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Alfaraj, S.A.; Kist, J.M.; Groenwold, R.H.H.; Spruit, M.; Mook-Kanamori, D.; Vos, R.C.

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FULL RESEARCH PAPER
Diabetes and metabolic disorders

External validation of SCORE2-Diabetes in The Netherlands across various socioeconomic levels in native-Dutch and non-Dutch populations

Sukainah A. Alfaraj [1]*, Janet M. Kist[1], Rolf H.H. Groenwold[2], Marco Spruit[1,3], Dennis Mook-Kanamori[1,2], and Rimke C. Vos[1]

[1]Department of Public Health and Primary Care/Health Campus the Hague, Leiden University Medical Center (LUMC), Leiden, The Netherlands; [2]Department of Clinical Epidemiology, LUMC, Leiden, The Netherlands; and [3]Leiden Institute of Advanced Computer Science (LIACS), Leiden University, Leiden, The Netherlands

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Aims Adults with type 2 diabetes have an increased risk of cardiovascular events (CVEs), the world's leading cause of mortality. The SCORE2-Diabetes model is a tool designed to estimate the 10-year risk of CVE specifically in individuals with type 2 diabetes. However, the performance of such models may vary across different demographic and socioeconomic groups, necessitating validation and assessment in diverse populations. This study aims to externally validate SCORE2-Diabetes and assess its performance across various socioeconomic and migration origins in The Netherlands.

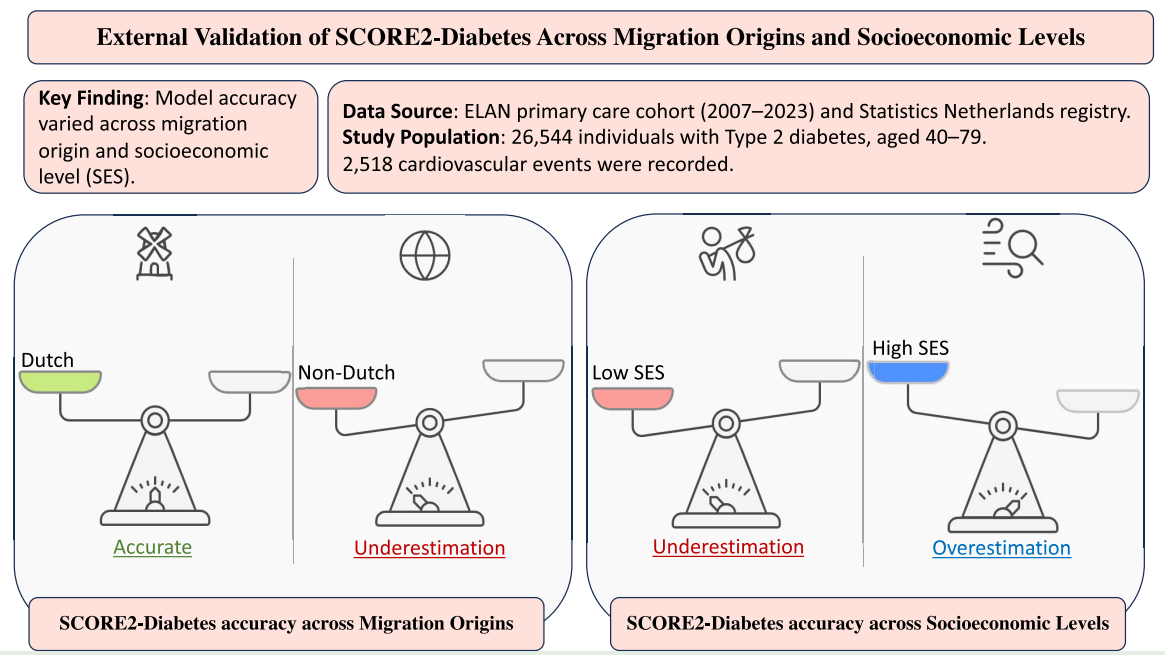
Methods and results We selected adults with type 2 diabetes, aged 40–79 years and without previous CVE from the Extramural LUMC Academic Network (ELAN) primary care data cohort from 2007 to 2023. ELAN data were linked with Statistics Netherlands registry data to obtain information about the country of origin and socioeconomic status (SES). Cardiovascular event was defined as myocardial infarction, stroke, or CV mortality. Non-CV mortality was considered a competing event. Analyses were stratified by sex, Dutch vs. other non-Dutch countries of origin, and quintiles of SES. Of the 26 544 included adults with type 2 diabetes, 2518 developed CVE. SCORE2-Diabetes showed strong predictive accuracy for CVE in the Dutch population [observed-to-expected ratio (OE) = 1.000, 95% CI = 0.990–1.008 for men, and OE = 1.050, 95% CI = 1.042–1.057 for women]. For non-Dutch individuals, the model underestimated CVE risk (OE = 1.121, 95% CI = 1.108–1.131 for men, and OE = 1.100, 95% CI = 1.092–1.111 for women). The model also underestimated the CVE risk (OE > 1) in low SES groups and overestimated the risk (OE < 1) in high SES groups. Discrimination was moderate across subgroups with *c*-indices between 0.6 and 0.7.

Conclusion SCORE2-Diabetes accurately predicted the risk of CVE in the Dutch population. However, it underpredicted the risk of CVE in the low SES groups and non-Dutch origins, while overpredicting the risk in high SES men and women. Additional clinical judgment must be considered when using SCORE2-Diabetes for different SES and countries of origin.

Lay summary A new study validates the SCORE2-Diabetes model for predicting a 10-year risk of cardiovascular events in type 2 diabetes. Strong accuracy for the Dutch population, but underestimation of the risk for low SES and non-Dutch groups. SCORE2-Diabetes should be used with extra caution across diverse subgroups.

* Corresponding author. Tel: +31626826676, Email: s.a.h.alfaraj@lumc.nl

Graphical Abstract



Keywords Type 2 diabetes • Cardiovascular events • SCORE2-Diabetes • External validation • Socioeconomic status

Research in context

What is already known about this subject?

- Type 2 diabetes significantly increases the risk of cardiovascular events (CVEs), especially when combined with other risk factors such as hypertension, high cholesterol, and low socioeconomic status (SES).
- SCORE2-Diabetes is a new model designed to predict 10-year CVE risk specifically for individuals with type 2 diabetes, incorporating diabetes-specific parameters and considering geographic variations in CVE prevalence.
- Ethnic background and SES are significant factors associated with higher cardiovascular disease risk, affecting the accuracy of CVE prediction models.

What is the key question?

- How effective is SCORE2-Diabetes at predicting 10-year cardiovascular event risk across diverse countries of origin and socioeconomic subgroups in The Netherlands?

What are the new findings?

- SCORE2-Diabetes shows strong predictive accuracy for the Dutch population but tends to underestimate CVE risk in low SES groups and non-Dutch groups.
- Adjusting risk prediction models to account for countries of origin and SES can lead to changes in the number of individuals eligible for treatment, highlighting the need for context-specific approaches.

How might this impact clinical practice in the foreseeable future?

Clinicians should apply SCORE2-Diabetes with caution across different countries of origin and SES subgroups, using clinical judgment to account for the model's varying accuracy in diverse populations.

Introduction

An increased risk of cardiovascular events (CVEs), the world's leading cause of mortality, is linked to type 2 diabetes.[1,2] In adults with type 2 diabetes who have other risk factors such as hypertension, high cholesterol, poor glycaemic control, certain ethnicities, and low socioeconomic status (SES), the risk of CVE is even higher.[2,3]

Various clinical tools have been developed to predict CVE mortality and morbidity rates, but many are limited in their applicability to adults with type 2 diabetes.[4] For instance, QRISK3 only considers the presence of diabetes and overlooks the impact of poor glycaemic control.[5] Other models such as the Swedish NDR, ADVANCE CVD, Fremantle Diabetes Research, and NZDCS incorporate diabetes duration and HbA1c level but do not account for competing risk and regional variations in CVE prevalence.[6–9] SCORE and its updated version, SCORE2, originally designed for the general population, consider non-CVE mortality and offer separate risk charts for low- and high-risk European countries.[10] External validation studies have demonstrated SCORE2's superior performance compared to QRISK3 and diabetes-specific models.[11] However, recent validation studies in The Netherlands revealed that SCORE2 underpredicts CVE risk, particularly among ethnic minorities and individuals with low SES. Moreover, the exclusion of known diabetes cases further limits SCORE2's applicability to the type 2 diabetes populations.[12]

To address diabetes-specific CVE risk, SCORE2-Diabetes was developed, incorporating additional diabetes-specific parameters. It outperforms SCORE2 in CVE risk discrimination for type 2 diabetes.[13] While SCORE2-Diabetes offers a more comprehensive approach to risk prediction by accounting for geographic differences, its validation across diverse ethnic and SES subgroups remains limited. This study aims to validate SCORE2-Diabetes using data from Dutch general practitioners (GPs) registries, evaluating its performance across individuals from different countries of origin and SES levels. This targeted validation aims to provide insight into the model's reliability and applicability across diverse demographic contexts.

Methods

Study population and design

Data for this external validation study were obtained from the Extramural LUMC Academic Network (ELAN), which is a dynamic registry of a prospective database collected from the electronic health records of the GPs in South Holland, The Netherlands. The ELAN-GP database encompasses a wealth of patient medical information and a comprehensive view of healthcare data. Within ELAN, details include diagnosed diseases, prescribed medications, and an array of laboratory measurements. This extensive dataset serves as a valuable resource for researchers, clinicians, and academic professionals affiliated with the Leiden University Medical Center. Further description of ELAN data is provided elsewhere.[14,15] ELAN-GP data were linked to the Statistics Netherlands database to obtain the annual disposable household income, country of origin, and death registrations. Data were pseudonymized to prevent identification of individual patients, and all participants were informed about the use of their pseudonymized data for research. This study was assessed by the Medical Ethical Committee of Leiden Den Haag and Delft (METC-LDD). In accordance with institutional guidelines and the nature of the study, which involved the analysis of pseudonymized routinely collected health data, a non-WMO statement was granted under METC Number 23-3100.

The study cohort consisted of adults with type 2 diabetes aged 40–79 years who were registered with one of the ELAN GPs between January 2007 and July 2023. Individuals with type 2 diabetes were selected based on the International Classification of Primary Care (ICPC) codes for diabetes and type 2 diabetes (T90 and T90.02). In accordance with the NHG (Dutch College of General Practitioners) guidelines, the diagnosis of T2DM in primary care is based on the presence of two fasting plasma glucose measurements of ≥7.0 mmol/L taken on separate occasions. Additionally, a diagnosis can be based on a single if a fasting plasma glucose level of ≥7.0 mmol/L or a random plasma glucose level is ≥11.1 mmol/L when accompanied by symptoms consistent with diabetes. None of the T2DM patients were diagnosed using HbA1c measurement only.[16] Individuals with type 1 diabetes were excluded using its assigned ICPC code (T90.01). Individuals with <6 months of follow-up with their GP ($n = 372$) were excluded to ensure data quality and minimize the percentage of missing data. None of the 372 excluded individuals had recorded deaths or CVE. Data collection and extraction for the ELAN database commenced in January 2007. Therefore, we defined our index date as January 2007 for individuals with a prior diagnosis of type 2 diabetes, aligning it with the time when lab measurements were available in the database. For individuals diagnosed with type 2 diabetes after 2007, we used their type 2 diabetes diagnosis date as the index date. This ensures a standardized reference point for analysis and minimizes missing information. The follow-up ended either at the time of the first CVE diagnosis, death, leaving the GP practice, or after 10 years of follow-up, whichever came first.

Outcome and competing risk

In line with the original SCORE2-Diabetes model, the outcome was a composite of non-fatal and fatal CVE. Non-fatal CVE included myocardial infarction (MI) or stroke and fatal CVE included sudden death or death due to coronary heart disease, heart failure, or stroke. Death from non-cardiovascular causes was considered a competing event. Stroke and MI were recorded using ICPC codes, whereas the ICD-10 codes were utilized to determine the cause of death from Statistics Netherlands death registrations. The list of codes is provided in Supplementary material online, *Appendix 1*.

Predictor variables

In our analysis, we utilized various demographic and biomarker factors as predictors, aligning with the SCORE2-Diabetes original model. These factors included sex, age at index date, age at type 2 diabetes diagnosis, smoking status, and biomarkers including total cholesterol, HDL cholesterol, systolic blood pressure, HbA1c, and estimated glomerular filtration rate (eGFR). We selected the laboratory measurement closest to the index time for each individual. A sensitivity analysis was performed using the mean HbA1c measurements from the 12 months before the index date to assess the impact of multiple measurements compared to a single measurement closest to the index date.

The SCORE2-Diabetes risk calculation charts and formula are both provided within the original SCORE2-Diabetes paper.[13]

To enrich our dataset, we integrated individual-level data from Statistics Netherlands, which provided information on mortality, migration origin, and disposable household income. Disposable household income, defined as the net amount available to a household annually and adjusted for variations in size and composition, was used as a proxy for SES. Statistics Netherlands' disclosure of information on disposable household level included percentiles of disposable household level in comparison to The Netherlands' overall population. The national cut-points in 2014 for the quintiles were an annual household income of €16 000, €21 100, €26 800, and €34 700. Migration origin classification was based on individuals' country of origin, dichotomized into Dutch and non-Dutch categories.

Statistical analysis

Sex-specific Fine and Gray competing risk analysis was applied to externally validate the SCORE2-Diabetes model. We calculated the linear predictors based on the formulas, syntax, baseline hazard, and regression coefficients that have been provided upon contact with the SCORE2-Diabetes development team.[13] SCORE2-Diabetes has been specifically recalibrated for low-risk regions. Therefore, additional recalibration was unnecessary. The 10-year CVE risk was available for four different European risk regions (low, moderate, high, and very high-risk regions). According to the latest WHO reports, The Netherlands is designated a low-risk region based on the standardized cardiovascular disease mortality rates. Thus, for external validation, we considered the 10-year CVE risk in the low-risk region. We further stratified the analysis into two different migration origins (Dutch and non-Dutch) and five SES levels. Observed-to-expected ratio (OE) and calibration plots (based on deciles of predicated risk) were used to evaluate calibration. LOESS (Locally Estimated Scatterplot Smoothing) smoother was used to generate the calibration plots. Discrimination was quantified with Harrell's *c*-index.

Less than 5% of the data were missing. In the case of missing data, we assumed that biomarkers or income was missing at random and that binary factors like smoking were absent when missing. Multiple imputation using chained equations was used to impute missing variables and create five multiple imputed datasets.[17] Each dataset was analysed separately, and results were pooled using Rubin's rules.[18] Further sensitivity analysis was performed using only incidental or prevalent cases (see Supplementary material online, *Appendix 5*). R Statistical Computing (version 4.2.1) was used for data preprocessing and analysis on the secure data infrastructure of Statistics Netherlands.[14] This external validation study adhered to the Transparent

Reporting of a Multivariable Prediction Model for Individual Prognosis or Diagnosis (TRIPOD) guidelines, as detailed in Supplementary material online, *Appendix 6*.[19]

Results

The study cohort included 26 544 type 2 diabetes adults without previous CVE. *Table 1* describes the characteristics of the study cohort, stratified by sex. Supplementary material online, *Appendix 2* describes the baseline characteristics of the Dutch and non-Dutch groups. During the 10-year follow-up period (median = 9, IQR = 5–10), 2518 fatal and non-fatal CVEs were observed (1462 in men and 1056 in women) as well as 2450 non-CVE deaths. The predicted number of CVEs based on SCORE2-Diabetes was 2899 (1695 for men and 1204 for women). Distribution of CVEs by sex, migration origin, and SES is in Supplementary material online, *Appendix 3*.

Calibration results for the low-risk region are shown in *Figures 1–3*. SCORE2-Diabetes validation results showed good calibration for the men overall (OE = 1.035, 95% CI = 1.029–1.042) and Dutch men (OE = 1.000, 95% CI = 0.990–1.008), while for non-Dutch men underprediction was observed (OE = 1.121, 95% CI = 1.108–1.131). The OE ratio was slightly higher in women overall (OE = 1.069, 95% CI = 1.062–1.075), in Dutch women (OE = 1.050, 95% CI = 1.042–1.057), and particularly in non-Dutch women (OE = 1.100, 95% CI = 1.092–1.111). The SCORE2-Diabetes model underpredicted the CVE risk in the low SES group while it overpredicted the CVE risk in the high SES group, both in men and women (*Figure 1*). Discrimination showed overall moderate discrimination with higher *c*-indices for women compared to men, as shown in *Table 2*. Sensitivity analyses using average HbA1c measurement over a 12 month period prior to the index data did not materially change the results (see Supplementary material online, *Appendix 4*). The calibration and discrimination results did not show significant improvement when excluding either incident or prevalent cases (see Supplementary material online, *Appendix 5*).

Discussion

This external validation study of the SCORE2-Diabetes model using routinely collected health care data of 26 544 type 2 diabetes individuals showed accurate overall performance among men and women, based on the models for low-risk regions. However, we found different performance of the model across various SES and migration origins.

Prediction models for CVE risk are essential to identify individuals with an increased risk, enabling timely interventions and preventive measures.[20] In the case of individuals with type 2 diabetes, who face a significantly increased cardiovascular risk, the presence of customized risk prediction models is especially important.[2] The superiority of SCORE2-Diabetes over other CVE risk prediction models lies in its meticulous tailoring for individuals with type 2 diabetes, taking into account

Table 1 Characteristics of the primary health care data (ELAN) cohort of persons with type 2 diabetes used for external validation of SCORE2-Diabetes

	Total	Men	Women
N (%)	26 544	14 131 (53)	12 413 (47)
Dutch (%)	17 839 (67)	9759 (69)	8080 (65)
Non-Dutch (%)	8705 (33)	4372 (31)	4333 (35)
SES (%)			
1st SES (low)	5416 (20)	2544 (18)	2872 (23)
2nd SES	5518 (21)	2516 (18)	3002 (24)
3rd SES	5110 (19)	2747 (19)	2363 (19)
4th SES	5264 (20)	3000 (21)	2264 (18)
5th SES (high)	5236 (20)	3324 (24)	1912 (15)
Smokers (%)	5711 (22)	3103 (22)	2608 (21)
Total observed cardiovascular events (%)	2518 (10)	1462 (10)	1056 (9)
Observed CVE in low SCORE2-Diabetes risk (>5)	114 (0.4)	42 (0.3)	72 (0.6)
Observed CVE in moderate SCORE2-Diabetes risk (5–9)	612 (2)	341 (2)	271 (2)
Observed CVE in high SCORE2-Diabetes risk (10–19)	1500 (6)	833 (6)	667 (5)
Observed CVE in very high SCORE2-Diabetes risk (>20)	292 (1)	246 (2)	46 (0.4)
Non-cardiovascular death (%)	2450 (9)	1362 (10)	1088 (9)
Follow-up time (years, median (IQR))	9 (5–10)	9 (5–10)	10 (6–10)
Age (years, mean ± SD)	60.3 ± 10	59.8 ± 10	60.9 ± 10
Age of diagnosis (years, mean ± SD)	57.6 ± 10	57.2 ± 10	58.1 ± 10
HbA1C			
mmol/mol, mean ± SD	52.9 ± 16	53.8 ± 17	51.9 ± 15
%, mean ± SD	7.0 ± 3.6	7.1 ± 3.7	6.9 ± 3.5
eGFR (mL/min/1.73 m^2, mean ± SD)	78.4 ± 22	80 ± 22	77 ± 22
Systolic blood pressure (mmHg, mean ± SD)	140 ± 19	139 ± 19	140 ± 20
HDL cholesterol (mmol/L, mean ± SD)	1.2 ± 0.4	1.1 ± 0.3	1.3 ± 0.4
Total cholesterol (mmol/L, mean ± SD)	5.0 ± 1.2	4.8 ± 1.2	5.1 ± 1.2

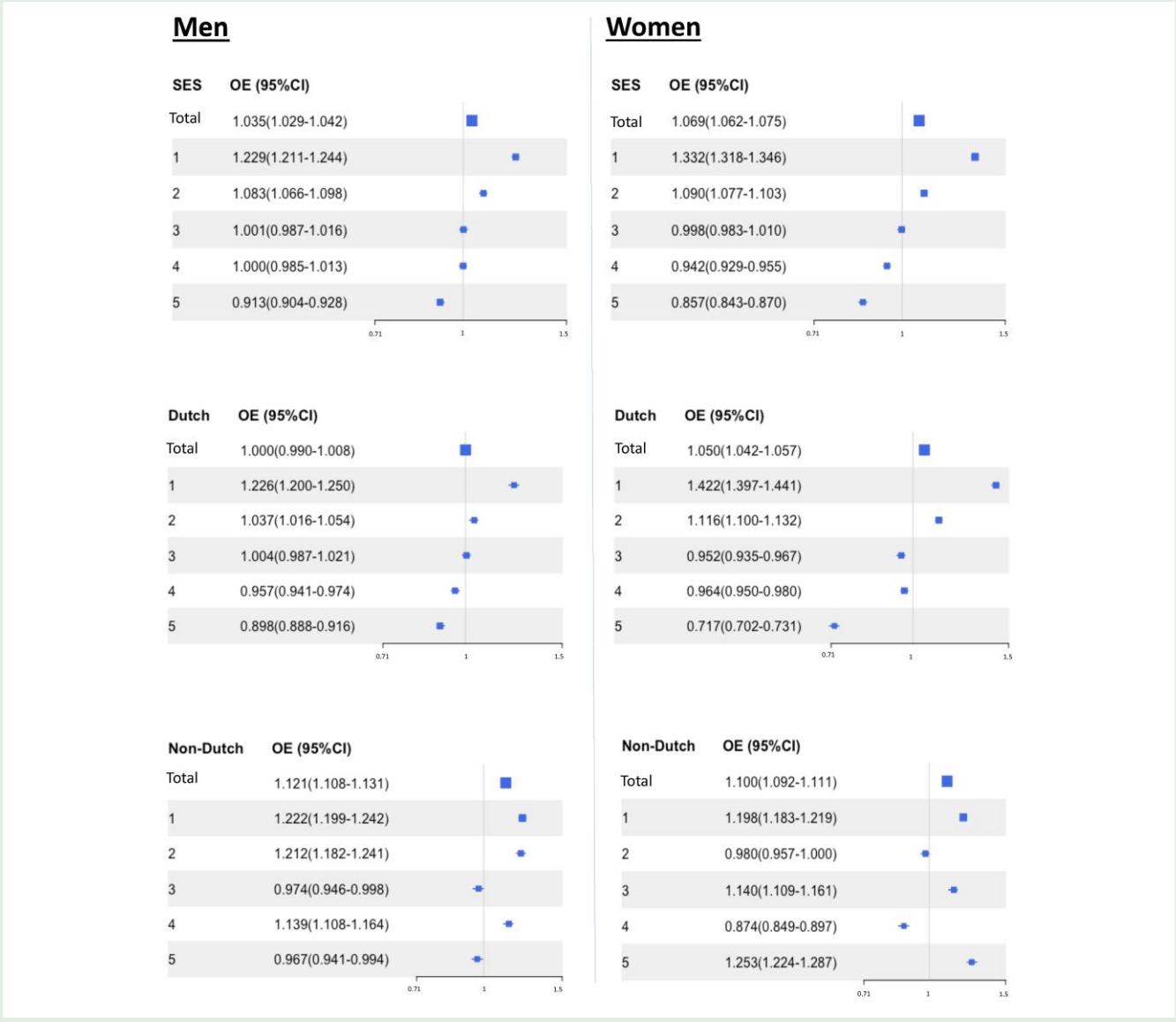


Figure 1 OE ratio represents calibration results of SCORE2-Diabetes low-risk regions for different sex, country of origin, and SES (1st is the lowest and 5th is the highest).

essential parameters such as HbA1c levels, eGFR, and the age of diabetes diagnosis. Moreover, it factors in the prevalence of CVE across different European regions, contributing to its robustness.[13] The variables used in SCORE2-Diabetes are readily accessible in clinical settings, facilitating its usability and allowing for the future incorporation of automatic generation of the risk score from electronic health records. Validating SCORE2-Diabetes in a Dutch population enhances its valuable utility for diabetes individuals in general practice.

The validation of a model like SCORE2-Diabetes is crucial for optimizing care in routine care settings. It allows healthcare professionals to stratify patients based on their individual risk levels and tailor preventive measures accordingly. Specifically, the ability to predict cardiovascular risk with accuracy in type 2 diabetes patients supports more personalized care decisions, such as using statin therapy, adjusting antihypertensive treatments, or introducing SGLT2 inhibitors for added cardiovascular protection.

While our validation of SCORE2-Diabetes in our Dutch data demonstrated correct predictions for the total population, specifically for both Dutch men and women, as reflected by an OE ratio close to one, disparities in CVE risk were observed across different SES and migration backgrounds. In line with existing literature, our study identified an elevated risk of CVE among individuals with low SES and type 2 diabetes in both Dutch and other individuals with migration backgrounds.[21,22,23] The OE ratio in the low SES group was 1.2, signifying a 20% larger observed CVE rate compared to the predicted risk derived from the SCORE2-Diabetes model. In contrast, we found a 10% lower observed CVE rate in high SES individuals compared to their predicted risk (OE = 0.9). Furthermore, we observed a distinct gradient, ranging from underestimation of the CVE risk in the lowest SES Dutch individuals to overestimation of CVE risk in the highest SES Dutch individuals. In non-Dutch groups, this pattern was not observed. The considerable diversity within non-Dutch origin groups

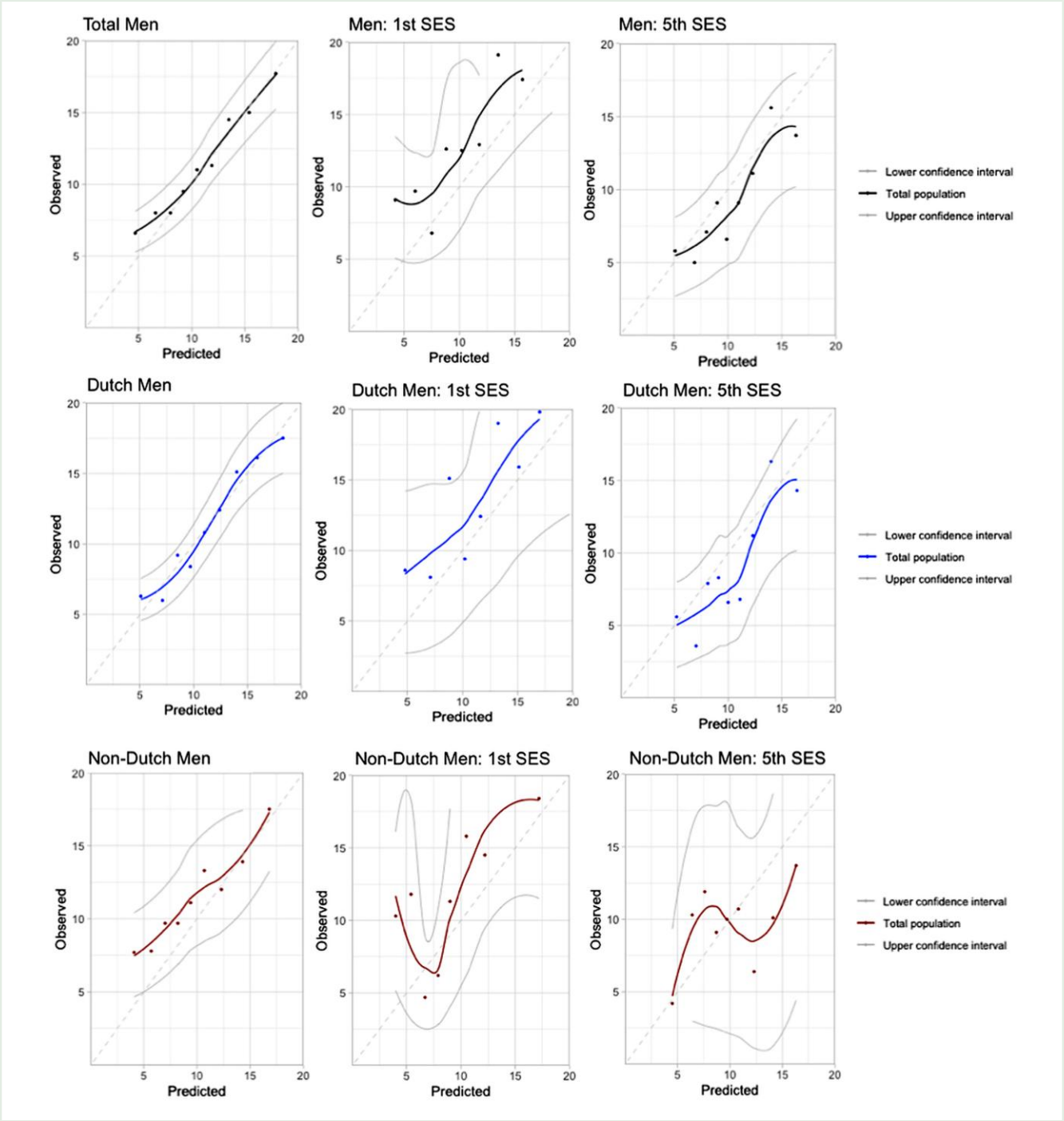


Figure 2 Calibration curves of the SCORE2-Diabetes low-risk regions model for men, stratified by sex, socioeconomic status (1st is the lowest and 5th is the highest), and country of origin (Dutch, non-Dutch).

presented challenges in delineating clear gradients across SES levels. Nevertheless, validating SCORE2-Diabetes for each country of origin was not possible due to the lower number of individuals in certain countries of origin, leading to a limited number of events.

Ethnicity emerged as a significant factor influencing CVE risk, consistent with existing evidence highlighting an increased CVE rate among immigrants.[12,22,24,25] Thus, having extra consideration for both SES level and ethnic background is essential in CVE risk assessment.

Clinicians should be aware of the potential underestimation of risk in these groups and may need to adopt more aggressive preventive strategies, including earlier intervention with statins, antihypertensives, or SGLT2 inhibitors. In clinical practice, this underscores the importance of not solely relying on generalized risk prediction tools, but rather integrating socioeconomic and ethnic factors into decision-making processes to provide equitable care across heterogeneous populations.

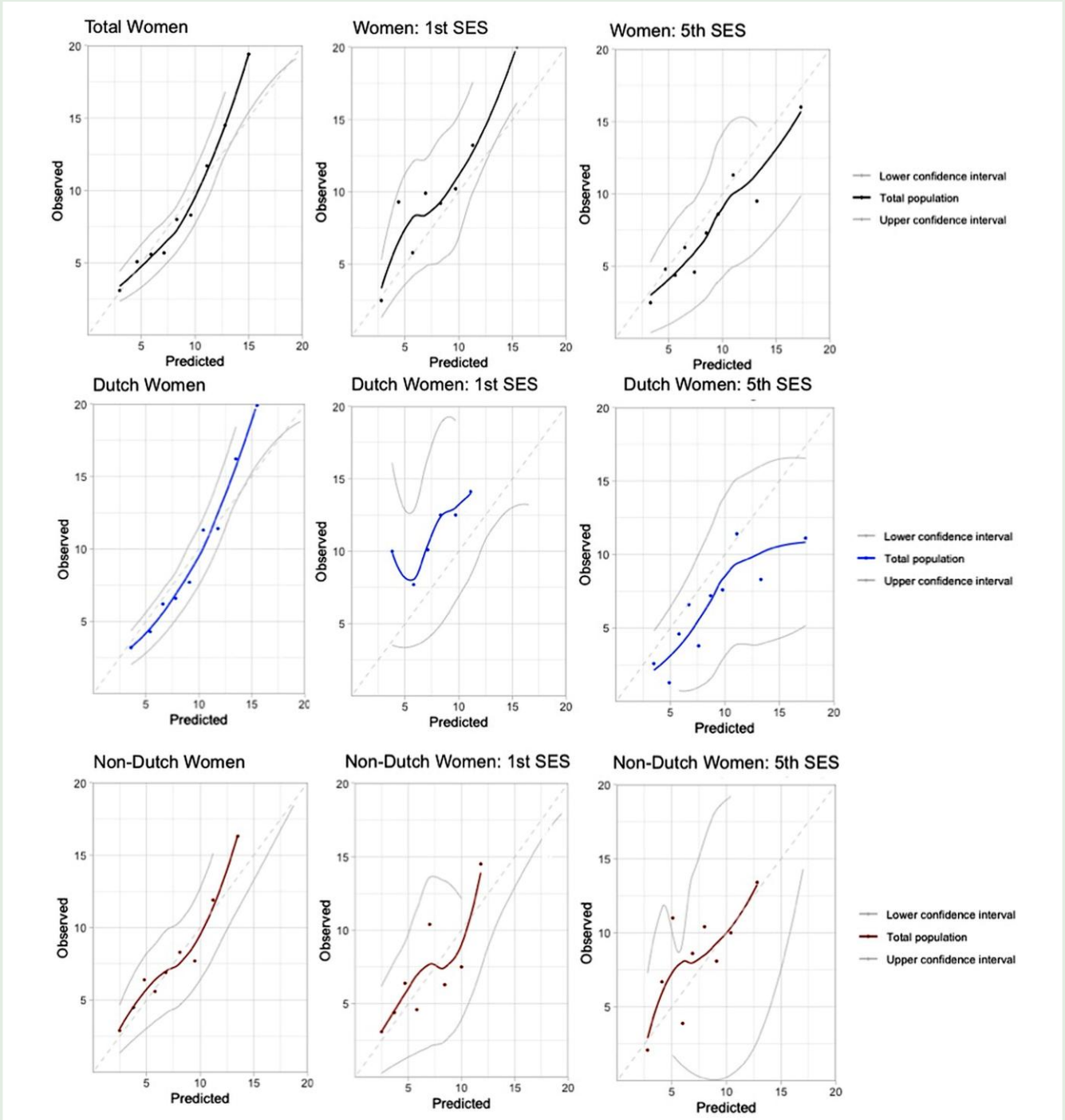


Figure 3 Calibration curves of the SCORE2-Diabetes low-risk regions model for women, stratified by sex, socioeconomic status (1st is the lowest and 5th is the highest), and country of origin (Dutch, non-Dutch).

Although external validation of SCORE2-Diabetes using ELAN data appeared relatively accurate, the model could face challenges in distinguishing individuals who encountered an event within a 10-year follow-up and those who remained event-free. Within subgroups, *c*-indices ranged between 0.6 and 0.7, which is comparable to values found in previous studies.[11] The moderate discrimination of the CVE prediction models can be attributed to various factors such as the dynamic nature of cardiovascular risk, especially when dealing with binary endpoints set far into the future and the absence of consideration of the treatment effect over time in prediction models.[26] The model's performance is inherently linked to the specific population and conditions from which it was derived, potentially limiting its applicability to other settings. Also, the model performance at external validation inherently applies to the population used for external validation.[27]

Table 2 Discrimination (c-index) of the SCORE2-DM model, stratified by sex, socioeconomic status, and ethnicity

	Men c-Index (95% CI)	Women c-Index (95% CI)
SES		
Total	0.63 (0.61–0.64)	0.68 (0.66–0.69)
1st quintile	0.62 (0.58–0.65)	0.66 (0.63–0.69)
2nd quintile	0.62 (0.59–0.65)	0.67 (0.60–0.74)
3rd quintile	0.64 (0.61–0.67)	0.68 (0.65–0.72)
4th quintile	0.62 (0.59–0.66)	0.68 (0.64–0.72)
5th quintile	0.63 (0.60–0.66)	0.64 (0.59–0.69)
Dutch		
Total	0.64 (0.62–0.66)	0.68 (0.66–0.70)
1st quintile	0.61 (0.56–0.66)	0.62 (0.57–0.66)
2nd quintile	0.62 (0.58–0.65)	0.67 (0.59–0.74)
3rd quintile	0.64 (0.60–0.68)	0.68 (0.64–0.72)
4th quintile	0.64 (0.60–0.68)	0.68 (0.63–0.73)
5th quintile	0.65 (0.62–0.69)	0.64 (0.58–0.71)
Non-Dutch		
Total	0.61 (0.59–0.64)	0.67 (0.64–0.70)
1st quintile	0.62 (0.57–0.67)	0.69 (0.64–0.74)
2nd quintile	0.64 (0.58–0.70)	0.64 (0.57–0.71)
3rd quintile	0.63 (0.56–0.71)	0.70 (0.62–0.77)
4th quintile	0.58 (0.52–0.65)	0.66 (0.56–0.75)
5th quintile	0.57 (0.50–0.64)	0.64 (0.56–0.73)

The moderate discrimination observed emphasizes the utilization of SCORE2-Diabetes with an added clinical judgment. While the model provides a useful foundation for risk stratification, the dynamic nature of CVE risk should prompt clinicians to incorporate additional factors, including family history, lifestyle, and using cardioprotective medication, into their risk assessments. This will ensure that preventive measures are not solely based on model predictions, but are tailored to the individual's broader clinical context.

The main strength of the study is the use of a large dataset from routinely collected data (with measurements according to daily practice) where such a model could be applied to the population of type 2 diabetes individuals. That lowers the selection bias and increases the generalizability of the performance of the SCORE2-Diabetes to clinical practice. The good calibration results could encourage the use of SCORE2-Diabetes as the first validated CVE risk scoring system tailored to type 2 diabetes individuals. Also, because of the structural diabetes care programme in The Netherlands, the rate of missingness in SCORE2-Diabetes variables is very low in the routine healthcare diabetes population. However, several methodological issues should be taken into account such as that we could not validate SCORE2-Diabetes in different migration origins given the low event number in subgroups of the non-Dutch. Additionally, the use of household income as a proxy for SES might not be sufficient for some groups.[28] The inaccuracy arises from the interactions among various SES factors such as the educational attainment, and neighbourhood disparities level that could affect the health outcome.[29]

In conclusion, the accurate predictions observed for Dutch men and women in our validation study underscore the potential clinical utility of SCORE2-Diabetes in the Dutch population. However, the distinctive underprediction for individuals with low SES and the converse overprediction for those with high SES raise important considerations for its application. These disparities indicate that extra caution and clinical judgment are imperative when utilizing SCORE2-Diabetes in diverse SES strata. Notably, the mixed results for individuals of non-Dutch origin further emphasize the challenges in applying this predictive model across a society of mixed ethnicity. While the model demonstrated efficacy for specific groups, its universal applicability may require additional adjustments or ethnic-specific validations to ensure accurate cardiovascular risk estimation. The findings prompt an insightful approach to integrating SCORE2-Diabetes into clinical practice, advocating for context-specific considerations and potentially tailored risk prediction models to enhance its precision across diverse demographic and SES subgroups.

Supplementary material

Supplementary material is available at *European Journal of Preventive Cardiology*.

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Author contribution

All were involved in the conception, design of the study, and interpretation of the results. S.A.A. wrote the first draft of the manuscript, and all authors edited, reviewed, and approved the final version of the manuscript. S.A.A. is the guarantor of this work and, as such, has full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

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Conflict of interest: none declared.

Data availability

The data utilized in this study are accessible only to researchers involved in the project due to strict security measures protecting data integrity and confidentiality. Access is restricted to comply with privacy regulations and prevent unauthorized use. While the data cannot be publicly shared, researchers interested in accessing it for valid purposes may submit requests through ELAN (www.elanresearch.nl).

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