Preliminary Study of the Use of the WATCH-DM Score in Type 2 Diabetes

Estudo Preliminar do Uso do "Score" WATCH-DM na Diabetes Tipo 2

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Abstract

Introduction: Type 2 diabetes *mellitus* is considered a 21st century preventable epidemic. WATCH-DM score predicts the risk of type 2 diabetes *mellitus* patients of developing heart failure within 5 years.
Objectives: Characterization of type 2 diabetes *mellitus* patients followed in Diabetes' appointment and application of WATCH-DM score.
Material and Methods: Retrospective, observational study of patients followed by an Internal Medicine specialist in the Diabetes' appointment of a Portuguese hospital. By accessing the clinical file, with emphasis on the last evaluation between 2022 - 2023, the following parameters were obtained: year of appointment, sex, record of risk factors and cardiovascular diseases, the elements of WATCH-DM score.
Results: A sample of 52 patients was obtained, with a mean age of 71 years, with male predominance (*n* = 34, 65.4%). The most prevalent associated cardiovascular comorbidities were arterial hypertension (*n* = 47, 90.4%) and dyslipidaemia (*n* = 43, 82.7%). By applying the WATCH-DM score, we concluded that 67.3% (*n* = 35) of the sample presented a high to very high risk of developing heart failure.
Conclusion: The WATCH-DM score presents itself as a recent, simple, and useful tool in the Diabetes' appointment. This highlights the interconnection of cardiovascular pathologies, requiring an active role in its prevention.

Keywords: Type 2 diabetes *mellitus*; Heart failure; WATCH-DM score

Resumo

Introdução: A diabetes *mellitus* tipo 2 é considerada uma epidemia do século XXI passível de prevenção. O score WATCH-DM prediz o risco de doentes com diabetes *mellitus* tipo 2 desenvolverem insuficiência cardíaca a 5 anos.
Objetivos: Caracterização de doentes com diabetes *mellitus* tipo 2 seguidos em consulta de Diabetes e aplicação do score WATCH-DM.
Material e Métodos: Estudo retrospetivo, observacional, de doentes seguidos por um especialista de Medicina Interna na consulta de Diabetes de um hospital português. Através da consulta do processo clínico, com ênfase para a última avaliação entre 2022 - 2023, foram obtidos os seguintes parâmetros: ano da consulta, sexo, história de fatores de risco e doenças cardiovasculares, elementos do score WATCH-DM.
Resultados: Obteve-se uma amostra de 52 doentes, com idade média de 71 anos e predomínio do sexo masculino (*n* = 34, 65,4%). As comorbilidades cardiovasculares mais prevalentes associadas foram hipertensão arterial (*n* = 47, 90,4%) e dislipidemia (*n* = 43, 82,7%). Aplicando o score WATCH-DM, concluiu-se que 67,3% (*n* = 35) da amostra apresentava um risco alto a muito alto de desenvolver insuficiência cardíaca.
Conclusão: O score WATCH-DM apresenta-se como uma ferramenta recente, simples e útil para aplicação na consulta de Diabetes. Este destaca a interligação com patologia cardiovascular, impondo uma intervenção ativa na sua prevenção.

Palavras-chave: Diabetes *mellitus* tipo 2; Insuficiência cardíaca; *score* WATCH-DM.

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> INTRODUCTION

Type 2 diabetes *mellitus* is considered a 21st century preventable epidemic. According to the International Diabetes Federation, in 2021 an estimated 537 million people worldwide were living with diabetes, with 61 million cases in Europe, being the most prevalent type 2 diabetes. [1]
The WATCH-DM score is a machine learning-derived risk score, included in the 2023 European Society of Cardiology Guidelines for the management of cardiovascular disease in patients with diabetes, which predicts the

risk of developing heart failure within 5 years in type 2 diabetes *mellitus* patients. [2,3]

To calculate WATCH-DM score it is necessary the following elements: weight and height (body mass index), age, systolic and diastolic blood pressure, creatinine, fasting plasma glucose (diabetes control), high density lipoprotein (HDL) cholesterol, QRS duration in electrocardiogram (ECG), prior history of myocardial infarction, and prior history of coronary artery bypass graft surgery. [2] One unit increment in the risk score is associated with a 24% higher heart failure risk within 5 years. [2]

The approach to type 2 diabetes *mellitus* has evolved throughout time, emphasising the importance of preventing cardiovascular events and the development of comorbidities, such as heart failure, by monitoring and reducing risk factors.

> OBJECTIVES

Characterization of a sample of type 2 diabetes *mellitus* patients followed by an Internal Medicine specialist in the Diabetes' appointment and application of WATCH--DM score, in order to predict the risk of heart failure within 5 years.

> METHODS

An observational, retrospective study was conducted on patients followed by an Internal Medicine specialist in the Internal Medicine – Diabetes consultation of a Portuguese hospital in 2022.

The data was obtained by accessing the patient's clinical file, with emphasis given on the last evaluation in Diabetes' consultation, even if this last evaluation had occurred in 2023.

We collected the data concerning: epidemiological specifics (sex and age), personal history detailing the existence of risk factors and cardiovascular diseases, namely arterial hypertension, dyslipidaemia, overweight, obesity, smoking, coronary disease and, when needed, type of revascularization conducted, cerebrovascular event (stroke or transient ischaemic attack), pulmonary embolism, peripheral artery disease, chronic kidney disease (its stage according to the 2021 CKD-EPI creatinine equation and microalbumin/creatinine ratio, in occasional urine, whenever available), as well as component elements of the WATCH-DM score (age, body mass index, systolic and diastolic blood pressure, QRS duration, fasting plasma glucose, creatinine, HDL cholesterol, history of acute myocardial infarction, coronary artery bypass graft surgery).

The exclusion criteria were: non-existence of type 2 diabetes *mellitus* diagnosis; an established diagnosis of heart failure expressed in the patient's clinical file; absence of electrocardiogram after 2020 and absence of analytical parameters after 2021. The exclusion criteria's timeline for electrocardiogram and analytical parameters was defined by the fact that blood sample analysis might change faster in time than electrocardiogram characteristics, and by the fact that it is more feasible requesting serial laboratory workup concerning subsequent patient's appointments than serial electrocardiograms (taken into consideration the time slots available for electrocardiography in the hospital).

The processing of data and their statistical analysis (mean, maximum and minimum values, and global percentages of the evaluated elements) was performed by using Microsoft Excel®.

This study was carried out in accordance with the Helsinki Declaration of Ethical Principles for Medical Research, with patients and their data undergoing patient anonymity.

> RESULTS

From the primary sample of 119 patients, by applying the exclusion criteria, it was gathered a final sample of 52 patients.

When applying the previously described exclusion criteria, 5 patients were not considered due to having other forms of diabetes, namely, latent autoimmune diabetes (n = 2), type 1 diabetes (n = 2) and glucocorticoid-induced diabetes (n = 1); 13 patients were excluded for having already a diagnosis of heart failure; 36 patients were excluded for not having a recent electrocardiogram and 13 patients for not having recent analytical parameters (Figure 1).

Analysing the final sample by time of last consultation, 19 patients (36.5%) were observed in 2022 and most of them, 33 patients (63.5%) in 2023.

Patients were predominantly male (n = 34, 65.4%) and had a mean age of 71 years, with a minimum age of 48 years and a maximum age of 87 years. Female patients' age ranged between 48 to 87 years with a mean age of 72 years, while male patients' age ranged between 55 to 85 years with a mean age of 70 years. When grouping the patients by age range, most patients were between 70 to 79 years of age (n = 19, 36.5%) (Figure 2).

The most prevalent cardiovascular diseases were: arterial hypertension (n = 47, 90.4%) present in almost every patient of the sample obtained, followed by dyslipidaemia (n = 43, 82.7%). Furthermore, 24 patients (46.2%)
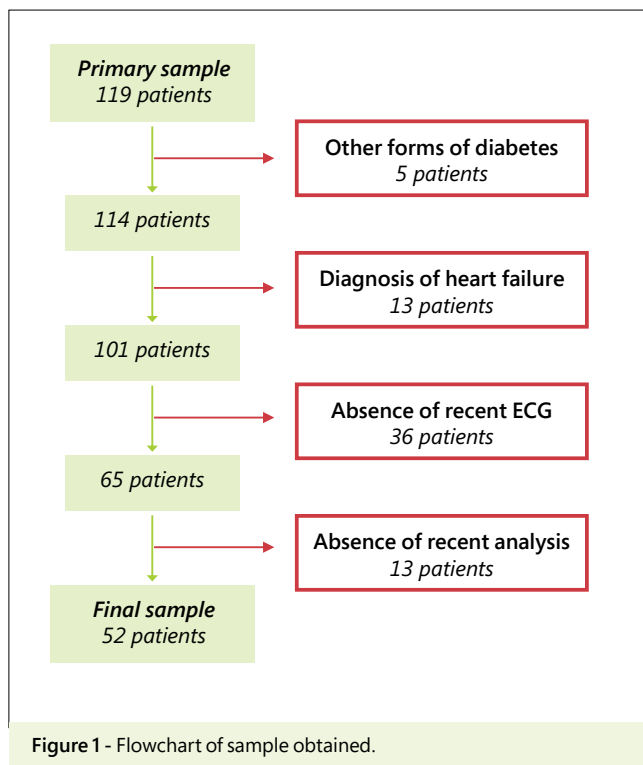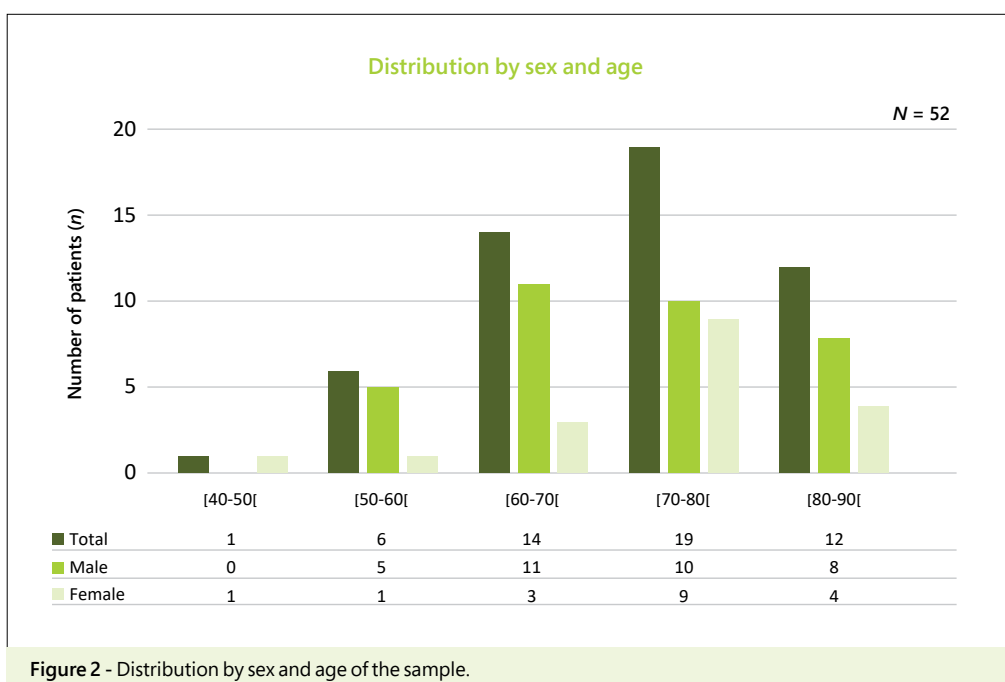
Figure 1 - Flowchart of sample obtained.

Occasional urine microalbumin/creatinine ratio was available in 46 out of the 52 patients (88.5%). This ratio was normal to mildly increased (stage A1) in 20 patients (38.5%), moderately increased (stage A2 - microalbuminuria) in 18 patients (34.6%) and severely increased (stage A3 - macroalbuminuria) in 8 patients (15.4%).

To a smaller extent, 6 patients had history of coronary disease (11.5%), half of them (n = 3) had myocardial infarction which underwent percutaneous coronary intervention, 6 patients (11.5%) had history of cerebrovascular disease whether in a form of transient ischaemic stroke or stroke, 4 patients (7.7%) had peripheral arterial disease and 1 patient (1.9%) had previous pulmonary embolism.

It is noteworthy that all 52 patients had at least one cardiovascular risk factor/disease beyond type 2 diabetes. Furthermore, by making a quantitative appreciation of the latest, it can be said that 5 patients (9.6%) had two cardiovascular risk factors/diseases, 19 patients (36.5%) had three, 16 patients (30.8%) had four, 9 patients (17.3%) had five, 2 patients (3.8%) had six and, finally, 1 patient (1.9%) had seven cardiovascular risk factors/diseases.

By applying the WATCH-DM score in the final sample, we noted that 18 patients (34.6%) were at very high risk, 17 patients (32.7%) were at high risk, 4 patients (7.7%) were at intermediate risk, 6 patients (11.5%) low risk and 7 patients (13.5%) very low risk of developing heart failure within 5 years, proving that 67.3% (n = 35) had high to very high risk of developing heart failure (Figure 4).
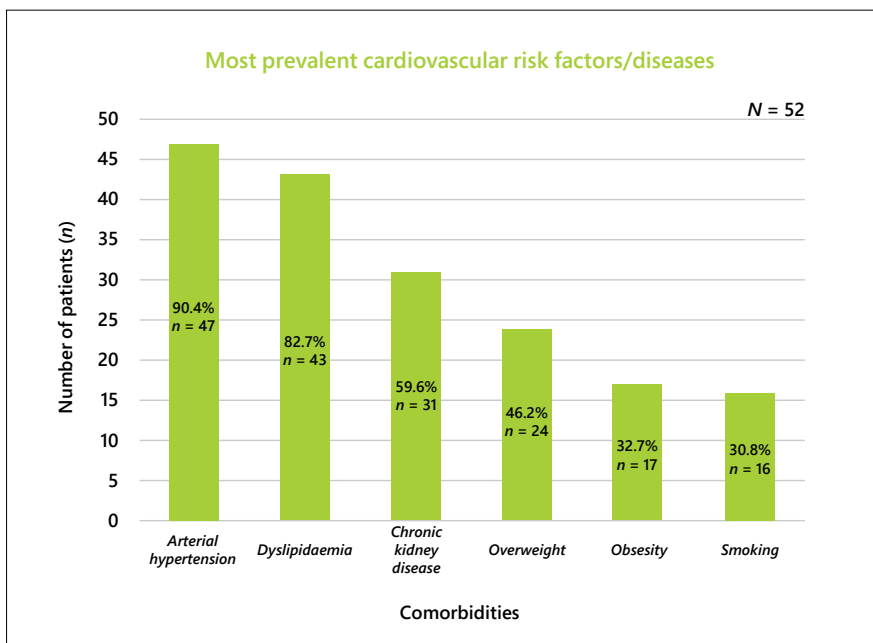
were overweight, and 17 patients (32.7%) were obese. From the sample obtained, 16 patients (30.8%) had a history of smoking (Figure 3). It is also important to underline that 31 patients (59.6%) had chronic kidney disease, being stage 3b the most frequent stage (stage 3a n = 5, 9.6%; stage 3b n = 11, 21.2%; stage 4 n = 4, 7.7%).

Figure 2 - Distribution by sex and age of the sample.

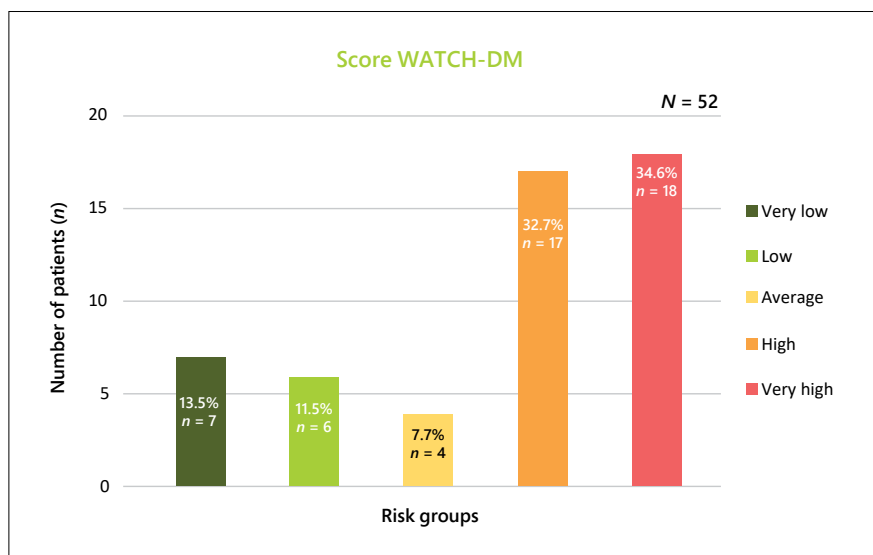**Figure 3** - Cardiovascular risk factors/diseases of the sample.

Figure 4 - Risk groups' distribution, according to WATCH-DM score application.

> **DISCUSSION**

By analysing the obtained results, we can observe that most patients were between 70 to 79 years of age, which aligns with the majority of the population observed in Internal Medicine appointments, including the Diabetes consultation. The larger part of the population consulted in this area is usually elderly, meaning, more than 65 years old, which can be challenging due to a higher pre-

valence of comorbidities, and also to the magnitude that type 2 diabetes and its micro/macrovascular consequences could represent by this age, being known that more disease years may lead to more consequences.

The type 2 diabetes disease duration was not obtained because there is no reliability regarding that information. Referral of patients to Internal Medicine consultation is often carried out after a few years of diagnosis, without this specific data being provided and, frequently, without the patient remembering exactly when the diagnosis was established.

On top of the already well established diabetes consequences, the interconnection amid cardiovascular diseases adding to the overall burden of type 2 diabetes cannot be disregarded. Furthermore, our results reflect the complexity of managing these patients and the need for an active role in preventing cardiovascular events. The sample obtained by the authors remarks this situation, as all patients had at least one cardiovascular risk factor/disease, more than one-third of the sample (36.5%) had three cardiovascular risk factors/diseases, with the most prevalent being hypertension (90.4%) followed by dyslipidaemia (82.7%). Our typical patient in this sample was male, within 70 to 79 years old, with arterial hypertension, dyslipidaemia and overweight/obesity. This pattern should alert us in our daily practice, compelling us to promote a healthier lifestyle and to try reducing their cardiovascular risk as early as possible, by controlling their comorbidities and stimulating a responsible and active role on the patient's behalf.

Chronic kidney disease is a strong risk predictor for heart failure and is seen in approximately 40% of people who live with type 2 diabetes. [4] From the 52 patients, 31 (59.6%) had chronic kidney disease, which highlights the importance of monitoring this disease and consider it as

an important risk factor for developing heart failure.

The WATCH-DM score easily establishes a relationship between diabetes and the risk of developing heart failure, a serious condition that can be prevented, monitored and controlled to diminish its life-threatening consequences.

We conclude that more than two thirds of the 52 patients' sample, namely 67.3%, had a high or very high risk of developing heart failure, which corresponds respectively to 9.2% and 17.4% risk of developing heart failure within 5 years, according to the WATCH-DM risk score.

This machine learning derived risk score has been validated across multiple external cohorts with good model performance. However, some disadvantages were identified, namely, that the score is founded on a single time point-based assessment of risk factors, not incorporating dynamic changes in its variables; also, it does not consider the contribution of cardiac biomarkers. [5]

Despite the mentioned weaknesses, we highlight the importance of integrating WATCH-DM score in the Diabetes consultation based on the results herein described. Bearing this in mind, the WATCH-DM score proves to be an inexpensive, easy applying tool, pointing out the risk of heart failure in each patient.

Limitations

The main limitation identified by the authors was the small sample collected.

On one hand, 13 patients were excluded for already having the diagnosis of heart failure.

This exclusion was carried out based on the patient's previous history, taking into account the comorbidities identified so far in the patient's clinical file. Due to this factor, it is possible that some cases of subclinical heart failure, although in minor extent, were included in the final sample. This is a study limitation that can be prevented in future studies with access to N-terminal prohormone of brain natriuretic peptide (NT-proBNP) recent values and recent imaging methods, that might alert us for that diagnosis. However, it must be taken into consideration that NT-proBNP might be elevated due to reasons other than heart failure.

Therefore, the results should be carefully analysed because some of the patients could already have heart failure without having a known diagnosis, being this a study limitation.

On the other hand, most of the patients (49 patients, corresponding to 41.2% of the initial sample) were excluded for not having recent laboratory results nor re-

cent electrocardiogram, both needed to calculate the WATCH-DM score. This reflects the difficulty in reassessing patients in a timely consultation and in requesting complementary exams, harming ultimately the prevention and control of chronic diseases. An explanation to this problem can be related to our own reality, namely, health policies, the increasing search for public health services, resulting in an imbalance between overcrowded health care facilities and an unsatisfactory number of healthcare professionals.

The small size of the sample can also lead to numbers that are different from the overall reality.

However, with these numbers it is possible to conclude that according to our typical population, and specially in diabetic patients, we should have a better control of all cardiovascular risk factors to lower the risk of developing heart failure and to improve life quality and expectancy.

To overcome the small sample limitation, a proposed solution could be to extend this study to all the Internal Medicine doctors performing Diabetes consultation in our Hospital.

Future Considerations

We emphasise the importance of developing new studies with 5-year patient follow-up, allowing to assess whether the predicted risk of developing heart failure calculated through WATCH-DM score actually corresponds to the reality of patients that develop heart failure. It would also be important in future studies to consider NT-proBNP and high-sensitivity troponin as possible biomarkers of subclinical myocardial dysfunction, considering these data, ideally associated with echocardiogram, in order to exclude patients with subclinical heart failure from the study.

Another future consideration is the possibility of generating consultation protocols, that can systematise all the exams needed, generating automatically the risk at 5 years of developing heart failure, raising an automatic alert to the clinician, helping to carefully follow-up these patients, to better control their cardiovascular risk and reduce the probability of actually developing heart failure. While this is not yet a reality, we highlight WATCH-DM score as an easy, simple, user-friendly tool that helps predict the risk of developing heart failure within 5 years in the Diabetes consultation.

> CONCLUSIONS

The comorbid relationship between type 2 diabetes and

other cardiovascular risk factors and diseases such as heart failure has long been established.

In individuals with type 2 diabetes it is crucial to identify those at highest risk of developing heart failure in order to better guide preventive strategies.

Bearing that in mind, the use of WATCH-DM score to predict the 5-year risk of having heart failure should be taken into account in the multi-modal approach to type 2 diabetes *mellitus* patients in the Diabetes consultation. Our results highlight the importance of adopting WA-TCH-DM score in Diabetes consultation by materialising patients heart failure risk, allowing an active intervention in heart failure prevention. <

Conflicts of interests/*Conflitos de interesses:*

Sponsorships/*Patrocínios:*

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