APPENDIX A

Table A. Search strategy and terms exact date searching on 30 OCT 2022, 22:32

P: participants -AND	I: Intervention -AND	C: comparator	O: outcome	S: setting
Adult >18 years with Prediabetes (Hyperglycemia OR dysglycemia OR intermediate OR hyperglycemia OR Impair glucose tolerance OR IGT OR Impair glucose OR glucose tolerance OR Impair fasting glucose OR IFG OR developing to diabetes)	Diabetic Risk Assessment tool in screening or diagnosing [Assessment OR, evaluation, OR determination OR Monitoring tools in detecting OR predicting OR determine OR identifying to diabetes]	Control group, standard tool or usual care (We did not use this term in searching)	Effect of risk assessment tools (Sensitivity, specificity, accuracy of tools as PPV or NPV or Au-ROC) Health outcome as (Normoglycemia, dysglycemia (prediabetes) Diabetes)	Community based, Primary care center, Health center, (We did not use this term in searching)

Note: Table A presented "Boolean OR AND NOT used in search term; OR was used between term, AND was used between P AND I, and we use NOT for excluding such as NOT gestational diabetes OR GDM OR pregnancy OR pregnant). We also use filter in the O and S.

A SPECIFIC SEARCH STRATEGY IN PUBMED

Keywords: Assessment prediabetes risk factors adults
Search Actions Details Query Results Time
#3
Search: ((Assessment tool OR evaluation OR determination OR monitoring) AND (Risk factors)) AND ((Adult Prediabetes Hyperglycemia Impair glucose tolerance OR IGT, Impaired glucose, glucose tolerance, Impair fasting glucose IFG) NOT (gestational diabetes OR GDM OR pregnancy OR pregnant)) Filters: in the last 10 years
217 22:17:33
#2
Search: (Adult prediabetes, Hyperglycemia, impair glucose tolerance OR IGT, impair glucose tolerance, Impair fasting glucose IFG) NOT (gestational diabetes OR GDM OR pregnancy OR pregnant) Filters: in the last 10 years
684 22:15:59
#1
Search: (Assessment tool OR evaluation OR determination OR monitoring) AND (Risk factors) Filters: in the last 10 years
539,036 22:14:02
Search term: PubMed: Mesh Terms
Results 103 studies after use filter: adult with age over 18 years

436 Studies from SCOPUS,
79 studies from TCI,
146 Studies from Google Scholar

Additional search from Keyword the article from google schlorlar in October 2022-September 2024 and Search by keywords after Pilot check about 81 = 845 studies
103 studies from PubMed, 436 Studies from SCOPUS, 79 studies from TCI, 146 Studies from Google Scholar, and search by keywords after Pilot check about 81 = 845 studies

80 studies from PubMed did not meet the objective
209 studies from SCOPUS-Google Scholar were deleted, as they did not meet the objective
200 studies on different populations - GDM, adolescents or children, or adults
126 Google Scholar deleted - not met the objective and pop
35 pop/patient not predm or other risk pop
81 review studies were deleted

SO:
88 studies were reviewed from the abstract
51 studies were reviewed from the Full text
37 studies deleted for duplication

The final 14 studies were eligible for review

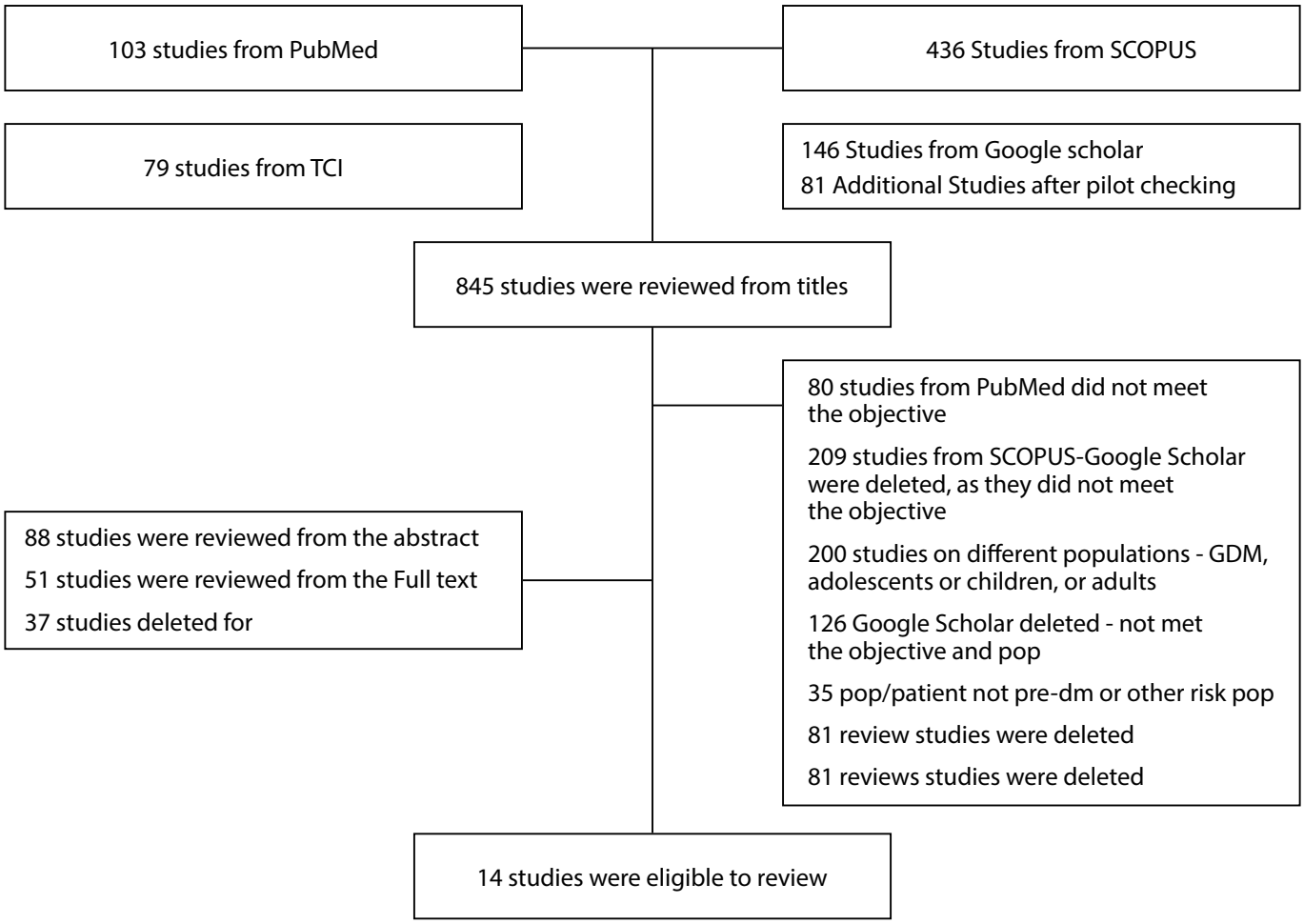

Figure 2. Prisma Diagram of article selection.

APPENDIX B

The 14 primary studies eligible to review.

1. Agarwal G, Guingona MM, Gaber J, et al. Choosing the most appropriate existing type 2 diabetes risk assessment tool for use in the Philippines: a case-control study with an urban Filipino population. *BMC Public Health*. 2019;19(1):1169. doi: https://doi.org/10.1186/s12889-019-7402-0
2. Aekplakorn W, Tantayotai V, Numsangkul S, et al. Detecting Prediabetes and Diabetes: Agreement between Fasting Plasma Glucose and Oral Glucose Tolerance Test in Thai Adults. J Diabetes Res. 2015;2015:396505. doi: https://doi.org/10.1155/2015/396505
3. Bahijri S, Al-Raddadi R, Ajabnoor G, et al. Dysglycemia risk score in Saudi Arabia: A tool to identify people at high future risk of developing type 2 diabetes. J Diabetes Investig. 2020;11(4):844-855. doi: https://doi.org/10.1111/jdi.13213
4. Bethel MA, Chacra AR, Deedwania P, et al. A Novel Risk Classification Paradigm for Patients With Impaired Glucose Tolerance and High Cardiovascular Risk. Am J Cardiol. 2013;112(2):231-237. doi: https://doi.org/10.1016/j.amjcard.2013.03.019
5. Hippisley-Cox J, Coupland C. Development and validation of QDiabetes-2018 risk prediction algorithm to estimate future risk of type 2 diabetes: cohort study. *BMJ*. 2017:j5019. doi: https://doi.org/10.1136/bmj.j5019
6. Jiang Y, Rogers Van Katwyk S, Mao Y, et al. Assessment of dysglycemia risk in the Kitikmeot region of Nunavut: using the CANRISK tool. *Health Promot Chronic Dis Prev Can*. 2017;37(4):114-122. doi: https://doi.org/10.24095/hpcdp.37.4.02
7. Kaneko K, Yatsuya H, Li Y, et al. Risk and population attributable fraction of metabolic syndrome and impaired fasting glucose for the incidence of type 2 diabetes mellitus among middle-aged Japanese individuals: Aichi Worker's Cohort Study. *J Diabetes Investig*. 2020;11(5):1163-1169. doi: https://doi.org/10.1111/jdi.13230
8. Memish ZA, Chang JL, Saeedi MY, et al. Screening for Type 2 Diabetes and Dysglycemia in Saudi Arabia: Development and Validation of Risk Scores. *Diabetes Technol Ther*. 2015;17(10):693-700. doi: https://doi.org/10.1089/dia.2014.0267
9. Risøy AJ, Kjome RLS, Sandberg S, Sølvik UØ. Risk assessment and HbA1c measurement in Norwegian community pharmacies to identify people with undiagnosed type 2 diabetes - A feasibility study. *PLoS One*. 2018;13(2):e0191316. doi: https://doi.org/10.1371/journal.pone.0191316
10. Rowan CP, Miadovnik LA, Riddell MC, et al. Identifying persons at risk for developing type 2 diabetes in a concentrated population of high risk ethnicities in Canada using a risk assessment questionnaire and point-of-care capillary blood HbA1c measurement. *BMC Public Health*. 2014;14(1):929. doi: https://doi.org/10.1186/1471-2458-14-929
11. Schmidt MI, Bracco PA, Yudkin JS, et al. Intermediate hyperglycaemia to predict progression to type 2 diabetes (ELSA-Brasil): an occupational cohort study in Brazil. *Lancet Diabetes Endocrinol*. 2019;7(4):267-277. doi: https://doi.org/10.1016/S2213-8587(19)30058-0 (Scopus)
12. Srugo SA, Morrison HI, Villeneuve PJ, et al. Assessing Dysglycemia Risk Among Younger Adults: A Validation of the Canadian Diabetes Risk Questionnaire. *Can J Diabetes*. 2020;44(5):379-386.e3. doi: https://doi.org/10.1016/j.jcjd.2019.11.002
13. Vanderwood KK, Kramer MK, Miller RG, et al. Evaluation of non-invasive screening measures to identify individuals with prediabetes. *Diabetes Res Clin Pract*. 2015;107(1):194-201. doi: https://doi.org/10.1016/j.diabres.2014.06.003
14. Xu S, Scott CAB, Coleman RL, et al. Predicting the risk of developing type 2 diabetes in Chinese people who have coronary heart disease and impaired glucose tolerance. *J Diabetes*. 2021;13(10):817-826. doi: https://doi.org/10.1111/1753-0407.13175

APPENDIX C

TOOL ASSESSMENT AND QUALITY APPRAISAL

To evaluate the quality and applicability of the tools, we utilized the Quality Assessment of Diagnostic Accuracy Studies (QUADAS-2) tool [36, 37], which assesses risk of bias across four domains: Patient Selection, Index Test, Reference Standard, and Flow and Timing. We also used the QUADAS-C tool for comparative diagnostic accuracy where applicable [38], as it enables a more nuanced evaluation of test accuracy and comparative judgments. Additional quality considerations included sampling bias and reporting bias.

We employed QUADAS-2 to evaluate each study's design rigor and relevance, categorizing results as «Yes,» «No,» or «Unclear.» The tool's structured domains allowed us to assess biases across diverse study designs, including 7 cross-sectional studies, 6 cohort studies, and 1 case-control study.

This section may be divided by subheadings. It should provide a concise and precise description of the experimental results, their interpretation, as well as the experimental conclusions that can be drawn.

Table B. presents the detailed risk of bias assessments for each study, highlighting the low risk across all domains.

First authors of the review articles	DOMAIN 1			DOMAIN 2				DOMAIN 3				DOMAIN 4			Quality of the study
Risk of bias and Applicability Signaling Question	PATIENT SELECTION			REFERENCE STANDARD				INDEX TEST				FLOW AND TIMING			
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	
1. Agarwal G (2019) [51] - Case -control	(?)	(?)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(?)	Low risk
2. Aekplakorn W (2015) [40] - A crosse sectional	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(?)	Low risk
3. Bahijri S (2020) [41] - A crosse sectional Randomly	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	Low risk
4. Jiang Y (2017) [42] - A crosse sectional	(?)	(?)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(?)	Low risk
5. Memish ZA (2015) [43] - A crosse sectional	(?)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	Low risk
6. Rowan CP (2014) [44] - A crosse sectional	(?)	(ü)	(?)	(?)	(ü)	(?)	(?)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(?)	Unclear risk
7. Srugo SA (2020) [45] - A crosse sectional	(?)	(?)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	Low risk
8. Vanderwood KK (2015) [52] - A crosse sectional	(?)	(ü)	(ü)	(ü)	(ü)	(ü)	(?)	(ü)	(ü)	(ü)	(?)	(ü)	(ü)	(?)	Unclear risk
9. Risøy AJ (2018) [49] - Longitudinal	(?)	(?)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(?)	Low risk
10. Schmidt MI (2019) [50] - Cohort	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	Low risk
11. Bethel MA (2013) [33] - Cohort	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	Low risk
12. Kaneko K (2020) [48] - Cohort	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	Low risk
13. Hippisley-Cox J (2017) [47] - Cohort	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	Low risk
14. Xu S (2021) [18] - Cohort	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	(ü)	Low risk

Note: (ü) Low Risk; (©) High Risk; (?) Unclear Risk

Table C. The Baseline characteristics of the included studies.

First Author (Year)	Sample Size (Case/ Control)	Mean Age (SD)	Sex (M/F, %)	Number of Risk Factors	High Risk Identified (%)	Complete Risk Assessment (%)	High Risk of Pre-DM (%)	Diagnosed with DM (%)
Agarwal G (2019)	200 (50/150)	56 (11.5)	M: 23.5, F: 76.5	9	NA	100	8	6
Aekplakorn W (2015)	6,884	50.5 (6.9)	M: 23.6, F: 76.4	6	38.8	88	38.8	13.4
Bahijri S (2020)	1,477	32 (11.5)	M: 53.6, F: 47.4	11	22.2	23	17.5	4.7
Jiang Y (2017)	303	<45 (50%)	M: 34.4, F: 65.6	12	6.7	100	18	4
Memish ZA (2015)	1,485	50–59 (64%)	M: 62, F: 38	7	49.2	96.6	49.2	16
Rowan CP (2014)	691	<40 (32.3%)	M: 29, F: 71	7	ADA: 79.7, CDA: 75	85.2	ADA: 79.7, CDA: 75	61.7
Srugo SA (2020)	3,334	28.5 (NA)	M: 37.6, F: 62.4	13	NA	100	5.8	1.5
Vanderwood KK (2015)	364	55.8 (12.5)	M: 36, F: 64	7	89	86	55	19.4
Risøy AJ (2018)	211	<45 (43%)	M: 40, F: 60	8	6.6	100	5.4	1.4
Schmidt MI (2019)	15,105	45–54 (32%)	M: 45.5, F: 54.5	5	79	74.1	59	2% (person-year)
Bethel MA (2013)	9,306	63.8 (6.8)	M: 49, F: 51	15	49	100	35	35
Hippisley-Cox J (2017)	8,640,363	44.9 (15.2)	M: 49.6, F: 50.4	12	NA	96.9	28.2	19.1
Kaneko K (2020)	8,989	50 (NA)	M: 82.7, F: 17.3	11	43.3	46	18.8	5.8
Xu S (2021)	3,250	63 (NA)	M: 72.4, F: 27.6	15	NA	96	15.8	21.1
14 studies	200 to 8.6 million participants, reflecting diverse population sizes.	from young (28.5 years) to older (63.8 years).	Male-to-female ratios were mostly balanced, with a few studies having male-dominated cohorts (e.g., Kaneko K: 82.7% male).	Risk factors assessed ranged from 5 to 15, showing different screening approaches.	High-risk identification rates varied widely (6.6% to 79.7%).	Most studies achieved over 85% completion rates for assessments.	The prevalence of pre-diabetes among high-risk individuals ranged from 5.4% to 55%.	Diabetes diagnosis rates ranged from 1.4% to 35%, depending on population and study design.

Note: NA: Not applicable, NS: NOT State, FBG: Fasting Blood Glucose, OGTT: Oral Glucose Tolerance Test, A1C: Hemoglobin A1C, ECG: electrocardiogram, THAIRISK: Thai Diabetes Risk Score, CDA: Canadian Diabetes Association, CANDRISK: Canadian Diabetes Risk Score FINDRISC ; Finnish Diabetes Risk Score, ADA RISK: America Diabetes Association Risk Score, IDRS; Indian Diabetes Risk Score, UDDM; Diabetes Risk tools for Indonesia, Filipino; Diabetes Risk tools for Philippine, SADRISC: Saudi Arabia diabetes risk tool, UK-diabetes risk.

APPENDIX D

QUADAS-2 TOOL: RISK OF BIAS AND APPLICABILITY JUDGMENTS

Domain 1: Patient selection	
A. Risk of bias	
Describe methods of patient selection:	
• Was a consecutive or random sample of patients enrolled?	Yes/No/Unclear
• Was a case-control design avoided?	Yes/No/Unclear
• Did the study avoid inappropriate exclusions?	Yes/No/Unclear
Could the selection of patients have introduced bias?	RISK: LOW/HIGH/UNCLEAR
B. Concerns regarding applicability	
Describe included patients (prior testing, presentation, intended use of index test and setting):	
Is there concern that the included patients do not match the review question?	CONCERN: LOW/HIGH/UNCLEAR
Domain 2: Index test(s) *(if more than 1 index test was used, please complete for each test)*	
A. Risk of bias	
Describe the index test and how it was conducted and interpreted:	
• Were the index test results interpreted without knowledge of the results of the reference standard?	Yes/No/Unclear
• If a threshold was used, was it pre-specified?	Yes/No/Unclear
Could the conduct or interpretation of the index test have introduced bias?	RISK: LOW/HIGH/UNCLEAR
B. Concerns regarding applicability	
Is there concern that the index test, its conduct, or interpretation differ from the review question?	CONCERN: LOW/HIGH/UNCLEAR
Domain 3: Reference standard	
A. Risk of bias	
Describe the reference standard and how it was conducted and interpreted:	
• Is the reference standard likely to correctly classify the target condition?	Yes/No/Unclear
• Were the reference standard results interpreted without knowledge of the results of the index test?	Yes/No/Unclear
Could the reference standard, its conduct, or its interpretation have introduced bias?	RISK: LOW/HIGH/UNCLEAR
B. Concerns regarding applicability	
Is there concern that the target condition as defined by the reference standard does not match the review question?	CONCERN: LOW/HIGH/UNCLEAR
Domain 4: Flow and timing	
A. Risk of bias	
Describe any patients who did not receive the index test(s) and/or reference standard or who were excluded from the 2x2 table (refer to flow diagram): Describe the time interval and any interventions between index test(s) and reference standard:	
• Was there an appropriate interval between index test(s) and reference standard?	Yes/No/Unclear
• Did all patients receive a reference standard?	Yes/No/Unclear
• Did patients receive the same reference standard?	Yes/No/Unclear
• Were all patients included in the analysis?	Yes/No/Unclear
Could the patient flow have introduced bias?	RISK: LOW/HIGH/UNCLEAR

doi: https://doi.org/10.14341/DM13324