9)	112874 (48.9)
	Female	76410 (51.8)	24105 (49.8)	17432 (50.1)	117947 (51.1)
Age	40-49	59999 (40.6)	19570 (40.4)	13363 (38.4)	92932 (40.3)
	50-59	56146 (38.0)	18775 (38,8)	13897 (39.9)	88818 (38.5)
	60-65	31458 (21.3)	10051 (20.8)	7562 (21.7)	49071 (21.3)
Total		147603	48396	34822	230821
2019					
Sex	Male	66011 (47.5)	22748 (49.5)	16224 (49.4)	104983 (48.2)
	Female	72860 (52.5)	23186 (50.5)	12643 (38.5)	112653 (51.8)
Age	40-49	56574 (40.7)	18780 (40.9)	13363 (38.4)	87997 (40.4)
	50-59	53012 (38.2)	17819 (38.8)	13199 (40.2)	84030 (38.6)
	60-65	29285 (21.1)	9335 (20.3)	6989 (21.3)	45609 (21.0)
Total		138871	45934	32831	217636

Cardiovascular risk had been assessed by the Framingham risk score for a total of 8469 individuals. Table 2 shows that the vast majority of these individuals had a low calculated CVD risk (91.1%). Using FINDRISC and according to table 2, in 2014 all the categories of FINDRISC were represented, very low (38.2%) and low (25.6%) grades being the most represented ones.

Table 2: Cardiovascular risk score registered in the three Administrative Primary Health Centre Clusters in 2014.

		Baixo Mondego N (%)	Pinhal Interior Norte N (%)	Cova da Beira N (%)	Total N (%)
Cardiovascular Risk 2014	Low	5647 (92.0)	1606 (90.3)	466 (84.0)	7719 (91.1)
	Moderate	488 (8.0)	173 (9.7)	89 (16.0)	750 (8.9)
Total		6135	1779	555	8469
FINDRISC 2014	Very low	970 (25.4)	1108 (64.0)	163 (50.0)	2241 (38.2)
	Low	1116 (29.3)	316 (18.3)	69 (21.2)	1501 (25.6)
	Moderate	778 (20.4)	150 (8.7)	43 (13.2)	971 (16.5)
	High	770 (20.2)	770 (20.2)	46 (14.1)	952 (16.2)
	Very High	180 (4.7)	20 (1.2)	5 (1.5)	205 (3.5)
Total		3814	1730	326	5870

The levels of future diabetes and cardiovascular risk presented in the 2019 data are shown in table 3. High risk of diabetes now exists for 3.2% of the population. Very high risk for

cardiovascular outcomes now exists for 1.9% of the population and the majority continues to present it in a low level (91.2%).

Table 3: Cardiovascular risk score registered in the three Administrative Primary Health Centre Clusters in 2019.

		Baixo Mondego N (%)	Pinhal Interior Norte N (%)	Cova da Beira N (%)	Total N (%)
Cardiovascular Risk 2019	Low	18686 (91.5)	5601 (91.5)	2072 (87.6)	26359 (91.2)
	Moderate	1379 (6.8)	408 (6.7)	211 (8.9)	1998 (6.9)
	High	362 (1.8)	115 (1.9)	82 (3.5)	559 (1.9)
Total		20427	6124	2365	28916
FINDRISC 2019	Very low	5514 (18.1)	1573 (19.4)	764 (17.2)	7851 (18.2)
	Low	11404 (37.4)	2852 (35.1)	1603 (36.0)	15859 (36.8)
	Moderate	6472 (21.2)	1798 (22.1)	979 (22.0)	9249 (21.5)
	High	6101 (20.0)	1716 (21.1)	929 (20.9)	8746 (20.3)
	Very High	1020 (3.3)	182 (2.2)	177 (4.0)	1379 (3.2)
Total		30511	8121	4452	43084

The Spearman correlation was used to study the relation between Framingham risk and FINDRISC in both years. Table 4 shows a very weak yet significant correlation between the risk indicators in each year, 2014 and 2019 ($\rho=0.09$, $p<0.001$, $\rho =0.091$, $p<0.001$, $p<0.001$, respectively), the difference between the two years being almost irrelevant. On the other hand,

an important significant correlation between 2014 and 2019 for both indicators, Framingham risk and FINDRISC, has been observed. ($\rho = 0.538$, $p < 0.001$, $\rho = 0.706$, $p < 0.001$, respectively), the FINDRISC being the most meaningful one.

Table 4: Correlation between Framingham risk and FINDRISC in 2014 with 2019.

	FINDRISC 2014
Framingham Risk 2014	$\rho = 0.09$, $p < 0.001$
	FINDRISC 2019
Framingham Risk 2019	$\rho = 0.091$, $p < 0.001$
	Framingham Risk 2019
Framingham Risk 2014	$\rho = 0.538$, $p < 0.001$
	FINDRISC 2019
FINDRISC 2014	$\rho = 0.706$, $p < 0.001$

Table 5 reveals that the frequency by each year of the calculation of both risks has a very small proportion in 2014 and a much greater one in 2019, still falling short from what was expected.

Table 5: Framingham Risk and FINDRISC's frequency by year of calculation.

	Frequency by year of calculation
Framingham Risk 2014	8469/230821=3.7%
FINDRISC 2014	5870/230821=2.5%
Framingham Risk 2019	29819/230821=12.9%
FINDRISC 2019	43911/230821=19.0%

The growth dynamic between 2014 and 2019, shown in table 6, both in absolute numbers and in frequency, noticed a very strong growth, FINDRISC being the higher one.

In spite of observing positive growth dynamics, negative growth dynamic of 16% have been found between 2014 and 2019 for very low and low risk relative frequencies, while positive growth dynamic of 21.8% have been detected in this period of time for moderate and high risk, for FINDRISC, as it can be seen in table 6.

Moreover, table 6 shows a positive growth dynamic for low risk of 0.001% and a negative one for moderate risk of 29.0% from 2014 to 2019, for Framingham risk.

Table 6: Framingham Risk and FINDRISC’s absolute numbers and frequency values of growth dynamic between 2014 and 2019.

	Absolute numbers of growth dynamic (%)
Framingham Risk	$(29819-8469) / 29819 = +71.6$
FINDRISC	$(43911-5870) / 43911 = +86.7$
	Frequency values of growth dynamic
Framingham Risk	$(12.9-3.7) / 12.9 = 71.3$
FINDRISC	$(19-2.5) / 19 = 86.8$
	FINDRISC frequency values of growth dynamic (%)
Moderate and high	$[(21.5+20.3) - (16.5+16.2)] / (21.5+20.3) = + 21.8$
Very low and low	$[(18.2+36.8) - (38.2+25.6)] / (18.2+36.8) = - 16$
	Framingham Risk frequency values of growth dynamic (%)
Low	$(91.2-91.1) / 91.2 = +0.00001$
Moderate	$(6.9-8.9) / 6.9 = - 29.0$

DISCUSSION

This study was based on data from a large population of the centre of Portugal aged from 40 to 65 years old living in three Administrative Primary Health Centre Clusters, Baixo Mondego, Cova da Beira e Pinhal Interior Norte.

Data in 2014 and 2019 showed no difference between the population variables, sex and age, comparing both years of recoil.

This study intended not only to raise awareness about cardiovascular and diabetes risks in a 10 years future lifespan, but also to understand if General Practitioners/Family Doctors had become more aware of the importance of filling in the FINDRISC.

The majority of the population in both years had a cardiovascular risk in a low level. In 2019, the high cardiovascular risk grade made its debut. All the grades of the FINDRISC were present in both years. A decrease in the prevalence of very low FINDRISC and a rise in low, moderate and high risk was observed when comparing 2014 and 2019. In 2019, low grade risk was the outstanding one. Very high grade was the least frequent risk in both years.

In fact, the growth dynamics between 2014 and 2019 show a notable increase. Such growth dynamics are probably explained by an improvement in the filling of the medical records software program by General Practitioners. Even though such growth dynamics were found, the frequency in which these are filled still has an enormous growth potential. Particularly, absolute numbers as well as frequency growth dynamic for FINDRISC are considerably more elevated comparing to cardiovascular risk ones, which may be justified by a higher search for diabetes risk in comparison with the cardiovascular risk.

Besides, a positive growth dynamic of 21.8 was found from 2014 to 2019 in the sum of the relative frequencies of moderate and high risk. Inversely, a negative growth dynamic of 16 was found between 2014 and 2019 for very low and low risk relative frequencies. For instance, an increase in the most harmful grades of the FINDRISC can be pointed out.

On the other hand, it happens that cardiovascular risk's relative frequency points a positive growth dynamic for low risk of 0.0001 % and a negative one for moderate risk of 29,0 % from 2014 to 2019 with the appearance of high risk in 2019. In other words, it has been noticed a decrease in the noxious grades of the Cardiovascular Risk, excluding the onset of high risk in 2019.

In fact, it is not only important to know this value, but also to make the person aware of the most important life-style changes that can reduce the risk, through enablement. Indeed,

General Practitioners/Family Doctors must support their patients' autonomy, preparing them towards a knowledgeable self-management of a healthier life style. (17),(18),(19),(15),(16)

This study also aimed to correlate cardiovascular and diabetes risks. The correlation between the two risks indicates a weak, yet significant relation, being similar in both years. On the other hand, the correlation between each one of the risks in the two years was important and significant, with FINDRISC registering the highest correlation between the two years.

Diabetes is one of the items involved in the present cardiovascular risk assessment and taking anti-hypertensive medication is part of the 10 years risk assessment of developing diabetes. Additionally, high blood pressure is part of the Framingham risk criteria. In fact, most of the risk factors used to predict the cardiovascular and diabetes risk are modifiable. So, in the context of the Portuguese medical records software, the SClinico, one would expect more doctors to be motivated for risk calculation. Such a task can have an important impact on cardiovascular outcomes, both of arterial hypertension and diabetes, which, in the end, also has cardiovascular outcomes. The present results also raise the utmost question about the reasons why an increase in cardiovascular risk as well as diabetes risk was found.

No previous studies in the Portuguese literature, nor any reports on the studied relation have been found, using a methodology like the present one. López-González ÁA et al selected patients from Mediterranean Spain without a previous diagnose of diabetes, in order to study the relationship between diabetes and cardiovascular risk, identifying a slight relation between the two risks. (6) Fahim Abbasi et al studied the possibility of an augmented risk of type 2 diabetes mellitus and cardiovascular disease in apparently healthy individuals who were submitted to an oral glucose test, with an increased risk of developing T2DM and/or CVD, being reported particularly in individuals identified as having an impaired fasting glucose. (7)

As limitations of this study, the high number of missing cases, in both years, along with the difference between members of both populations are to be cited. The present results cannot be generalised to the entire Portuguese population.

Due to informatic problems, the two populations are different. Only hard values and relative frequencies could be studied. In particular, all those individuals that were close to 65 years old in 2014 were not studied in 2019. Moreover, in each year of observation many new patients entered the population. Furthermore, at first instance this study aimed to study data from 2009 and 2019. Since it could not be collected an enough amount of information in 2009, due to a deficient informatization of medical records system at that time, the study had to be adapted. Therefore, the most recently data available was respective to 2014.

Nevertheless, this study is about large populations in a General Practice/Family Medicine context, and it reveals the awareness of doctors for preventive medicine, a core matter in this medical speciality in Primary Care, that must be even more uplifted. (20) In fact, despite there are already protocols that guide the follow up personalized of the patients at risk for cardiovascular disease and diabetes in the Portuguese primary health care, those should be incremented. (15),(16)

CONCLUSION

In a big data study, a weak, yet significant correlation between cardiovascular disease and diabetes was found. A noticeable increase in growth dynamics was detected. However, frequency of the filling of questionnaires still has an enormous growth potential. Therefore, clinical doctors should be motivated not only to filling FINDRISC and cardiovascular risks' questionnaires, but also to the enablement of their patients' healthier life-style.

The study of future cardiovascular and diabetes risks association might raise the awareness to the reinforcement of earlier effective prevention programs in Clinical Practice and consequently to the reduction of comorbidities and mortality due to cardiovascular diseases and diabetes.

More studies using a similar methodology should be encouraged. In particular, it could be applied a follow-up study, since in the present one it had not been possible to study all the population during the period of time established.

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