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RISK SCORE PREDICTION MODEL FOR DEMENTIA IN PATIENTS WITH TYPE 2 DIABETES MELLITUS : AN UPDATE SYSTEMATIC REVIEW

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ABSTRACT

Background: *Dementia is a substantial global health issue. Reduction in future numbers of dementia cases through effective preventive strategies could significantly affect the personal and socioeconomic burdens of dementia. WHO has recommended that countries urgently develop national public health programmes to reduce the impact of dementia.*

The aim: *The aim of this study to show about risk score prediction model for dementia in patients with type 2 diabetes mellitus.*

Methods: *By the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) 2020, this study was able to show that it met all of the requirements. This search approach, publications that came out between 2014 and 2024 were taken into account. Several different online reference sources, like Pubmed, SagePub, and Google Scholar were used to do this. It was decided not to take into account review pieces, works that had already been published, or works that were only half done.*

Result: *In the PubMed database, the results of our search get 67 articles, whereas the results of our search on SagePub get 210 articles, on Google Scholar 1350 articles. Records remove before screening are 667, so we get 960 articles fos screening. After we screened based on record exclude, we compiled a total of 10 papers. We included five research that met the criteria.*

Conclusion: *RxDx-Dementia risk index to predict dementia in patients with type 2 diabetes and hypertension. The RxDx-Dementia risk index which incorporated diagnosis and prescription-based information in a single summary score performed better than diagnosis- or prescription-based comorbidity scores or its combinations. The RxDx-Dementia risk index can be used for prognostic purpose or to control confounding in epidemiological studies.*

Keyword: *Type 2 diabetes mellitus, dementia, risk score.*

INTRODUCTION

Diabetes mellitus (DM) is a worldwide major pathological condition due to its high prevalence, its negative impact on both lifespan and quality of life, as well as the extremely high costs it requires. An impressive dynamic growth in its prevalence on a global level is estimated in next years. If in 1980, there were around 108 million patients with DM, their number has increased to 422 million in 2016. The global prevalence of DM has almost doubled from 1980, a growth that can be explained by the increase of the DM risk factors' prevalence, such as overweight and obesity. A substantial increase of DM prevalence can be observed in poorly developed countries as well as in developing countries.[1,2]

Although recent medical innovations have greatly improved the prognosis of T2DM, its impact is still challenging for the survivors, especially regarding onset of dementia, which may cause serious long-term health problems. Unfortunately, dementia is a silent illness and thus affected persons may be unaware of their cognitive impairment. An earlier meta-analysis of 29 prospective observational studies reported a risk for all-cause dementia among T2DM patients as high as 73%. Notably, T2DM patients experience twice the risk of dying after experiencing comorbid dementia. Recent studies have presumed a link between T2DM and dementia that may include systemic insulin resistance and increased levels of circulating pro-inflammatory markers, both of which would lead to defects in insulin signaling pathway and changes in brain synaptic plasticity, thereby inciting chance of dementia. Given the prominence of dementia in the patients with T2DM, it is critical to attenuate the likelihood of dementia while managing people with T2DM.[3,4]

Implementation of guidelines requires an infrastructure that is adaptable to individual settings within countries, health care systems, and communities, including the development of tools and resources on dementia risk reduction, and validated means of assessing risk factors. The use of such instruments can be informative both at the individual patient level, as well as at the health policy and planning level. In this article, we provide an overview of the key perspectives on dementia risk scores as assessment tools in the context of public health based on expert opinion regarding evidence-based research and practice. The following sections include (a) the rationale for dementia risk assessment, (b) methodological issues to consider when reviewing risk scores, (c) examples of dementia risk scores that are currently in use and their strengths and limitations, and (d) some comments on moving evidence into practice.[5]

METHODS

Protocol

By following the rules provided by Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) 2020, the author of this study made certain that it was up to par with the requirements. This is done to ensure that the conclusions drawn from the inquiry are accurate.

Criteria for Eligibility

For the purpose of this literature review, we compare and contrast risk score prediction model for dementia in patients with type 2 diabetes mellitus. It is possible to accomplish this by researching or investigating risk score prediction model for dementia in patients with type 2 diabetes mellitus. As the primary purpose of this piece of writing, demonstrating the relevance of the difficulties that have been identified will take place throughout its entirety.

In order for researchers to take part in the study, it was necessary for them to fulfil the following requirements: 1) The paper needs to be written in English, and it needs to determine about risk score prediction model for dementia in patients with type 2 diabetes mellitus. In order for the manuscript to be considered for publication, it needs to meet both of these requirements. 2) The studied papers include several that were published after 2014, but before the time period that this systematic review deems to be relevant. Examples of studies that are not permitted include editorials, submissions that do not have a DOI, review articles that have already been published, and entries that are essentially identical to journal papers that have already been published.

Search Strategy

We used " risk score prediction model for dementia in patients with type 2 diabetes mellitus." as keywords. The search for studies to be included in the systematic review was carried out using the PubMed and SagePub databases by inputting the words: *((*"Dementia"*[MeSH Subheading] OR* "Risk score of dementia"*[All Fields] OR* "Type 2 diabetes mellitus*" [All Fields]) AND (*"Diabetes mellitus"*[All Fields] OR "* Complications of diabetes mellitus"*[All Fields]) AND (*"Risk factor of dementia"*[All Fields]) OR (*"Dementia and type 2 diabets mellitus" *[All Fields]))* used in searching the literature.

Data retrieval

After reading the abstract and the title of each study, the writers performed an examination to determine whether or not the study satisfied the inclusion criteria. The writers then decided which previous research they wanted to utilise as sources for their article and selected those studies. After looking at a number of different research, which all seemed to point to the same trend, this conclusion was drawn. All submissions need to be written in English and cannot have been seen anywhere else.

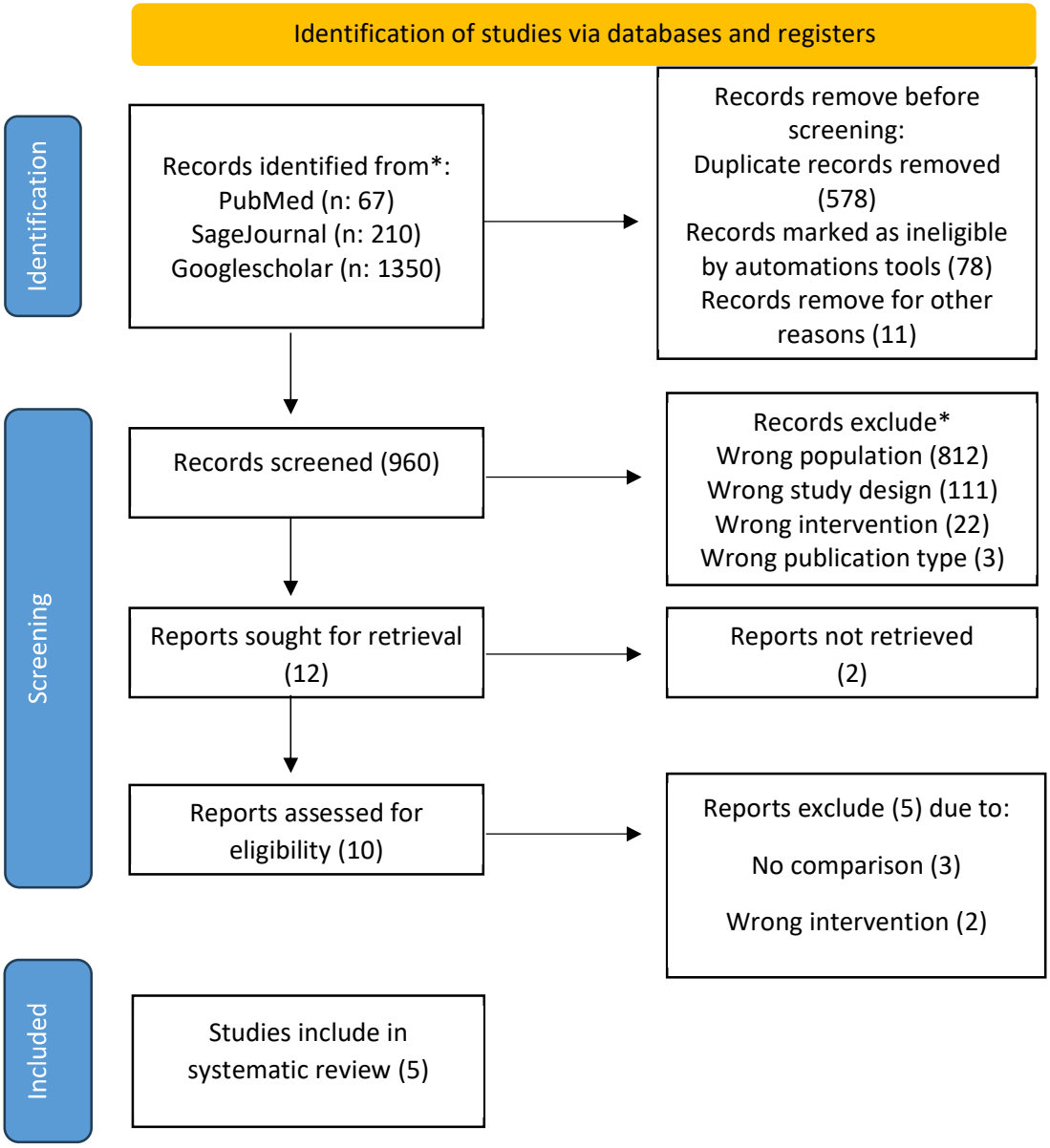

Figure 1. Article search flowchart

Only those papers that were able to satisfy all of the inclusion criteria were taken into consideration for the systematic review. This reduces the number of results to only those that are pertinent to the search. We do not take into consideration the conclusions of any study that does not satisfy our requirements. After this, the findings of the research will be analysed in great detail. The following pieces of information were uncovered as a result of the inquiry that was carried out for the purpose of this study: names, authors, publication dates, location, study activities, and parameters.

Quality Assessment and Data Synthesis

Each author did their own study on the research that was included in the publication's title and abstract before making a decision about which publications to explore further. The next step will be to evaluate all of the articles that are suitable for inclusion in the review because they match the criteria set forth for that purpose in the review. After that, we'll determine which articles to include in the review depending on the findings that we've uncovered. This criteria is utilised in the process of selecting papers for further assessment. in order to simplify the process as much as feasible when selecting papers to evaluate. Which earlier investigations were carried out, and what elements of those studies made it appropriate to include them in the review, are being discussed here.

RESULT

From the PubMed database, the results of our search get 67 articles, whereas the results of our search on SagePub get 210 articles, on Google Scholar 1350 articles. Records remove before screening are 667, so we get 960 articles fos screening. After we screened based on record exclude, we compiled a total of 10 papers. We included five research that met the criteria.

Zuniga, AMO et al (2020)[6] showed diabetic patients in the tertiary care setting seem to have a high risk of developing cognitive impairment, but they are usually patients with other severe diseases and complications. In consequence in the case of these patients, the cognitive impairment is viewed as a secondary issue. Nevertheless, early detection of AD is particularly important in this scenario because it could have a great impact on diabetes control and self-management of complex regimes of treatment. Therefore, reliable screening tools and more education about cognitive impairment as a complication of type 2 diabetes are needed both for patients and diabetes care providers.

Chavallo, OYB et al (2020)[7] showed the DSDRS is associated with frailty, disability, risk of malnutrition, lower cognitive performance and impaired quality of life. Evaluation of this score in primary care facilities might prove useful for identification of subjects with T2D who might benefit from multidisciplinary interventions focusing on rehabilitation to improve upon IADL and ADL disability, frequent cognitive screening, nutritional counseling and evaluation of interventions to reduce burden related to frailty. The role of said interventions to delay onset of cognitive decline and dementia in high risk patients identified using the DSDRS should be evaluated in future studies.

Table 1. The litelature include in this study

Author	Origin	Method	Sample Size	Result
Zuniga, AMO et al., 2020[6]	Spain	T2D patients > 65 years, without known cognitive impairment, attended in a third-level hospital, were evaluated. As per MOPEAD protocol, patients with MMSE ≤ 27 or DSDRS ≥ 7 were referred to the memory clinic for complete neuropsychological assessment.	112	112 T2D patients were recruited. A total of 82 fulfilled the criteria for referral to the memory unit (43 of them declined referral: 48.8% for associated comorbidities, 37.2% lack of interest, 13.95% lack of social support). At the Fundació ACE's Memory Clinic, 34 cases (87.2%) of mild cognitive impairment (MCI) and 3 cases (7.7%) of dementia were diagnosed. The predictive value of DSDRS ≥ 7 as a screening tool of cognitive impairment was AUROC = 0.739, *p* 0.024, CI 95% (0.609–0.825).
Chavolla, OYB et al., 2020[7]	Mexico	We included 257 community-dwelling older adults with T2D to evaluate the association between DSDRS and Mini-mental state examination (MMSE), Isaac's set-test (IST), clock drawing test (CDT), quality of life (SF-36), risk of malnutrition (Mini-Nutritional Assessment or MNA), as well as frailty, Katz' and Lawton-	257	Mean age of participants was 78.0 ± 6.2 years. DSDRS showed a significant correlation with MMSE test, IST, CDT, SF-36, MNA, Lawton-Brody and Katz scores, and an increasing number of frailty components. DSDRS was higher among frail, pre-frail, and subjects with limited ADL and IADL ($p < 0.001$). Participants with DSDRS >75th age-specific percentiles had lower education, MMSE, IST, SF-36, MNA, Katz, Lawton-Brody, and higher frailty scores. High-estimated 10-year dementia risk was associated with ADL and IADL disability, frailty and risk of malnutrition. When assessing individual components of DSDRS, T2D-

		Brody scores. We also assessed the phenotype and correlates of high-estimated dementia risk by assessing individuals with DSDRS >75th age-specific percentiles.		related microvascular complications were associated to all outcome measures.
Fayosse, A et al., 2020[8]	France	A total of 7553 participants, 39–63 years in 1991–1993, were followed for cardiometaboli c disease (diabetes, coronary heart disease, stroke) and dementia ($N = 318$) for a mean 23.5 years. Cox regression was used to model associations of age at baseline, CAIDE, FRS, and FINDRISC risk scores with incident dementia. Predictive performance was assessed using Royston's R^2, Harrell's C-index, Akaike's information criterion (AIC), the Greenwood-Nam-D'Agostino (GND) test, and calibration-in-the-large.	7553	Among the risk scores, the predictive performance of CAIDE (C-statistic = 0.714; 95% CI 0.690–0.739) and FRS (C-statistic = 0.719; 95% CI 0.693–0.745) scores was better than FINDRISC (C-statistic = 0.630; 95% CI 0.602–0.659); $p < 0.001$), AIC difference > 3; R^2 32.5%, 32.0%, and 12.5%, respectively. When the effect of age in these risk scores was removed by drawing data on risk scores at age 55, 60, and 65 years, the association with dementia in all age groups remained for FRS and FINDRISC, but not for CAIDE. Only FRS at age 55 was associated with dementia in persons who remained free of cardiometabolic diseases prior to dementia diagnosis while no such association was observed at older ages for any risk score.
Liu, G et al., 2022[9]	China	This study included 192 dementia patients, 610 patients with mild cognitive impairment (MCI), and 2,218 normal controls. Their general demographic information	3020	The proportion of type 2 diabetes was significantly higher in the dementia group (25.5%) than that in the normal elderly group (15.6%) and the MCI group (17.7%). By using stepwise multiple logistics regression analysis, we found that type 2 diabetes was associated with dementia (p = 0.005*, OR = 1.805, 95%CI: 1.199–2.761), but not with MCI ($p > 0.05$). The volume of

		(such as gender, age, education, etc.), disease-related information (hypertension), and diabetes information (such as whether you have diabetes, course of the disease, etc) were collected by standardized questionnaires. The mini-mental state examination (MMSE) and Montreal Cognitive Assessment (MoCA) were used to assess their overall cognitive function		the fourth ventricle of the healthy elderly with diabetes was significantly larger than that of the healthy elderly without diabetes ($p < 0.05$), but there was no statistical difference ($p > 0.05$) in the volume of the hippocampus, the third ventricle, and the fifth ventricle between the two groups. However, we did not find an association between the fourth ventricle and cognitive scores (MMSE and MoCA).
Ren, L et al., 2022[10]	China	This study used a large UK population-based prospective cohort study conducted between March 13, 2006, and October 1, 2010. Data analysis was performed from June 7 to September 15, 2021. Individual analyses of time end points were concluded at the first dementia diagnosis during the follow-up period. The data were split into training and testing data sets to separately establish and validate a prediction model.	502505	A total of 502 505 participants were selected; the population after exclusions for missing data and dementia diagnosis at baseline was 444 695 (205 187 men; mean [SD] age, 56.74 [8.18] years; 239 508 women; mean [SD] age, 56.20 [8.01] years). Dementia occurrence during the 13 years of follow-up was 0.7% for men and 0.5% for women. The *C* statistic of the final multivariate Cox proportional hazards regression model was 0.86 for men and 0.85 for women in the training data set, and 0.85 for men and 0.87 for women in the testing data set. Men and women shared some modifiable risk and protective factors, but they also presented independent risk factors that accounted for 31.7% of men developing dementia and 53.35% of women developing dementia according to the weighted population-attributable fraction. The total point score of the risk score model ranged from −18 to 30 in men and −17 to 30 in women. The risk score model yielded nearly 100% prediction accuracy of 13-year

				dementia risk both in men and women.

Fayosse, A et al (2020)[8] showed the FRS in midlife to predict dementia as well as the CAIDE risk score, its predictive value being also evident among individuals who did not develop cardiometabolic events. The importance of age in the predictive performance of all three risk scores highlights the need for the development of multivariable risk scores in midlife for primary prevention of dementia.

Liu, G et al (2022)[9] showed type 2 diabetes in elderly Chinese people is associated with dementia, but not MCI. Type 2 diabetes may impair cognitive function by affecting the volume of the fourth ventricle. However, larger longitudinal follow-up studies are needed to confirm these conclusions.

Ren, L et al (2022)[10] showed a practical risk score tool was developed for individual prediction of dementia risk, which may help individuals identify their potential risk profile and provide guidance on precise and timely actions to promote dementia delay or prevention.

DISCUSSION

Type 2 diabetes mellitus is one of the most common metabolic conditions, with an increasing prevalence attributable to aging, sedentary lifestyles, environmental changes and better disease management. Patients with this condition are at an increased risk of premature death and other complications. Existing risk models have been developed, such as QDiabetes for predicting new onset diabetes, and CORE, BRAVO and Michigan models for predicting disease progression, complications and mortality.[11]

More than 115 million people are predicted to have dementia by 2050, with huge associated health and social care costs. There is both epidemiological and policy support for the identification and management of modifiable risk factors for dementia to delay dementia onset. Around a third of Alzheimer's disease cases might be attributable to potentially modifiable risk factors (diabetes, mid-life hypertension, mid-life obesity, depression, physical inactivity, smoking, low education). It has been estimated that a reduction in the seven main modifiable risk factors by 10–25 % would prevent an estimated 1–3 million dementia cases worldwide. There is a strong drive internationally for clinicians to be more pro-active in dementia diagnosis. There is, however, a limited evidence base for current approaches to dementia screening and case-finding and further work needs to be completed to validate new methods across different settings, including primary care.[12,13]

Diabetes affects 10.9 million people over age 65 (26.9% of the elderly population) and nearly 70 to 80% diabetic patients have hypertension. With the baby boomers aging, the prevalence of diabetes and hypertension is expected to increase in coming decades. The RxDx-Dementia risk index can be useful in identifying patients who are at high risk of developing dementia. Studies have shown that 10–25% reduction in modifiable risk factors could potentially prevent as many as 184,000–492,000 dementia cases in the US which could lead to substantial cost savings.[14,15]

CONCLUSION

RxDx-Dementia risk index to predict dementia in patients with type 2 diabetes and hypertension. The RxDx-Dementia risk index which incorporated diagnosis and prescription-based information in a single summary score performed better than diagnosis- or prescription-based comorbidity scores or its combinations. The RxDx-Dementia risk index can be used for prognostic purpose or to control confounding in epidemiological studies.

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