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Revised and Modified FINDRISC (Finnish Diabetes Risk Score) for Type 2 Diabetes risk assessment and screening: A Scoping Review

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VÄSTRA GÖTALANDSREGIONEN

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VÄSTRA
GÖTALANDSREGIONEN

Sammanfattning

Bakgrund

Finnish Diabetes Risk Score (FINDRISC) är ett icke-invasivt verktyg för att uppskatta risken för typ 2-diabetes (T2DM) i kliniska och samhällsbaserade miljöer. Flera reviderade och modifierade versioner av FINDRISC har utvecklats för att bättre spegla lokala kroppsmått, sociodemografiska förhållanden och hälso- och sjukvårdssystemens behov men evidensen för dessa uppdaterade verktyg har inte sammanställts på ett strukturerat sätt.

Syfte/frågeställning

Syftet med denna litteraturöversikt var att kartlägga hur FINDRISC har reviderats eller modifierats i olika populationer och kontexter samt att beskriva det diagnostiska och prognostiska värdet hos dessa reviderade verktyg för riskbedömning och screening av T2DM.

Metod

Översikten genomfördes enligt den metodologiska ram som beskrivits av Arksey och O'Malley (2005). Population–Concept–Context-ramverket användes, där populationen definierades som vuxna, konceptet som reviderade eller modifierade FINDRISC-verktyg och kontexten som alla kliniska eller samhällsbaserade miljöer.

Resultat

Litteratursökningen identifierade 13 studier som beskrev reviderade eller modifierade FINDRISC-verktyg. De flesta verktygen uppvisade god diskriminationsförmåga för odiagnostiserad diabetes, störd glukoskontroll, metabolt syndrom eller insjuknande i T2DM.

Konklusion

De flesta av de reviderade och modifierade FINDRISC-verktygen uppvisar god diagnostisk och prognostisk prestanda och hur FINDRISC kan användas i olika miljöer. Men fortsatta jämförelser och kalibrering krävs.

Nyckelord

Typ 2-diabetes mellitus; riskbedömning; screening; FINDRISC; reviderat FINDRISC; modifierat FINDRISC.

Abstract

Background

The Finnish Diabetes Risk Score (FINDRISC) is a widely used noninvasive tool for estimating type 2 diabetes mellitus (T2DM) risk in clinical and community settings. Several revised and modified versions of FINDRISC have been proposed to better reflect local anthropometry, sociodemographic characteristics and health-system needs over the past two decades, but the evidence about these updated tools has not been synthesised in a structured way.

Aim/Objective

The aim of this scoping review was to map and synthesise how FINDRISC has been revised or modified in different settings and populations, and to describe the diagnostic and prognostic performance of these updated tools for T2DM risk assessment and screening.

Methods

This scoping review was conducted according to the methodological framework described by Arksey och O'Malley 2005. The Population–Concept–Context framework was used and defined the population as adults, the concept as revised or modified FINDRISC tools, and the context as any clinical or community setting.

Results

The study search was conducted in Pubmed and Embase databases and after assessment thirteen studies describing revised or modified FINDRISC tools were included. These included global recalibration (DETECT-2), reduced or simplified scores (ARIC modified FINDRISC, MADRISC, Kenyan simplified FINDRISC), anthropometric or ethnic adaptations (ModAsian FINDRISC in Malaysia and Vietnam, Indonesian Modified FINDRISC, LA-FINDRISC, CUBDRISC), a Turkish country-specific model and the revised-FINDRISC incorporating sociodemographic indicators.

Conclusion

Most of these tools show good diagnostic and prognostic performance and may improve feasibility or local calibration compared with the original FINDRISC, but further validation, comparisons and systematic evaluations are needed to guide tool selection in different settings.

Keywords

Type 2 Diabetes Mellitus; Risk Assessment; Screening; FINDRISC; Revised FINDRISC; Modified FINDRISC.

Background

Type 2 diabetes mellitus (T2DM) is a major and growing public health challenge worldwide, driven by ageing populations, rising obesity, and widening social inequalities in health (1–3). A substantial proportion of T2DM remains undiagnosed, and at the time of diagnosis many individuals already have microvascular or macrovascular complications, emphasizing the need for effective approaches to early diagnosis (4,5). Risk-score–based screening tools that do not rely on laboratory measurements are particularly attractive for use in low-resource contexts and among socioeconomically disadvantaged or hard-to-reach populations (6–8).

The Finnish Diabetes Risk Score (FINDRISC) is one of the most widely used risk scores for identifying individuals at high risk of developing T2DM (9–11). It consists of questions about age, body mass index, waist circumference, physical activity, diet, history of antihypertensive drug treatment, history of hyperglycemia, and family history of diabetes, in a simple questionnaire that can be self-administered or used by health professionals. FINDRISC has been validated in many countries and settings, and a recent systematic review and meta-analysis has synthesised its diagnostic accuracy compared with the oral glucose tolerance test for T2DM screening (9,12,13). However, performance varies across demographic groups, and several studies suggest that recalibration or modification of the original score may be needed to maintain good discrimination and calibration in different epidemiological and socio-demographic contexts (14,15).

Based on the original version, a revised FINDRISC has recently been developed using large, international datasets to improve the identification of individuals at elevated risk of developing T2DM, while preserving the simplicity and non-invasive nature of the original tool. The revised score updates items and reference values, and early validation results show higher overall discrimination than the original FINDRISC, including in low- and middle-income countries and across European regions. Similarly, multiple modified FINDRISC variants have been proposed, for example tools adapted to predict metabolic syndrome, tailored to specific ethnicities or nationalities, or designed for clinical or community settings. These developments reflect a dynamic landscape in which FINDRISC is being refined and repurposed to address diverse screening needs (16,17).

Despite this rapid development, existing evidence has focused primarily on the original FINDRISC and its diagnostic accuracy. Individual studies have reported promising performance of specific modified or revised FINDRISC tools, yet there is no synthesis that systematically maps where and in which populations these tools have been developed, what types of modifications have been made and how their performance compares with the original score. This lack of consolidation makes it difficult for clinicians, public health practitioners and policymakers to select a suitable FINDRISC-based tool for their context and to identify gaps where further validation or methodological work is needed. A scoping review is therefore warranted to systematically map the extent, range, and nature of research on revised and modified FINDRISC tools, to summarise their applications and performance, and to find knowledge gaps to inform future validation and implementation studies.

Aim/Objective

The overall aim of this scoping review was to map and synthesise how the Finnish Diabetes Risk Score (FINDRISC) has been revised or modified in different settings and populations, and how these changes affect its performance for T2DM and dysglycemia risk assessment.

The specific objectives were:

- To describe the geographical, clinical and population contexts in which revised or modified FINDRISC tools have been developed and applied.
- To identify and categorise the types of revisions or modifications made to the original FINDRISC, including changes to predictors, scoring and statistical updating.
- To describe and/or compare the diagnostic or prognostic performance of revised or modified FINDRISC tools, and their performance compared to the original FINDRISC.

Methods

This scoping review was conducted using the methodological framework first described by Arksey and O'Malley (2005), which outlines five core stages: 1) identifying the research question; 2) identifying relevant studies; 3) study selection; 4) charting the data; and 5) collating, summarising and reporting the results (18).

The Population–Concept–Context (PCC) approach was used. The population was defined as adults, the concept as revised or modified FINDRISC tools, and the context as any clinical or community setting.

Identifying the research question

How has the Finnish Diabetes Risk Score (FINDRISC) been revised or modified in different settings and populations, and what is known about the performance of these revised or modified tools for type 2 diabetes and dysglycemia risk assessment?

Identifying relevant studies

A search strategy was developed to identify relevant literature on revised or modified FINDRISC tools. In line with Arksey and O'Malley's emphasis on breadth of coverage, the search aimed to capture a wide range of study designs and settings, while remaining feasible given time and resource constraints. Two electronic databases were searched: PubMed and Embase, with no lower date limit.

In PubMed, the search string was: "type 2 diabetes" OR "Diabetes Mellitus, Type 2"[Mesh] AND screening OR "Mass Screening"[Mesh] OR "risk assessment" OR "Risk Assessment"[Mesh] AND FINDRISC OR "Finnish Diabetes Risk Score" OR "revised-FINDRISC" OR "modified FINDRISC".

In Embase, the search string was: non-insulin dependent diabetes mellitus/ or type 2 diabetes.mp. and Finnish Diabetes Risk Score/ or FINDRISC.mp. or revised FINDRISC.mp. or modified FINDRISC.mp. and exp risk assessment/ or risk assessment.mp. or screening.mp. or exp mass screening/

Study selection

Study selection followed Arksey and O'Malley's third stage, with eligibility criteria applied as mentioned below.

Inclusion criteria

Studies were eligible if they:

- Were original research published in a peer-reviewed journal.
- Included an adult population (≥18 years).
- Reported a revised or modified FINDRISC or a risk score explicitly described as derived from FINDRISC.
- Reported at least one performance metric for type 2 diabetes, dysglycemia or closely related cardiometabolic outcomes (Area

Under the Receiver Operating Characteristic (ROC) curve/AUC (19), sensitivity, specificity, predictive values).

Exclusion criteria

Studies were excluded if they:

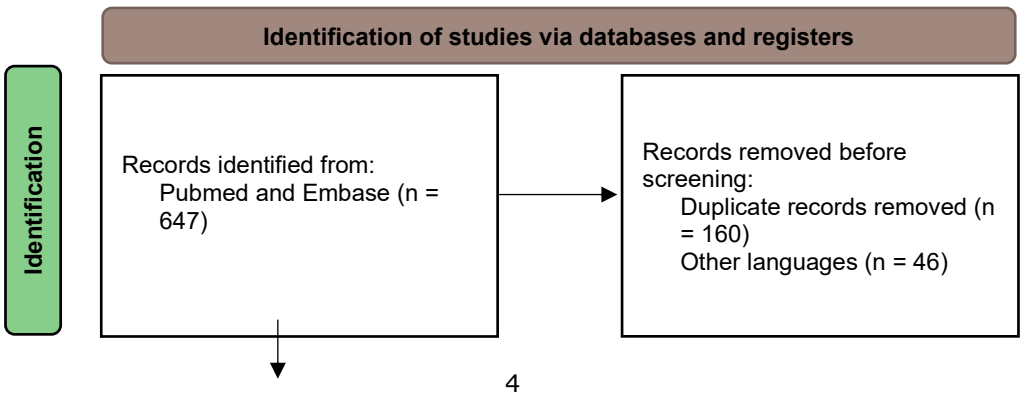
- Evaluated only the original FINDRISC without structural or scoring modification.
- Evaluated risk scores not derived from FINDRISC.
- Used FINDRISC solely as a descriptive measure or covariate, without reporting performance metrics for prediction.
- Were systematic reviews or meta-analysis.
- Were not available in full text or were published in languages other than English.

Research ethical consideration

This scoping review relied entirely on data from previously published studies and did not involve direct contact with human participants or identifiable individual-level data. In accordance with local and institutional guidance, formal research ethics approval was therefore not required. Information about ethics approval and informed consent was noted during data charting.

Results

The database searches identified 647 records (319 from PubMed and 328 from Embase). After removal of duplicates and restriction to English-language publications, 441 records were screened by title and abstract, of which 372 were excluded. Full texts were sought for 69 articles; 6 could not be retrieved. Sixty-three full-text articles were assessed for eligibility, and 50 were excluded based on the criteria. Thirteen studies met all inclusion criteria and were included in the review. The study selection process is summarised in a PRISMA flow diagram (20) illustrated in Figure 1.



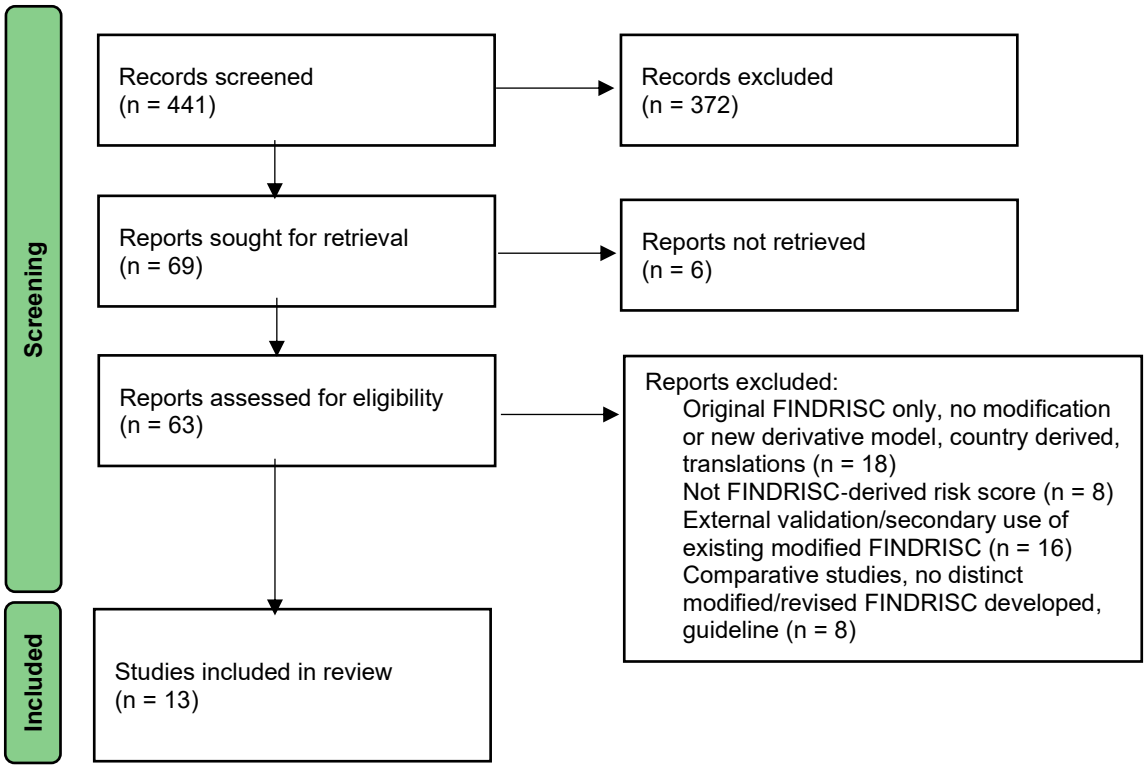


Figure 1: Prisma flowchart illustrating the study selection process.

Characteristics of included studies

The 13 included studies were published between 2010 and 2026 and covered diverse geographic regions. European studies comprised of the DETECT-2 updated FINDRISC (multi-country) (21), SPREDIA-2 MADRISC (Spain) (22), revised-FINDRISC in multi-country European cohorts (23) and a Turkish country-specific model (24). Latin-American adaptations included LA-FINDRISC in Ciudad Bolívar, Venezuela (25) and CUBDRISC in Cuba (26). Asian settings comprised ModAsian FINDRISC in a Malaysian primary care clinic (27) and in a large Vietnamese community sample (28), the Indonesian Modified FINDRISC (29) and ModChinese developed and validated in large Chinese adult cohorts (30). The Chinese ModChinese model was based on two large datasets, one for development and one for external validation, and used nationally representative adult samples. In the Asia–Pacific region, original, modified and simplified FINDRISC scores were assessed in Filipino adults in community-based screening (31). In Africa, a modified and simplified FINDRISC was evaluated among Kenyan adults participating in a national non-communicable disease risk factor survey (32), while in North America an ARIC-modified FINDRISC was examined in a US cohort (33). A summary table presents, for each study, the country, setting, sample size, population, type of modification and outcomes (Table 1).

Tabell 1: Characteristics of included revised/modified FINDRISC tools, outcomes and AUCs.

First author (year)	Country / region	FINDRISC version(s) evaluated	Study design and setting	Population and age	Sample size (n)	Outcome(s) and reference standard	AUC and optimal cut-off point (if mentioned)
Lim et al. (2020) (27)	Malaysia	Original FINDRISC; ModAsian FINDRISC (Asian Body Mass Index(BMI)/waist circumference cut-offs)	Cross-sectional; primary care clinic	Adults without known diabetes, 18-74 years old (multi-ethnic)	293	Undiagnosed T2DM and dysglycemia; diabetes HbA1c ≥48 mmol/mol and prediabetes HbA1c 39–46 mmol/mol	AUC for undiagnosed diabetes and dysglycemia for Original FINDRISC: 0.76 and 0.79; ModAsian FINDRISC: 0.77 and 0.81. Cut-off ≥11.
Doan et al. (2023) (28)	Vietnam	ModAsian FINDRISC[1] (Asian BMI/waist circumference cut-offs)	Cross-sectional; community-based across four different ecoregions	Adults ≥25 years, randomly selected from urban, delta, mountainous and coastal areas	2,258	Undiagnosed T2DM; fasting plasma glucose and OGTT[2] (World Health Organisation criteria)	AUC for ModAsian FINDRISC: 0.840 (BMI), 0.824 (waist circumference), 0.751 (family history of T2DM), 0.708 (history of regularly taking anti-hypertensive medication).
Cahyaningsih et al. (2025) (29)	Indonesia	Modified FINDRISC with Asian BMI/waist circumference cut-offs	Cross-sectional; analysis of national health survey data	Adults ≥18 years from a nationally representative sample	25,432	Metabolic syndrome defined using standard NCEP-ATP III[3] and IDF[4] criteria	Modified FINDRISC (NCEP-ATP III criteria): AUC 0.809; Modified FINDRISC (IDF criteria): AUC 0.889. Cut-off 6.
Muñoz-González et al. (2019) (25)	Venezuela (Ciudad Bolívar)	LA-FINDRISC (FINDRISC modified for Latin America)	Cross-sectional; community and primary care	Adults ≥20 years with cardiovascular risk factors	200	Carbohydrate metabolism disorder (prediabetes + T2DM) by OGTT (ADA[5]/WHO criteria)	LA-FINDRISC: AUC 0.727. Cut-off ≥14.

First author (year)	Country / region	FINDRISC version(s) evaluated	Study design and setting	Population and age	Sample size (n)	Outcome(s) and reference standard	AUC and optimal cut-off point (if mentioned)
Cabrera-Rode et al. (2024) (26)	Cuba	CUBDRISC (FINDRISC modified for Cuba); LA-FINDRISC; Original FINDRISC	Cross-sectional; community based	Adults ≥20 years from three provinces	3,737	Dysglycemia (prediabetes + undiagnosed T2DM); fasting plasma glucose and OGTT	AUC for prediabetes and undiagnosed diabetes for Original FINDRISC 0.831 and 0.877; LA-FINDRISC 0.831 and 0.877; CUBDRISC 0.833 and 0.880. Cut-off ≥13 (FINDRISC and CUBDRISC); ≥11 (LA-FINDRISC).
Salinero-Fort et al. (2016) (22)	Spain (SPREDIA-2[6])	Original FINDRISC; MADRISC[7] (simplified 3-item FINDRISC)	Cross-sectional; population-based screening in two districts of Madrid	Adults 45–74 years	1,426	Undiagnosed T2DM and dysglycemia; OGTT and/or HbA1c	Original FINDRISC: AUC 0.72; MADRISC: AUC 0.76. Cut-off ≥13.
Ku & Kegels (2013) (31)	Philippines	Original FINDRISC; Modified FINDRISC; Simplified FINDRISC	Cross-sectional; community-based screening	Adults ≥20 years in an urban Filipino population	1,752	Undiagnosed diabetes; capillary fasting glucose and 2-h post-load glucose	AUC for undiagnosed diabetes for Original FINDRISC 0.738; Modified FINDRISC: 0.743; Simplified FINDRISC: 0.752. Cut-off ≥9 (FINDRISC and Modified FINDRISC); ≥7 (Simplified FINDRISC).
Kulkarni et al. (2017) (33)	United States (ARIC[8] cohort)	ARIC modified FINDRISC	Prospective cohort; community-based	White and Black adults 45–64 years at baseline	9754	Incident T2DM; fasting glucose ≥7.0 mmol/L, non-fasting ≥11.1 mmol/L, or diabetes medication	AUC for ARIC modified FINDRISC: Overall 0.74 for incident T2DM.

First author (year)	Country / region	FINDRISC version(s) evaluated	Study design and setting	Population and age	Sample size (n)	Outcome(s) and reference standard	AUC and optimal cut-off point (if mentioned)
Mugume et al. (2023) (32)	Kenya	Original FINDRISC; Modified FINDRISC; Simplified FINDRISC	Cross-sectional; national STEPwise NCD[9] risk factor survey	Adults 18–69 years from a nationally representative sample	4,027	Undiagnosed T2DM and prediabetes; capillary fasting glucose	AUC for undiagnosed diabetes and prediabetes for Modified FINDRISC: 0.748 and 0.631; Simplified FINDRISC: 0.749 and 0.636 for prediabetes. Cut-off ≥7.
Alssema et al. (2010) (21)	Multi-country (DETECT-2 project[10])	DETECT-2 updated FINDRISC (recalibrated models based on FINDRISC items)	Prospective cohorts pooled from several countries	Adults from European, Asian and other cohorts, mostly middle-aged and older	20,564	Incident T2DM over 5–10 years; fasting plasma glucose, OGTT or clinical diagnosis	AUC for incident T2DM for Updated FINDRISC: 0.766; Original FINDRISC: 0.742. Cut-off ≥7.
Ture et al. (2025) (24)	Turkey	Original FINDRISC; Turkish country-specific prediction models derived from FINDRISC predictors	Prospective cohort; national chronic disease and risk factor survey with follow-up (TurCDRFs[11])	Turkish adults ≥20 years from a nationally representative sample	12,249	Incident T2DM over 8–10 years; fasting plasma glucose and self-reported diagnosis	AUC for Original FINDRISC: 0.76; waist circumference and waist-to-hip-based models: 0.77. Cut-off ≥8.5.
Vitoratou et al. (2026) (23)	Europe (multi-country and Greece)	Original FINDRISC; Revised-FINDRISC (extended with sociodemographic variables)	Model development and validation; European lifestyle/digital health cohorts and ATTICA[12] cohorts	Adults from European projects and a population-based Greek cohort (ATTICA), mostly middle-aged and older	5,164 (3,526 Feel4Diabetes[13], 2,156 DigiCare4You[14], 3042 validation data from ATTICA)	Current T2DM and high diabetes risk; fasting glucose, OGTT and/or HbA1c	AUC for current T2DM in development data vs validation sample for Revised-FINDRISC: 0.911 vs 0.890; Original FINDRISC 0.832 vs 0.758. Cut-off ≥6-9.

First author (year)	Country / region	FINDRISC version(s) evaluated	Study design and setting	Population and age	Sample size (n)	Outcome(s) and reference standard	AUC and optimal cut-off point (if mentioned)
Zhang et al. (2025) (30)	China	Original FINDRISC; ModChinese (adapted FINDRISC for Chinese adults)	Cross-sectional; development in Chinese national survey (CHNS[15]) and external validation (GNHS[16])	Chinese adults without known diabetes from large, nationally relevant cohorts	2970	Undiagnosed T2DM and hyperglycemia (T2DM + prediabetes); fasting plasma glucose, OGTT and/or HbA1c according to Chinese and international criteria	AUC for undiagnosed diabetes and hyperglycemia in development dataset for ModChinese: 0.707 and 0.680; FINDRISC: 0.681 and 0.661; 0.707 vs 0.681. In validation dataset for Modchinese: 0.663 and 0.606; FINDRISC: 0.622 and 0.593. Cut-off ≥7-8.

[1] ModAsian FINDRISC: Modified Asian Finnish Diabetes Risk Score
[2] OGTT: Oral glucose tolerance test
[3] NCEP ATP III: National Cholesterol Education Program Adult Treatment Panel III
[4] IDF: International Diabetes Federation
[5] ADA: American Diabetes Association
[6] SPREDIA-2: Screening PRE-diabetes and type 2 DIAbetes study, Spain
[7] MADRISC: Madrid Simplified Finnish Diabetes Risk Score
[8] ARIC cohort: Atherosclerosis Risk in Communities study, prospective biracial cohort study, United states
[9] NCD: non-communicable disease (Kenya STEPwise survey for non-communicable diseases risk factors)
[10] DETECT-2 project: international data pooling collaboration, Evaluation of Screening and Early Detection Strategies for Type 2 Diabetes and Impaired Glucose Tolerance
[11] TurCDRFs: Türkiye Chronic Diseases and Risk Factors study
[12] ATTICA study: prospective population-based epidemiological cohort study designed to investigate the association of various factors with the long-term incidence of cardiovascular diseases, Greece
[13] Feel4Diabetes: Families across Europe following a hEalthy Lifestyle 4 Diabetes prevention, school- and community-based intervention, aiming to promote healthy lifestyle
[14] DigiCare4You project: intersectoral innovation involving digital tools for early screening, prevention and management of type 2 diabetes and hypertension, EU
[15] GNHS: Guangzhou Nutrition and Health Study
[16] CHNS: China Health and Nutrition Survey

Contexts and populations

Study settings included community-based screening programs, primary care clinics, national surveys and prospective cohort studies. Sample sizes ranged from around 200 participants in some community studies to more than 20,000 in large surveys and cohort datasets, and participants were generally middle-aged or older adults, often with a high prevalence of overweight, obesity or other cardiometabolic risk factors.

In Europe, DETECT-2 pooled data from multiple international cohorts to update FINDRISC for predicting incident type 2 diabetes over five years (21). SPREDIA-2 assessed FINDRISC and a simplified three-item derivative (MADRISC) in a community-based sample of adults aged 45–74 years in Madrid (22), while revised-FINDRISC was developed using European lifestyle and digital care projects and validated in the ATTICA cohort (23). The Turkish study used a national chronic disease and risk factor survey to validate FINDRISC and derive a country-specific model (24).

In Latin America, LA-FINDRISC was developed and tested in adults from Ciudad Bolívar, Venezuela (25), using oral glucose tolerance tests to classify impaired glucose metabolism, whereas CUBDRISC was derived in a Cuban adult population with a high burden of cardiometabolic risk factors and compared against LA-FINDRISC and the original score (26). In North America, the ARIC modified FINDRISC used data from the Atherosclerosis Risk in Communities cohort of middle-aged white and Black adults, with approximately nine years of follow-up for incident type 2 diabetes (33).

The Kenyan study analysed adults aged 18–69 years from a national stepwise non-communicable disease risk factor survey and evaluated modified and simplified FINDRISC versions tailored to available variables for detecting undiagnosed diabetes (32).

In Asia, ModAsian FINDRISC was first evaluated in a multi-ethnic Malaysian primary care clinic (27) and subsequently applied in a large community-based cross-sectional study across four ecoregions in Vietnam (28), while the Indonesian Modified FINDRISC was examined in national survey data to detect metabolic syndrome, encompassing both urban and rural settings and multiple ethnic groups (29). Also in Asia, original, modified and simplified FINDRISC versions were assessed in Filipino adults participating in community-based screening through interviews one-on-one (31). In China, the ModChinese model was developed using data from a large national survey and externally validated in an

independent Chinese cohort, focusing on adults without known diabetes and assessing both undiagnosed diabetes and hyperglycemia (30).

Types of revisions and modifications

The included studies represented three broad modification strategies: recalibrated and extended models, simplified or reduced-item scores and anthropometric or ethnic adaptations.

Recalibrated and extended models included DETECT-2, which re-estimated coefficients for the eight original FINDRISC items using pooled international data to optimise prediction of incident type 2 diabetes over five years (21). Revised-FINDRISC extended the original score by incorporating sociodemographic and clinical variables such as education and employment, generating an updated integer-based score with improved discrimination across European populations (23). The Turkish study validated FINDRISC and then developed two country-specific models using waist circumference or waist-to-hip ratio alongside other predictors, including educational level and marital status (24). Similarly, the ModChinese model re-estimated coefficients for FINDRISC-based predictors in large Chinese datasets and adapted cut-offs to Chinese guidelines to improve screening for undiagnosed diabetes and hyperglycemia (30).

Simplified and reduced-item scores were derived in several settings. In SPREDIA-2, the MADRISC score was constructed as a three-item tool based on body mass index, history of high blood glucose and antihypertensive medication use to facilitate application in primary care (22). The ARIC modified FINDRISC reduced the number of predictors to a subset of the original items that best predicted incident type 2 diabetes in the ARIC cohort (33). In Kenya, modified and simplified FINDRISC versions were tailored to variables available in the national survey (32) and in the Philippines Ku and Kegels proposed a simplified FINDRISC for community screening (31). Several of these simplified scores, including MADRISC (22), the Kenyan simplified FINDRISC (32), the Filipino simplified FINDRISC (31), were explicitly designed to reduce the number of questions while maintaining acceptable performance.

Anthropometric and ethnic adaptations focused on aligning BMI and waist circumference categories with regional recommendations. The ModAsian FINDRISC retained the eight original items but replaced BMI and waist categories with Asian thresholds (27,28), while the Indonesian Modified FINDRISC used similar Asian cut-offs in evaluating risk for metabolic syndrome (29). LA-FINDRISC adapted waist circumference scoring to Latin-American cut-offs and recalibrated risk categories for impaired

glucose metabolism in Venezuelan adults (25) and CUBDRISC applied Cuban-specific waist and risk thresholds, comparing its performance with LA-FINDRISC and the original FINDRISC (26). The ModChinese model can also be viewed as an anthropometric and ethnic adaptation, as it uses Chinese-specific anthropometric thresholds and recalibrated coefficients to reflect local risk profiles (30). These adaptations were generally motivated by the need to improve local calibration, reflect regional anthropometric profiles or simplify implementation.

Performance of revised and modified FINDRISC tools

Across studies, discrimination for undiagnosed diabetes, dysglycemia, metabolic syndrome or incident type 2 diabetes was generally acceptable to good, with AUC values typically in the range of 0.70–0.80 for most modified tools. DETECT-2 reported an AUC of approximately 0.76 for the updated FINDRISC models in pooled international cohorts, compared with 0.74 for the original score, indicating modest improvement with recalibration (21). Revised-FINDRISC achieved an overall AUC close to 0.90 for current type 2 diabetes in its development datasets, versus roughly 0.83 for the original FINDRISC, and improved discrimination in the ATTICA validation cohort (23).

In Malaysia, FINDRISC showed AUCs of 0.76 for undiagnosed diabetes and 0.79 for dysglycemia, with no statistically significant difference between the original FINDRISC and ModAsian FINDRISC (27). In Kenya, modified and simplified FINDRISC scores had AUCs of 0.748 and 0.749 respectively for detecting undiagnosed diabetes, indicating comparable discrimination between the full and simplified tools (32). LA-FINDRISC reported an AUC of 0.727 (95% CI 0.636–0.818, , p = 0.0001) for impaired glucose metabolism in Venezuelan adults (25), while CUBDRISC demonstrated good performance in detecting dysglycemia in Cuba and showed almost perfect concordance with both LA-FINDRISC and the original FINDRISC across cut-offs from 11 to 16 points (concordance, kappa- 0.882–0.922) (26). The Turkish models reported an AUC of 0.76 (95% CI 0.74–0.78) for FINDRISC in predicting incident diabetes over six years, with both waist-to-hip ratio and waist-circumference-based country-specific models achieving AUCs of 0.77 (24). Simplified scores such as MADRISC in Spain (22) and the Filipino simplified FINDRISC (31) also maintained AUCs broadly like the full scores while using fewer items. In China, the ModChinese model achieved higher AUCs than the original FINDRISC for both undiagnosed diabetes (for example, 0.707 vs 0.681 for undiagnosed diabetes and hyperglycemia 0.680 vs 0.661 in the CHNS development dataset), indicating a measurable improvement in discrimination after adaptation to Chinese data and guidelines (30).

Optimal cut-off points varied by tool and setting. In Malaysia, an optimal FINDRISC cut-off ≥11 yielded a sensitivity of 86.4% and a specificity of 48.7% for undiagnosed diabetes, with ModAsian FINDRISC showing similar thresholds (27). LA-FINDRISC suggested cut-offs of 10 points to prioritise sensitivity and 14 points to prioritise specificity for impaired glucose metabolism (25), while in Kenya a simplified FINDRISC cut-off ≥7 produced an AUC of 0.748, a positive predictive value of 7.9% and a diagnostic odds ratio of 6.65 (32). Revised-FINDRISC proposed a threshold of approximately 13 points out of 24 clinically (23), and CUBDRISC used different cut-offs between 11 and 16 points to define elevated risk categories with high concordance to the original FINDRISC (26). For ModChinese, a cut-off 7 points was identified as a useful threshold for screening hyperglycemia in the validation cohort, balancing sensitivity and specificity in Chinese adults (30). Overall, simplified tools tended to preserve discrimination and reduce the proportion of individuals requiring laboratory tests (22,31–33), while anthropometric adaptations improved local relevance (25–30) and recalibrated or extended models (such as DETECT-2 (21) and revised-FINDRISC (23)) yielded modest to substantial gains in discrimination for incident diabetes and current diabetes in several cohorts (24,30).

Discussion

Summary of main findings

This scoping review identified 12 revised or modified versions (ModAsian Malaysia (27) & Vietnam (27) counted as one) of the FINDRISC and mapped their development, application and performance in diverse settings. Included tools spanned global recalibration and extension (DETECT-2, revised-FINDRISC, Turkish models, ModChinese (21,23,24,30)), simplification (MADRISC, ARIC modified FINDRISC, Kenyan simplified scores, Filipino simplified FINDRISC (22,31–33)) and anthropometric adaptation (ModAsian, LA-FINDRISC, CUBDRISC, Indonesian Modified FINDRISC, ModChinese (25–30)).

Modified tools generally displayed good discriminative performance for undiagnosed T2DM, dysglycemia or incident T2DM, most with AUCs around 0.7–0.8 (25–29). Recalibrated and extended models, particularly revised-FINDRISC and DETECT-2, and ModChinese showed improved discrimination compared with the original FINDRISC in their datasets (21,23,30). Simplified versions retained similar AUCs while reducing the number of items (22,31–33), and anthropometric adaptations improved alignment with regional body composition and waist circumference thresholds (25–29).

Interpretation in relation to existing literature

Previous reviews of diabetes risk scores have catalogued many models and noted substantial heterogeneity in performance (34,35). However, they have not specifically focused on FINDRISC-based tools. This review adds a synthesis of how FINDRISC has been adapted or revised and offers concrete examples of modifications.

The findings suggest that recalibration and model extension can meaningfully improve predictive accuracy, particularly when large, diverse datasets are used and when sociodemographic factors or region-specific are incorporated (21,23,24,30). At the same time, many simplified and anthropometrically adapted versions achieve performance comparable to the original score while being more feasible or better aligned with local body composition (22,25–33). This supports a pragmatic approach: different FINDRISC-based tools may be optimal for different purposes and settings.

Strengths and limitations of the included studies

Strengths of the evidence base include the use of large multi-country (21,23) or nationally representative cohorts in some recalibration studies (24,29,30,32), the explicit derivation of simplified tools from existing predictors and the consideration of ethnic and regional differences in anthropometric adaptations (22,25–33). However, several limitations must be acknowledged.

Many studies were cross-sectional and focused on prevalent undiagnosed diabetes or dysglycemia, which can limit causal interpretation (22,25–32). Outcome definitions varied, with some studies using OGTT (25,31), others fasting glucose (24,33) or HbA1c (27), potentially affecting comparability. External validation was limited for several modified tools, and calibration measures were often incompletely reported. Small sample sizes in some community studies may have led to imprecise performance estimates (25,27).

Strengths and limitations of this review

This scoping review used a structured approach with explicit eligibility criteria, searched two major databases and followed recognised scoping review guidance (18). It also focuses specifically on revised and modified FINDRISC tools, filling a gap not addressed by broader risk score reviews.

Nonetheless, limitations exist. Restricting to English-language studies may have led to omission of some relevant non-English publications. Only PubMed and Embase were searched; additional databases could identify

further studies. Study selection and data extraction were conducted by a single reviewer, which may introduce some risk of bias, although transparent criteria were applied. Due to heterogeneity in methods and reporting, quantitative pooling was not attempted. Because the studies differed across countries, settings and cutoffs, the results are best seen as broadly informative but not directly transferable to every population.

Implications for clinical practice and public health

For clinicians and policymakers, the findings suggest that the choice of a FINDRISC-based tool should be guided by the intended use and local context rather than by a single model. In resource-constrained primary care or community settings, simplified scores such as MADRISC, ARIC modified FINDRISC or Kenyan simplified FINDRISC may be particularly suitable because they require fewer data while maintaining acceptable discrimination (22,32,33). In populations with distinct body composition patterns, anthropometrically adapted scores (ModAsian, LA-FINDRISC, CUBDRISC, Indonesian Modified FINDRISC, ModChinese) may offer better calibration and acceptability (25–30).

If high predictive accuracy for incident T2DM is needed and data collection resources are available, recalibrated or extended models like DETECT-2, revised-FINDRISC or the Turkish model, ARIC modified FINDRISC or ModChinese may be more appropriate (23,24,30,32,33). In all cases, careful selection of cut-off points is essential to balance sensitivity and specificity.

Implications for future research

Many modified or revised FINDRISC tools require external validation in independent populations, especially in low- and middle-income countries and under-represented ethnic groups (36). Comparisons of different FINDRISC-based tools in the same cohort would clarify their relative benefits. Systematic evaluations are needed to assess whether using these tools in routine practice leads to earlier diagnosis, improved risk factor control or better clinical outcomes.

It would also be valuable to explore integration of FINDRISC-based tools into digital health platforms and electronic health records, and to evaluate whether adding new predictors, such as psychosocial factors, laboratory markers or imaging measures, offers sufficient improvement in prediction to justify additional complexity and cost (37).

Conclusion

This scoping review identified revised or modified versions of the Finnish Diabetes Risk Score (FINDRISC) and mapped their development, application and performance across diverse settings. Most showed good discriminative performance for undiagnosed diabetes, dysglycemia or incident T2DM, and some extended models, notably revised-FINDRISC (23), DETECT-2 (21) and ModChinese (30), achieved higher AUCs than the original FINDRISC.

These findings highlight FINDRISC as a flexible platform that can be adapted to different populations and purposes. Selection of a specific FINDRISC-based tool should consider local epidemiology, resource availability and implementation context. Further external validation, comparative studies and impact evaluations are needed to support decisions about which revised or modified FINDRISC tools to adopt in clinical practice and public health programs.

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