Table S1 Search strategy			
Database	**Date**	**Search strategy (with English language filter)**	**Results**
PubMed	2025-02-10	((Hypothyroidism* OR “Thyroid-Stimulating Hormone Deficiency” OR (Deficiency AND “Thyroid-Stimulating Hormone”) OR (“Hormone Deficiency” AND Thyroid-Stimulating) OR “Thyroid Stimulating Hormone Deficiency” OR “Thyroid-Stimulating Hormone Deficiencies” OR “TSH Deficiency” OR (Deficiency AND TSH) OR “TSH Deficiencies” OR Hypothyroid OR “Thyroid deficiency” OR “thyroid insufficiency” OR “underactive thyroid” OR “low thyroid” OR “Subclinical hypothyroidism” OR Hashimoto* OR “Chronic Lymphocytic Thyroiditis”)) AND (“Metabolic Syndrome” OR “Metabolic Syndromes” OR “Metabolic Syndrome X” OR “Insulin Resistance Syndrome X” OR “Insulin resistance syndrome” OR (“Syndrome X” AND Metabolic) OR (“Syndrome X” AND “Insulin Resistance”) OR “Metabolic X Syndrome” OR (Syndrome AND “Metabolic X”) OR (“X Syndrome” AND Metabolic) OR “Dysmetabolic Syndrome X” OR (“Syndrome X” AND Dysmetabolic) OR “Reaven Syndrome X” OR (“Syndrome X” AND Reaven) OR “Metabolic Cardiovascular Syndrome” OR (“Cardiovascular Syndrome” AND Metabolic) OR (“Cardiovascular Syndromes” AND Metabolic) OR (Syndrome AND “Metabolic Cardiovascular”) OR “Cardiometabolic Syndrome” OR “Cardiometabolic Syndromes” OR (Syndrome AND Cardiometabolic) OR (Syndromes AND Cardiometabolic))	522
Scopus	2025-02-10	((ALL(Hypothyroidism*) OR TITLE-ABS-KEY(“Thyroid-Stimulating Hormone Deficiency”) OR (TITLE-ABS-KEY(Deficiency) AND TITLE-ABS-KEY(“Thyroid-Stimulating Hormone”)) OR (TITLE-ABS-KEY(“Hormone Deficiency”) AND TITLE-ABS-KEY(Thyroid-Stimulating)) OR TITLE-ABS-KEY(“Thyroid Stimulating Hormone Deficiency”) OR TITLE-ABS-KEY(“Thyroid-Stimulating Hormone Deficiencies”) OR TITLE-ABS-KEY(“TSH Deficiency”) OR (TITLE-ABS-KEY(Deficiency) AND TITLE-ABS-KEY(TSH)) OR TITLE-ABS-KEY(“TSH Deficiencies”) OR TITLE-ABS-KEY(Hypothyroid) OR TITLE-ABS-KEY(“Thyroid deficiency”) OR TITLE-ABS-KEY(“thyroid insufficiency”) OR TITLE-ABS-KEY(“underactive thyroid”) OR TITLE-ABS-KEY(“low thyroid”) OR ALL(“Subclinical hypothyroidism”) OR TITLE-ABS-KEY(Hashimoto*) OR TITLE-ABS-KEY(“Chronic Lymphocytic Thyroiditis”))) AND (TITLE-ABS-KEY(“Metabolic Syndrome”) OR TITLE-ABS-KEY(“Metabolic Syndromes”) OR TITLE-ABS-KEY(“Metabolic Syndrome X”) OR TITLE-ABS-KEY(“Insulin Resistance Syndrome X”) OR TITLE-ABS-KEY(“Insulin resistance syndrome”) OR (TITLE-ABS-KEY(“Syndrome X”) AND TITLE-ABS-KEY(Metabolic)) OR (TITLE-ABS-KEY(“Syndrome X”) AND TITLE-ABS-KEY(“Insulin Resistance”)) OR TITLE-ABS-KEY(“Metabolic X Syndrome”) OR (TITLE-ABS-KEY(Syndrome) AND TITLE-ABS-KEY(“Metabolic X”)) OR (TITLE-ABS-KEY(“X Syndrome”) AND TITLE-ABS-KEY(Metabolic)) OR TITLE-ABS-KEY(“Dysmetabolic Syndrome X”) OR (TITLE-ABS-KEY(“Syndrome X”) AND TITLE-ABS-KEY(Dysmetabolic)) OR TITLE-ABS-KEY(“Reaven Syndrome X”) OR (TITLE-ABS-KEY(“Syndrome X”) AND TITLE-ABS-KEY(Reaven)) OR TITLE-ABS-KEY(“Metabolic Cardiovascular Syndrome”) OR (TITLE-ABS-KEY(“Cardiovascular Syndrome”) AND TITLE-ABS-KEY(Metabolic)) OR (TITLE-ABS-KEY(“Cardiovascular Syndromes”) AND TITLE-ABS-KEY(Metabolic)) OR (TITLE-ABS-KEY(Syndrome) AND TITLE-ABS-KEY(“Metabolic Cardiovascular”)) OR TITLE-ABS-KEY(“Cardiometabolic Syndrome”) OR TITLE-ABS-KEY(“Cardiometabolic Syndromes”) OR (TITLE-ABS-KEY(Syndrome) AND TITLE-ABS-KEY(Cardiometabolic)) OR (TITLE-ABS-KEY(Syndromes) AND TITLE-ABS-KEY(Cardiometabolic)))	1810
Embase	2025-02-10	((Hypothyroidism* OR 'Thyroid-Stimulating Hormone Deficiency':ti,ab OR (Deficiency:ti,ab AND 'Thyroid-Stimulating Hormone':ti,ab) OR ('Hormone Deficiency':ti,ab AND Thyroid-Stimulating:ti,ab) OR 'Thyroid Stimulating	1058

		Hormone Deficiency':ti,ab OR 'Thyroid-Stimulating Hormone Deficiencies':ti,ab OR 'TSH Deficiency':ti,ab OR (Deficiency:ti,ab AND TSH:ti,ab) OR 'TSH Deficiencies':ti,ab OR Hypothyroid:ti,ab OR 'Thyroid deficiency':ti,ab OR 'thyroid insufficiency':ti,ab OR 'underactive thyroid':ti,ab OR 'low thyroid':ti,ab OR 'Subclinical hypothyroidism' OR Hashimoto* OR 'Chronic Lymphocytic Thyroiditis')) AND ('Metabolic Syndrome':ti,ab OR 'Metabolic Syndromes':ti,ab OR 'Metabolic Syndrome X':ti,ab OR 'Insulin Resistance Syndrome X':ti,ab OR 'Insulin resistance syndrome':ti,ab OR ('Syndrome X':ti,ab AND Metabolic:ti,ab) OR ('Syndrome X':ti,ab AND 'Insulin Resistance':ti,ab) OR 'Metabolic X Syndrome':ti,ab OR (Syndrome:ti,ab AND 'Metabolic X':ti,ab) OR ('X Syndrome':ti,ab AND Metabolic:ti,ab) OR 'Dysmetabolic Syndrome X':ti,ab OR ('Syndrome X':ti,ab AND Dysmetabolic:ti,ab) OR 'Reaven Syndrome X':ti,ab OR ('Syndrome X':ti,ab AND Reaven:ti,ab) OR 'Metabolic Cardiovascular Syndrome':ti,ab OR ('Cardiovascular Syndrome':ti,ab AND Metabolic:ti,ab) OR ('Cardiovascular Syndromes':ti,ab AND Metabolic:ti,ab) OR (Syndrome:ti,ab AND 'Metabolic Cardiovascular':ti,ab) OR 'Cardiometabolic Syndrome':ti,ab OR 'Cardiometabolic Syndromes':ti,ab OR (Syndrome:ti,ab AND Cardiometabolic:ti,ab) OR (Syndromes:ti,ab AND Cardiometabolic:ti,ab))	
Web of Science Core Collection	2025-02-10	((ALL=(Hypothyroidism*) OR ALL=("Thyroid-Stimulating Hormone Deficiency") OR (ALL=(Deficiency) AND ALL=("Thyroid-Stimulating Hormone")) OR (ALL=("Hormone Deficiency") AND ALL=(Thyroid-Stimulating)) OR ALL=("Thyroid Stimulating Hormone Deficiency") OR ALL=("Thyroid-Stimulating Hormone Deficiencies") OR ALL=("TSH Deficiency") OR (ALL=(Deficiency) AND ALL=(TSH)) OR ALL=("TSH Deficiencies") OR ALL=(Hypothyroid) OR ALL=("Thyroid deficiency") OR ALL=("thyroid insufficiency") OR ALL=("underactive thyroid") OR ALL=("low thyroid") OR ALL=("Subclinical hypothyroidism") OR ALL=(Hashimoto*) OR ALL=("Chronic Lymphocytic Thyroiditis"))) AND (ALL=("Metabolic Syndrome") OR ALL=("Metabolic Syndromes") OR ALL=("Metabolic Syndrome X") OR ALL=("Insulin Resistance Syndrome X") OR ALL=("Insulin resistance syndrome") OR (ALL=("Syndrome X") AND ALL=(Metabolic)) OR (ALL=("Syndrome X") AND ALL=("Insulin Resistance")) OR ALL=("Metabolic X Syndrome") OR (ALL=(Syndrome) AND ALL=("Metabolic X")) OR (ALL=("X Syndrome") AND ALL=(Metabolic)) OR ALL=("Dysmetabolic Syndrome X") OR (ALL=("Syndrome X") AND ALL=(Dysmetabolic)) OR ALL=("Reaven Syndrome X") OR (ALL=("Syndrome X") AND ALL=(Reaven)) OR ALL=("Metabolic Cardiovascular Syndrome") OR (ALL=("Cardiovascular Syndrome") AND ALL=(Metabolic)) OR (ALL=("Cardiovascular Syndromes") AND ALL=(Metabolic)) OR (ALL=(Syndrome) AND ALL=("Metabolic Cardiovascular")) OR ALL=("Cardiometabolic Syndrome") OR ALL=("Cardiometabolic Syndromes") OR (ALL=(Syndrome) AND ALL=(Cardiometabolic)) OR (ALL=(Syndromes) AND ALL=(Cardiometabolic)))	928

Table S2 Diagnostic criteria for metabolic syndrome

Component	NCEP ATP III	IDF	Joint Interim Statement	Chinese Diabetes Society
Diagnostic requirement	≥ 3 of 5 components	Central obesity (required) + ≥ 2 components	≥ 3 of 5 components	≥ 3 of 5 components
Central Obesity (Waist Circumference)	Men ≥ 102 cm Women ≥ 88 cm	Ethnicity-specific cutoffs	Ethnicity-specific cutoffs	Men ≥ 90 cm Women ≥ 85 cm
Triglycerides	≥ 150 mg/dL or drug treatment	≥ 150 mg/dL or treatment	≥ 150 mg/dL or drug treatment	≥ 150 mg/dL
HDL Cholesterol	Men < 40 mg/dL Women < 50 mg/dL or drug treatment	Men < 40 mg/dL Women < 50 mg/dL or treatment	Men < 40 mg/dL Women < 50 mg/dL or drug treatment	Men < 35 mg/dL Women < 39 mg/dL
Blood Pressure	≥ 130/85 mmHg or drug treatment	≥ 130/85 mmHg or treatment	≥ 130/85 mmHg or drug treatment	≥ 130/85 mmHg or treatment
Fasting Plasma Glucose	≥ 100 mg/dL or drug treatment	≥ 100 mg/dL or previously diagnosed type 2 diabetes	≥ 100 mg/dL or drug treatment	≥ 110 mg/dL or 2-hour post prandial glucose ≥ 140 or diabetes

The fasting plasma glucose threshold for NCEP ATP III was originally ≥ 110 mg/dL (2001) and revised to ≥ 100 mg/dL in 2005. The 2005 update also acknowledged that lower, ethnicity-specific cutoffs may be more appropriate for certain populations.
In the original Chinese Diabetes Society criteria (2004), triglycerides and HDL cholesterol were combined into a single "dyslipidemia" component, and diagnosis required ≥ 3 of 4 components. The original criteria also used BMI ≥ 25 instead of waist circumference and blood pressure of ≥ 140/90

Table S3 Quality assessment of the studies with the JBI checklist

Author (year)	Was the sample frame appropriate to address the target population?	Were study participants recruited in an appropriate way?	Was the sample size adequate?	Were the study subjects and setting described in detail?	Was data analysis conducted with sufficient coverage of the identified sample?	Were valid methods used for the identification of the condition?	Was the condition measured in a standard, reliable way for all participants?	Was there appropriate statistical analysis?	Was the response rate adequate, and if not, was the low response rate managed appropriately?
Agarwal (2011)	No	No	No	No	Unclear	Yes	No	No	Unclear
Ahirwar (2017)	No	No	No	Yes	Unclear	Yes	Yes	Yes	Unclear
Aldhafiri (2022)	No	No	Yes	Yes	Unclear	Yes	Yes	Yes	Unclear
Baghel (2023)	Yes	No	Yes	No	Unclear	Yes	No	No	Unclear
Bermudez (2018)	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
Bhaskar (2022)	Yes	No	Yes	Yes	Unclear	No	No	No	Unclear
Chang (2017)	Yes	Yes	Yes	No	No	Yes	No	Yes	Yes
Choudhary (2016)	Yes	No	Yes	Yes	Unclear	Yes	Yes	Yes	Unclear
Deshmukh (2018)	Yes	Yes	Yes	Yes	Unclear	Yes	No	No	Unclear
Deshpande (2023)	Yes	No	No	Yes	Unclear	No	No	Yes	Unclear
Garduno-Garcia (2010)	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	Unclear

Gierach (2015)	No	Yes	Yes	No	Unclear	Yes	No	Yes	Unclear
Gupta (2016)	Yes	No	No	No	Unclear	Yes	Yes	No	Unclear
Gyawali (2015)	Yes	Unclear	Yes	No	Unclear	Yes	Yes	Yes	Unclear
Khan (2011)	Yes	No	Yes	Yes	Unclear	Yes	No	Yes	Unclear
Khatiwada (2016)	Yes	No	Yes	Yes	Unclear	Yes	Yes	Yes	Unclear
Kumar (2022)	Yes	No	Yes	Yes	Unclear	No	No	Yes	Unclear
Lai (2011)	No	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	Unclear
Lai (2011)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lakhani (2024)	Yes	No	No	Yes	Unclear	No	No	Yes	Unclear
Mahesh (2022)	Yes	No	Yes	No	Unclear	Yes	Yes	No	Unclear
Meher (2013)	Yes	No	Yes	Yes	Unclear	Yes	Yes	Yes	Unclear
Mehran (2017)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Orluwene (2013)	No	No	No	No	Unclear	Yes	Yes	Yes	Unclear
Osmani (2022)	Yes	No	Yes	No	Unclear	Yes	No	Yes	Unclear
Patel (2023)	Yes	No	No	No	Unclear	No	No	No	Unclear
Ramezani-Tehrani (2011)	No	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	Yes
Rao (2022)	Yes	Unclear	Yes	No	Unclear	No	No	No	Unclear
Saluja (2017)	Yes	No	Yes	No	Unclear	No	No	No	Unclear
Senthil (2015)	Yes	No	Yes	No	Unclear	No	No	No	Unclear
Shantha (2009)	Yes	No	Yes	No	Unclear	Yes	Yes	Yes	Unclear
Sharma (2017)	Yes	No	Yes	No	Unclear	No	No	No	Unclear
Suganya (2016)	No	Unclear	No	No	Unclear	No	Yes	Yes	Unclear
Suhashini (2018)	Unclear	No	No	No	Unclear	No	Yes	Yes	Unclear
Tale (2024)	Yes	No	No	No	Unclear	Yes	No	Yes	Unclear
Uzunlulu (2007)	No	No	Yes	Yes	Unclear	Yes	Yes	Yes	Unclear
Vishwakarma (2024)	Yes	No	No	No	Unclear	No	Yes	No	Unclear
Wang (2012)	Yes	No	Yes	Yes	Yes	Yes	No	Yes	Yes
Xie (2023)	No	No	Yes	Yes	Unclear	Yes	Yes	Yes	Yes
Yadav (2017)	No	No	No	No	Unclear	No	No	Yes	Unclear

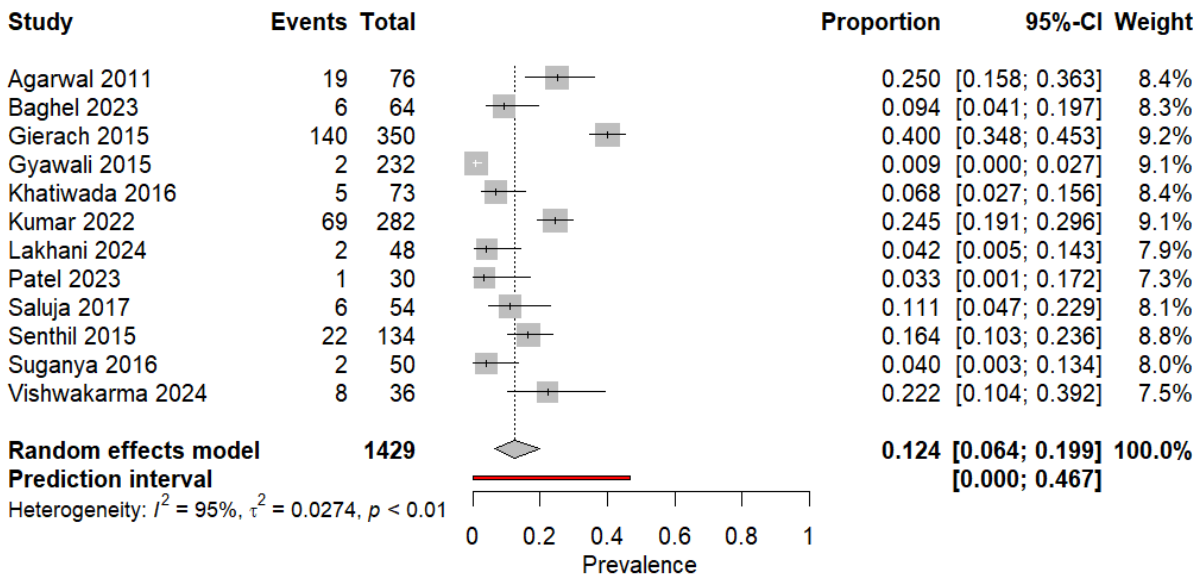


Fig. S1 forest plot showing the pooled prevalence of overt hypothyroidism among females with metabolic syndrome

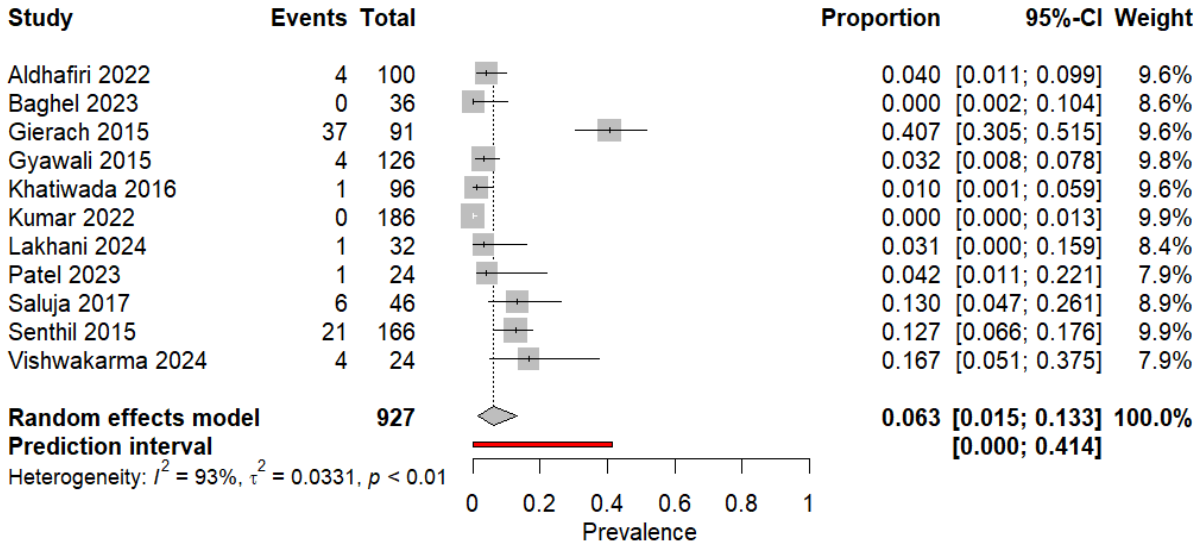


Fig. S2 forest plot showing the pooled prevalence of overt hypothyroidism among males with metabolic syndrome

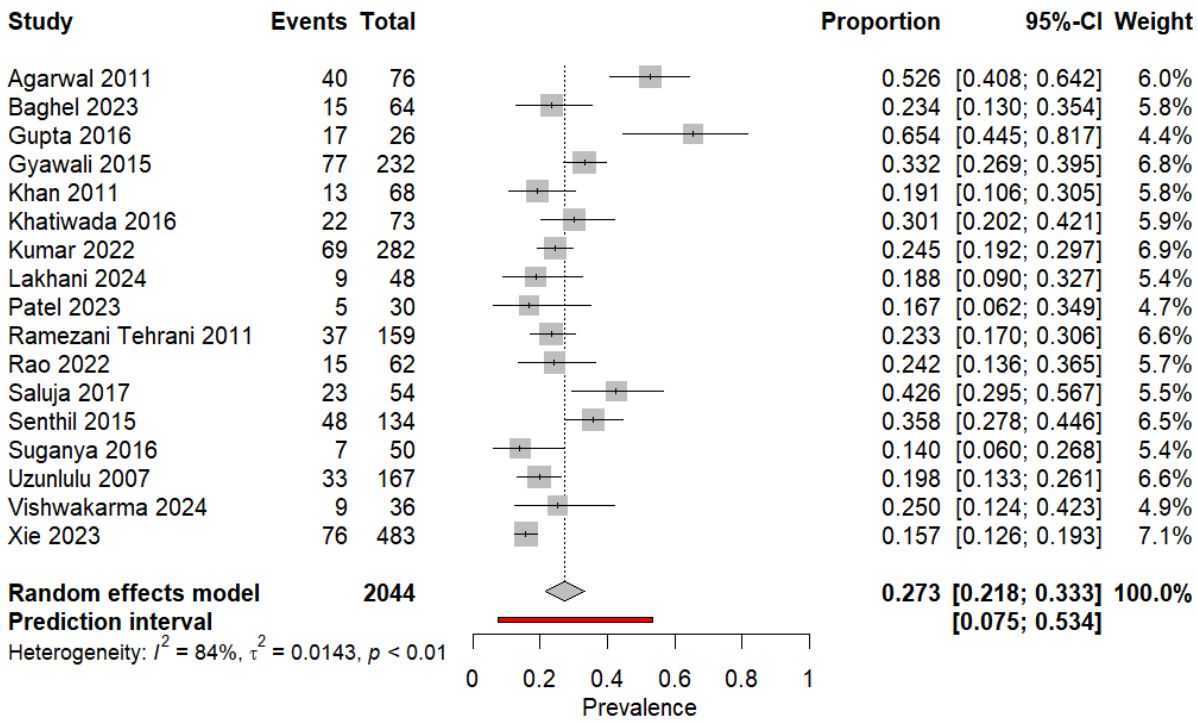


Fig. S3 forest plot showing the pooled prevalence of subclinical hypothyroidism among females with metabolic syndrome

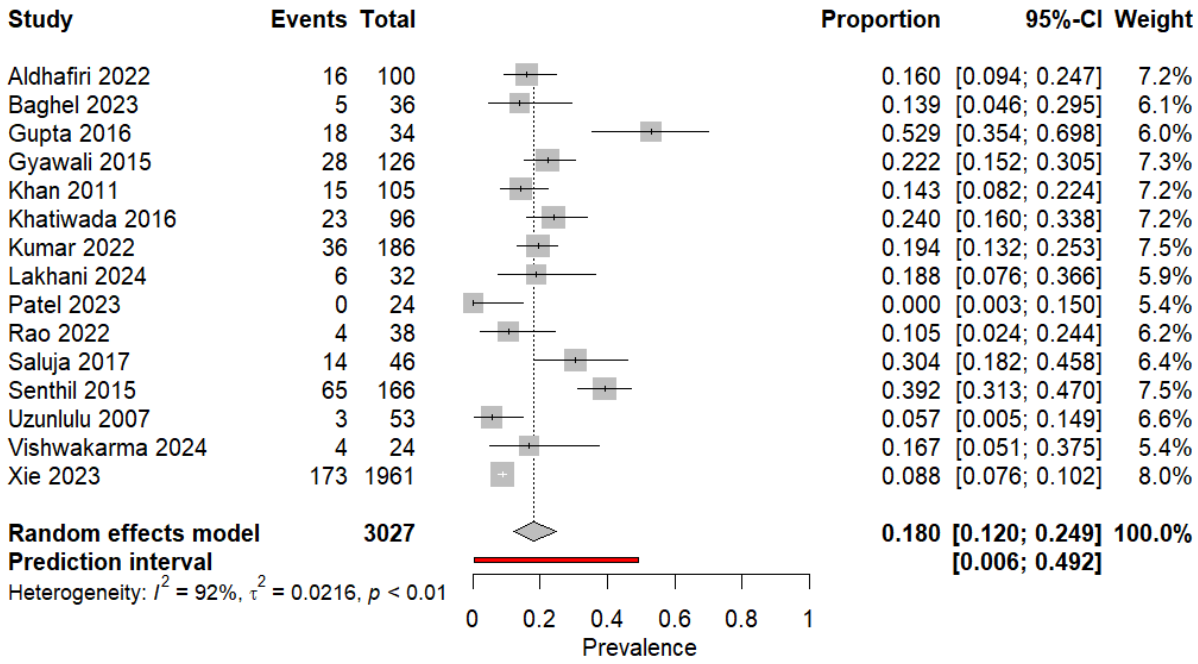
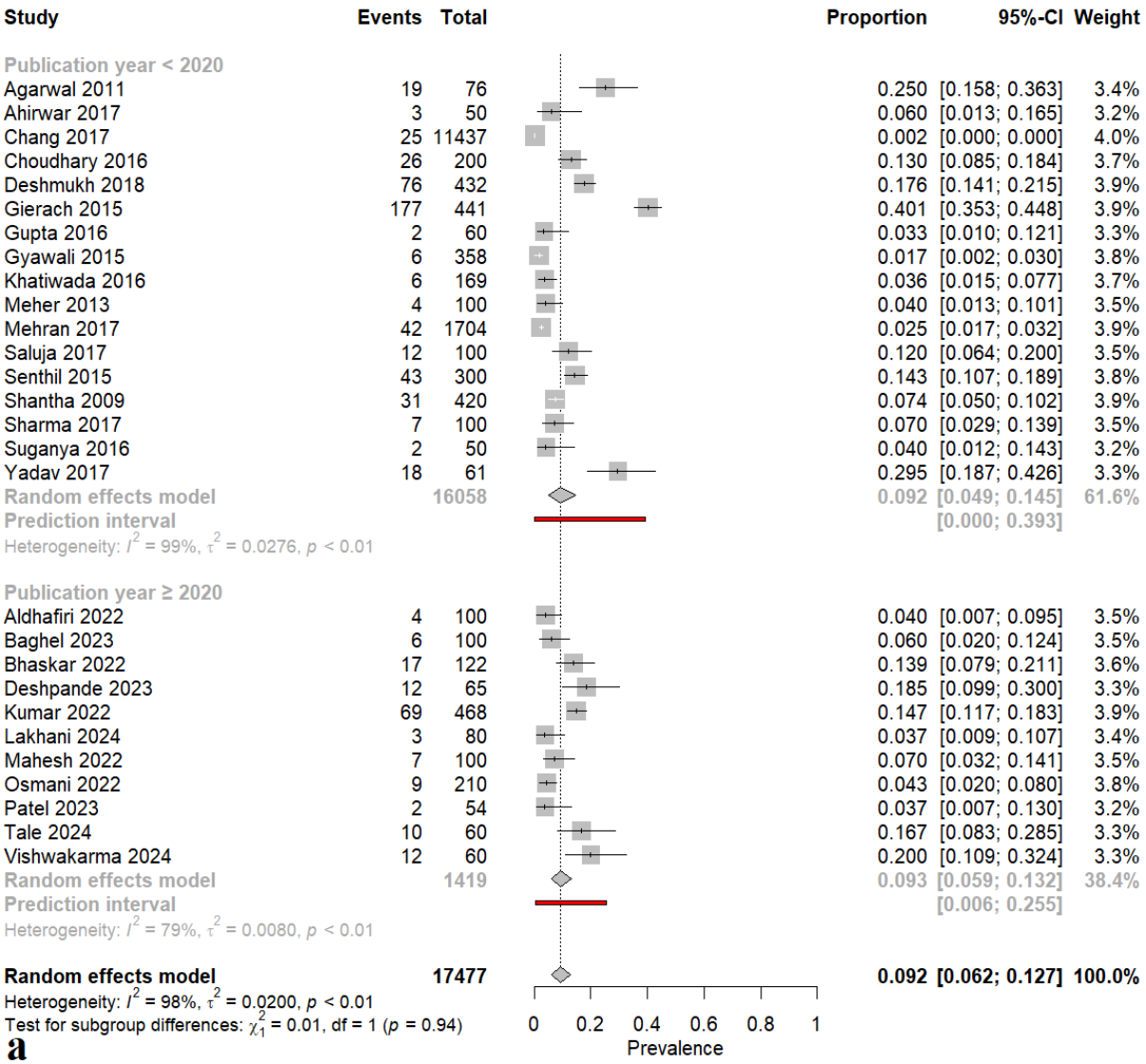
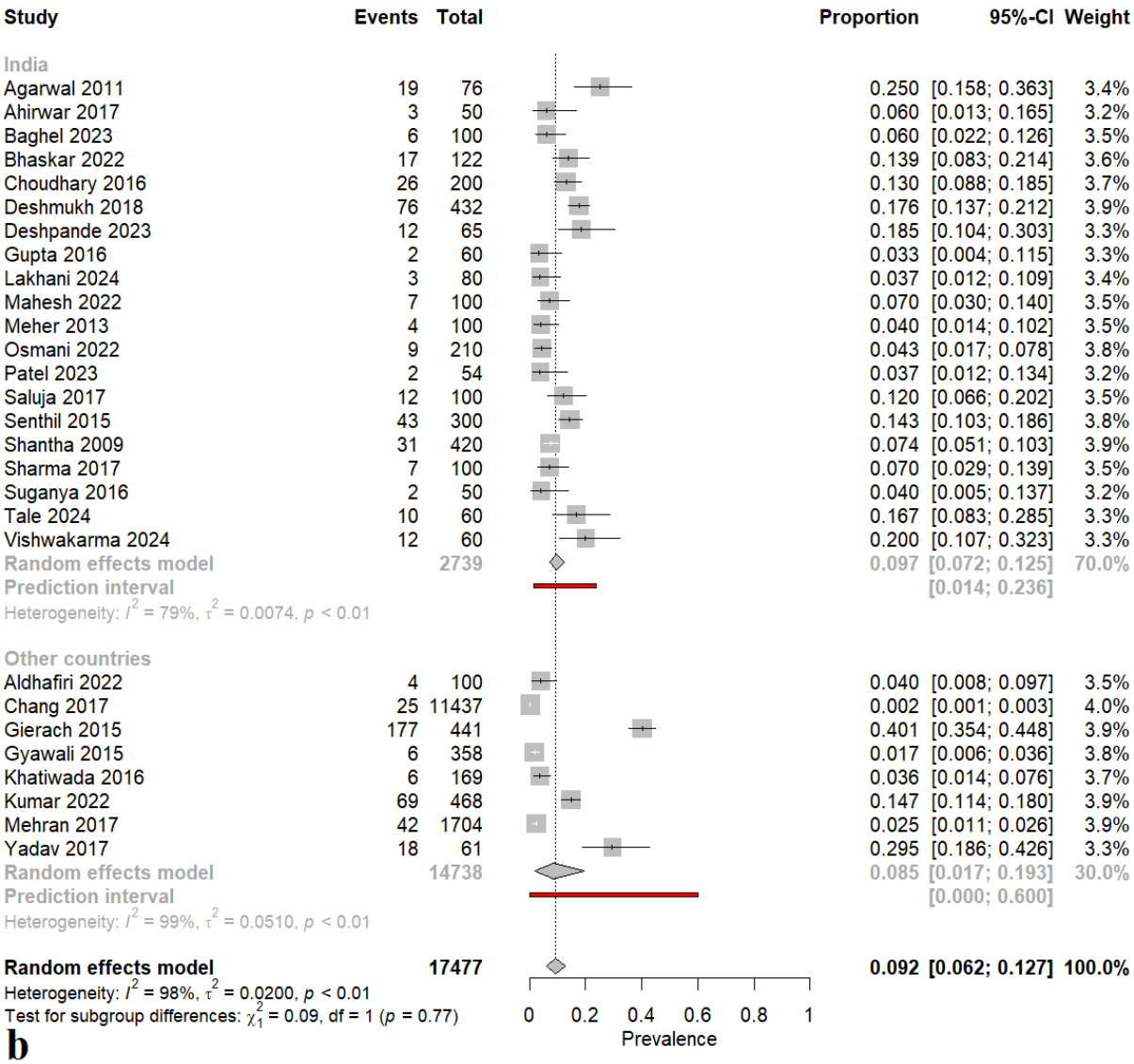


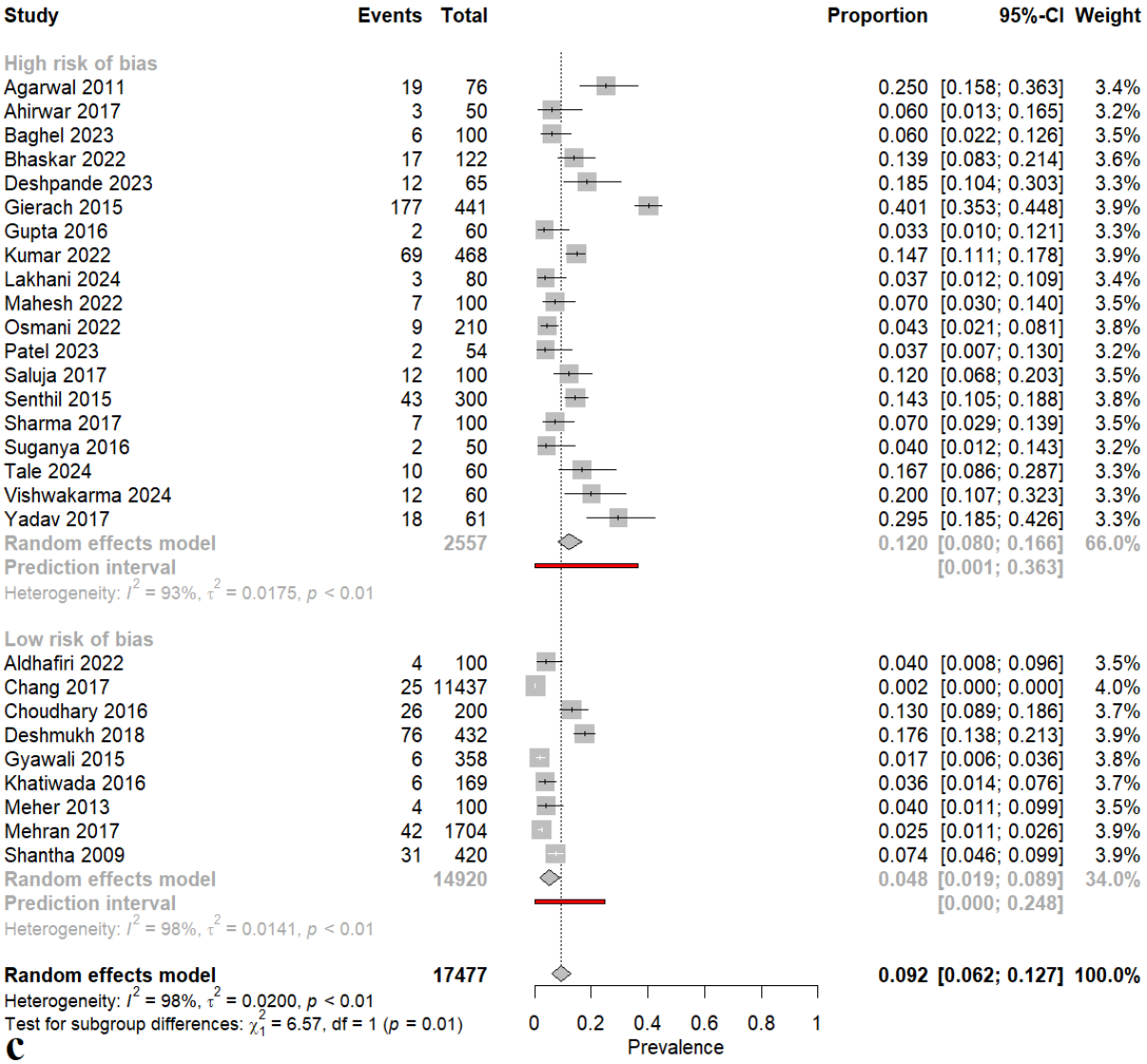
Fig. S4 forest plot showing the pooled prevalence of subclinical hypothyroidism among males with metabolic syndrome


Study
Events
Total
Proportion
95%-CI
Weight
Publication year < 2020
Agarwal 2011 19 76 0.250 [0.158; 0.363] 3.4%
Ahirwar 2017 3 50 0.060 [0.013; 0.165] 3.2%
Chang 2017 25 11437 0.002 [0.000; 0.000] 4.0%
Choudhary 2016 26 200 0.130 [0.085; 0.184] 3.7%
Deshmukh 2018 76 432 0.176 [0.141; 0.215] 3.9%
Gierach 2015 177 441 0.401 [0.353; 0.448] 3.9%
Gupta 2016 2 60 0.033 [0.010; 0.121] 3.3%
Gyawali 2015 6 358 0.017 [0.002; 0.030] 3.8%
Khatiwada 2016 6 169 0.036 [0.015; 0.077] 3.7%
Meher 2013 4 100 0.040 [0.013; 0.101] 3.5%
Mehran 2017 42 1704 0.025 [0.017; 0.032] 3.9%
Saluja 2017 12 100 0.120 [0.064; 0.200] 3.5%
Senthil 2015 43 300 0.143 [0.107; 0.189] 3.8%
Shantha 2009 31 420 0.074 [0.050; 0.102] 3.9%
Sharma 2017 7 100 0.070 [0.029; 0.139] 3.5%
Suganya 2016 2 50 0.040 [0.012; 0.143] 3.2%
Yadav 2017 18 61 0.295 [0.187; 0.426] 3.3%
Random effects model 16058 0.092 [0.049; 0.145] 61.6%
Prediction interval [0.000; 0.393]
Heterogeneity: I^2 = 99%, τ^2 = 0.0276, p < 0.01
Publication year ≥ 2020
Aldhafiri 2022 4 100 0.040 [0.007; 0.095] 3.5%
Baghel 2023 6 100 0.060 [0.020; 0.124] 3.5%
Bhaskar 2022 17 122 0.139 [0.079; 0.211] 3.6%
Deshpande 2023 12 65 0.185 [0.099; 0.300] 3.3%
Kumar 2022 69 468 0.147 [0.117; 0.183] 3.9%
Lakhani 2024 3 80 0.037 [0.009; 0.107] 3.4%
Mahesh 2022 7 100 0.070 [0.032; 0.141] 3.5%
Osmani 2022 9 210 0.043 [0.020; 0.080] 3.8%
Patel 2023 2 54 0.037 [0.007; 0.130] 3.2%
Tale 2024 10 60 0.167 [0.083; 0.285] 3.3%
Vishwakarma 2024 12 60 0.200 [0.109; 0.324] 3.3%
Random effects model 1419 0.093 [0.059; 0.132] 38.4%
Prediction interval [0.006; 0.255]
Heterogeneity: I^2 = 79%, τ^2 = 0.0080, p < 0.01
Random effects model 17477 0.092 [0.062; 0.127] 100.0%
Heterogeneity: I^2 = 98%, τ^2 = 0.0200, p < 0.01
Test for subgroup differences: χ^2_1 = 0.01, df = 1 (p = 0.94)
0
0.2
0.4
0.6
0.8
1
Prevalence

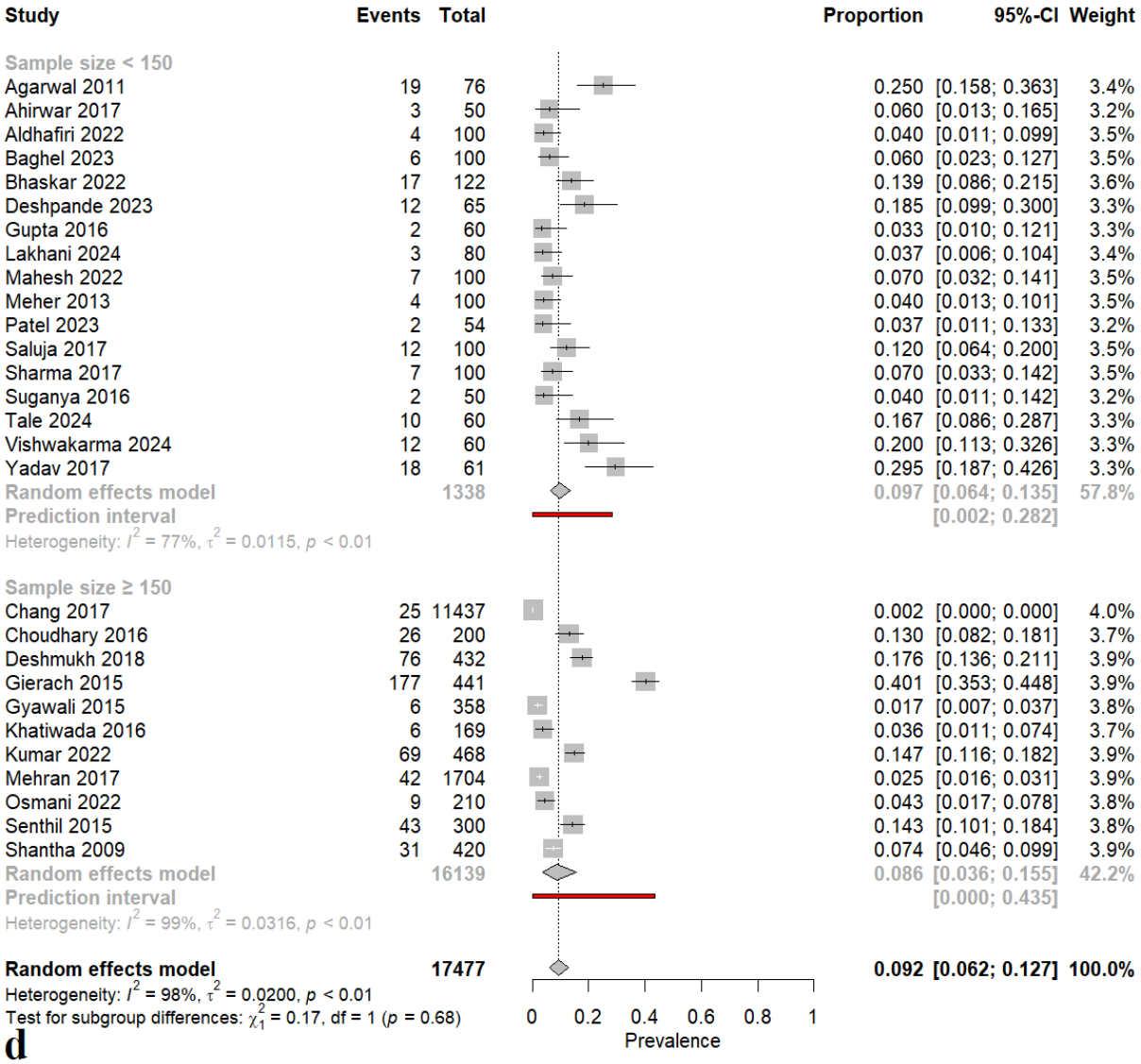
a


Study
Events
Total
Proportion
95%-CI
Weight
India
Agarwal 2011 19 76 0.250 [0.158; 0.363] 3.4%
Ahirwar 2017 3 50 0.060 [0.013; 0.165] 3.2%
Baghel 2023 6 100 0.060 [0.022; 0.126] 3.5%
Bhaskar 2022 17 122 0.139 [0.083; 0.214] 3.6%
Choudhary 2016 26 200 0.130 [0.088; 0.185] 3.7%
Deshmukh 2018 76 432 0.176 [0.137; 0.212] 3.9%
Deshpande 2023 12 65 0.185 [0.104; 0.303] 3.3%
Gupta 2016 2 60 0.033 [0.004; 0.115] 3.3%
Lakhani 2024 3 80 0.037 [0.012; 0.109] 3.4%
Mahesh 2022 7 100 0.070 [0.030; 0.140] 3.5%
Meher 2013 4 100 0.040 [0.014; 0.102] 3.5%
Osmani 2022 9 210 0.043 [0.017; 0.078] 3.8%
Patel 2023 2 54 0.037 [0.012; 0.134] 3.2%
Saluja 2017 12 100 0.120 [0.066; 0.202] 3.5%
Senthil 2015 43 300 0.143 [0.103; 0.186] 3.8%
Shantha 2009 31 420 0.074 [0.051; 0.103] 3.9%
Sharma 2017 7 100 0.070 [0.029; 0.139] 3.5%
Suganya 2016 2 50 0.040 [0.005; 0.137] 3.2%
Tale 2024 10 60 0.167 [0.083; 0.285] 3.3%
Vishwakarma 2024 12 60 0.200 [0.107; 0.323] 3.3%
Random effects model 2739 0.097 [0.072; 0.125] 70.0%
Prediction interval [0.014; 0.236]
Heterogeneity: I^2 = 79%, τ^2 = 0.0074, p < 0.01
Other countries
Aldhafiri 2022 4 100 0.040 [0.008; 0.097] 3.5%
Chang 2017 25 11437 0.002 [0.001; 0.003] 4.0%
Gierach 2015 177 441 0.401 [0.354; 0.448] 3.9%
Gyawali 2015 6 358 0.017 [0.006; 0.036] 3.8%
Khatiwada 2016 6 169 0.036 [0.014; 0.076] 3.7%
Kumar 2022 69 468 0.147 [0.114; 0.180] 3.9%
Mehran 2017 42 1704 0.025 [0.011; 0.026] 3.9%
Yadav 2017 18 61 0.295 [0.186; 0.426] 3.3%
Random effects model 14738 0.085 [0.017; 0.193] 30.0%
Prediction interval [0.000; 0.600]
Heterogeneity: I^2 = 99%, τ^2 = 0.0510, p < 0.01
Random effects model 17477 0.092 [0.062; 0.127] 100.0%
Heterogeneity: I^2 = 98%, τ^2 = 0.0200, p < 0.01
Test for subgroup differences: χ^2_1 = 0.09, df = 1 (p = 0.77)
0
0.2
0.4
0.6
0.8
1
Prevalence

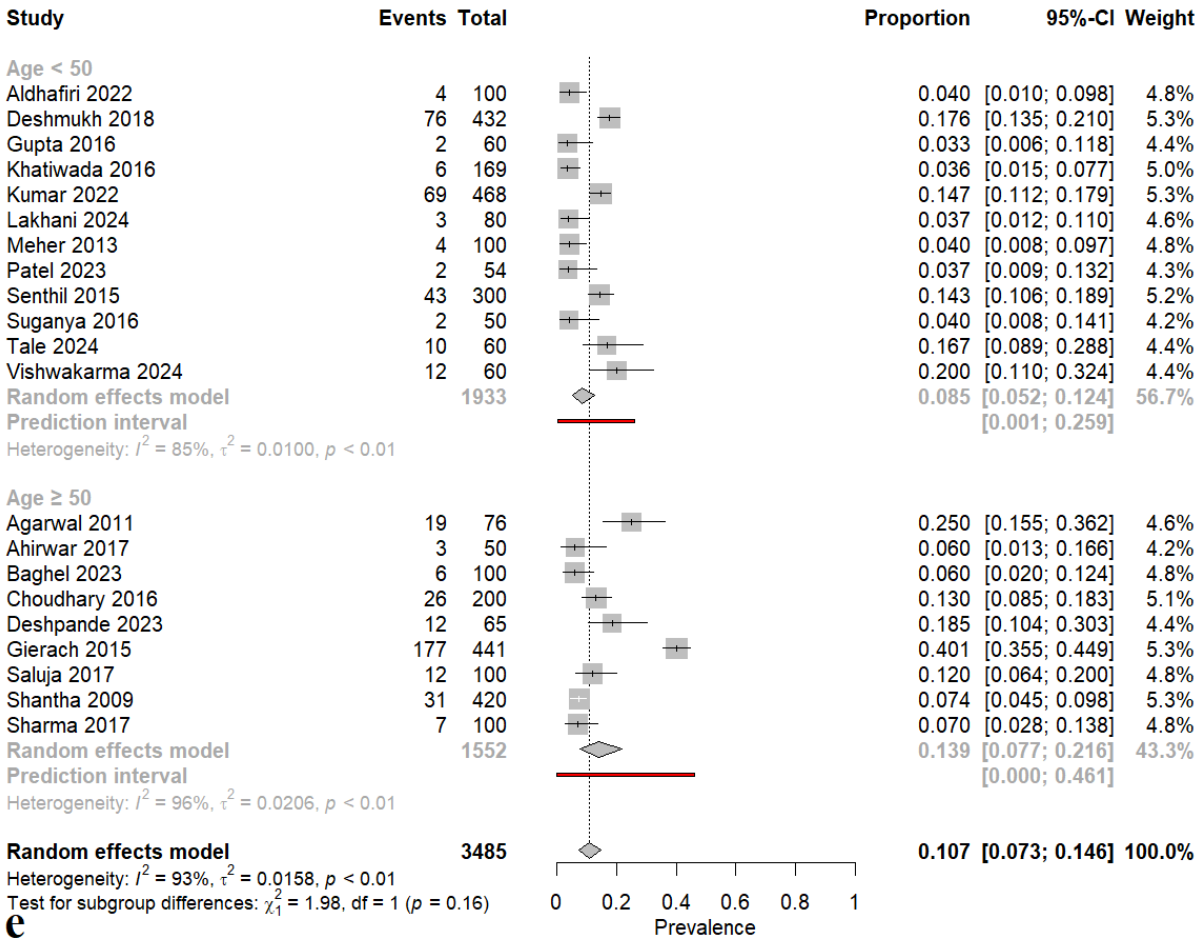
b


Study
Events
Total
Proportion
95%-CI
Weight
High risk of bias
Agarwal 2011 19 76 0.250 [0.158; 0.363] 3.4%
Ahirwar 2017 3 50 0.060 [0.013; 0.165] 3.2%
Baghel 2023 6 100 0.060 [0.022; 0.126] 3.5%
Bhaskar 2022 17 122 0.139 [0.083; 0.214] 3.6%
Deshpande 2023 12 65 0.185 [0.104; 0.303] 3.3%
Gierach 2015 177 441 0.401 [0.353; 0.448] 3.9%
Gupta 2016 2 60 0.033 [0.010; 0.121] 3.3%
Kumar 2022 69 468 0.147 [0.111; 0.178] 3.9%
Lakhani 2024 3 80 0.037 [0.012; 0.109] 3.4%
Mahesh 2022 7 100 0.070 [0.030; 0.140] 3.5%
Osmani 2022 9 210 0.043 [0.021; 0.081] 3.8%
Patel 2023 2 54 0.037 [0.007; 0.130] 3.2%
Saluja 2017 12 100 0.120 [0.068; 0.203] 3.5%
Senthil 2015 43 300 0.143 [0.105; 0.188] 3.8%
Sharma 2017 7 100 0.070 [0.029; 0.139] 3.5%
Suganya 2016 2 50 0.040 [0.012; 0.143] 3.2%
Tale 2024 10 60 0.167 [0.086; 0.287] 3.3%
Vishwakarma 2024 12 60 0.200 [0.107; 0.323] 3.3%
Yadav 2017 18 61 0.295 [0.185; 0.426] 3.3%
Random effects model 2557 0.120 [0.080; 0.166] 66.0%
Prediction interval [0.001; 0.363]
Heterogeneity: I^2 = 93%, τ^2 = 0.0175, p < 0.01
Low risk of bias
Aldhafiri 2022 4 100 0.040 [0.008; 0.096] 3.5%
Chang 2017 25 11437 0.002 [0.000; 0.000] 4.0%
Choudhary 2016 26 200 0.130 [0.089; 0.186] 3.7%
Deshmukh 2018 76 432 0.176 [0.138; 0.213] 3.9%
Gyawali 2015 6 358 0.017 [0.006; 0.036] 3.8%
Khatiwada 2016 6 169 0.036 [0.014; 0.076] 3.7%
Meher 2013 4 100 0.040 [0.011; 0.099] 3.5%
Mehran 2017 42 1704 0.025 [0.011; 0.026] 3.9%
Shantha 2009 31 420 0.074 [0.046; 0.099] 3.9%
Random effects model 14920 0.048 [0.019; 0.089] 34.0%
Prediction interval [0.000; 0.248]
Heterogeneity: I^2 = 98%, τ^2 = 0.0141, p < 0.01
Random effects model 17477 0.092 [0.062; 0.127] 100.0%
Heterogeneity: I^2 = 98%, τ^2 = 0.0200, p < 0.01
Test for subgroup differences: χ^2_1 = 6.57, df = 1 (p = 0.01)
0
0.2
0.4
0.6
0.8
1
Prevalence

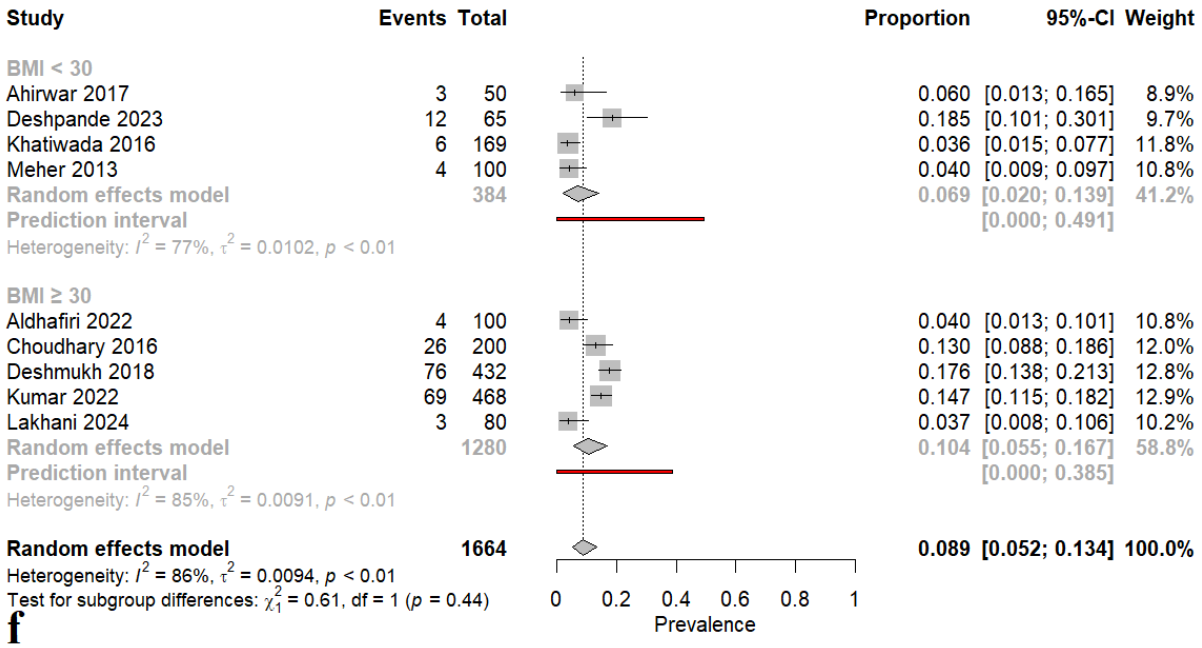
c


Study
Events
Total
Proportion
95%-CI
Weight
Sample size < 150
Agarwal 2011 19 76 0.250 [0.158; 0.363] 3.4%
Ahirwar 2017 3 50 0.060 [0.013; 0.165] 3.2%
Aldhafiri 2022 4 100 0.040 [0.011; 0.099] 3.5%
Baghel 2023 6 100 0.060 [0.023; 0.127] 3.5%
Bhaskar 2022 17 122 0.139 [0.086; 0.215] 3.6%
Deshpande 2023 12 65 0.185 [0.099; 0.300] 3.3%
Gupta 2016 2 60 0.033 [0.010; 0.121] 3.3%
Lakhani 2024 3 80 0.037 [0.006; 0.104] 3.4%
Mahesh 2022 7 100 0.070 [0.032; 0.141] 3.5%
Meher 2013 4 100 0.040 [0.013; 0.101] 3.5%
Patel 2023 2 54 0.037 [0.011; 0.133] 3.2%
Saluja 2017 12 100 0.120 [0.064; 0.200] 3.5%
Sharma 2017 7 100 0.070 [0.033; 0.142] 3.5%
Suganya 2016 2 50 0.040 [0.011; 0.142] 3.2%
Tale 2024 10 60 0.167 [0.086; 0.287] 3.3%
Vishwakarma 2024 12 60 0.200 [0.113; 0.326] 3.3%
Yadav 2017 18 61 0.295 [0.187; 0.426] 3.3%
Random effects model 1338 0.097 [0.064; 0.135] 57.8%
Prediction interval [0.002; 0.282]
Heterogeneity: I^2 = 77%, τ^2 = 0.0115, p < 0.01
Sample size ≥ 150
Chang 2017 25 11437 0.002 [0.000; 0.000] 4.0%
Choudhary 2016 26 200 0.130 [0.082; 0.181] 3.7%
Deshmukh 2018 76 432 0.176 [0.136; 0.211] 3.9%
Gierach 2015 177 441 0.401 [0.353; 0.448] 3.9%
Gyawali 2015 6 358 0.017 [0.007; 0.037] 3.8%
Khatiwada 2016 6 169 0.036 [0.011; 0.074] 3.7%
Kumar 2022 69 468 0.147 [0.116; 0.182] 3.9%
Mehran 2017 42 1704 0.025 [0.016; 0.031] 3.9%
Osmani 2022 9 210 0.043 [0.017; 0.078] 3.8%
Senthil 2015 43 300 0.143 [0.101; 0.184] 3.8%
Shantha 2009 31 420 0.074 [0.046; 0.099] 3.9%
Random effects model 16139 0.086 [0.036; 0.155] 42.2%
Prediction interval [0.000; 0.435]
Heterogeneity: I^2 = 99%, τ^2 = 0.0316, p < 0.01
Random effects model 17477 0.092 [0.062; 0.127] 100.0%
Heterogeneity: I^2 = 98%, τ^2 = 0.0200, p < 0.01
Test for subgroup differences: χ^2_1 = 0.17, df = 1 (p = 0.68)
0
0.2
0.4
0.6
0.8
1
Prevalence

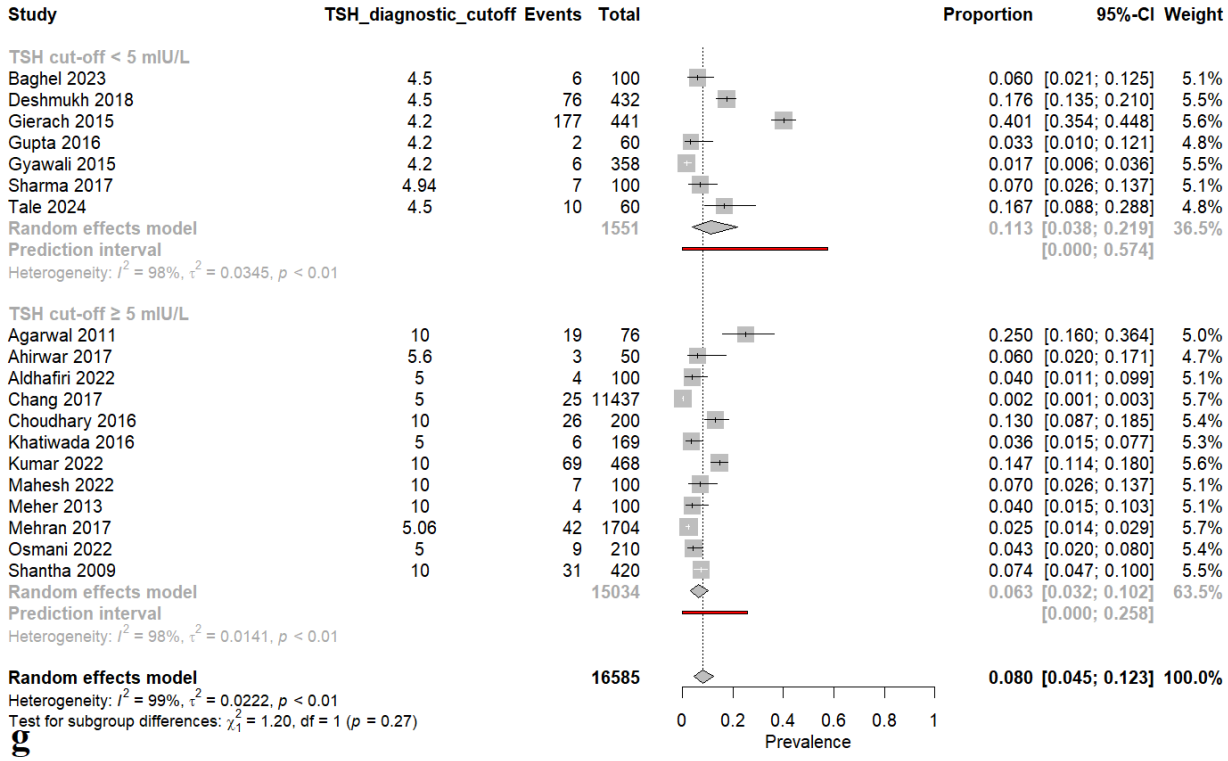
d


Study
Events
Total
Proportion
95%-CI
Weight
Age < 50
Aldhafiri 2022 4 100 0.040 [0.010; 0.098] 4.8%
Deshmukh 2018 76 432 0.176 [0.135; 0.210] 5.3%
Gupta 2016 2 60 0.033 [0.006; 0.118] 4.4%
Khatiwada 2016 6 169 0.036 [0.015; 0.077] 5.0%
Kumar 2022 69 468 0.147 [0.112; 0.179] 5.3%
Lakhani 2024 3 80 0.037 [0.012; 0.110] 4.6%
Meher 2013 4 100 0.040 [0.008; 0.097] 4.8%
Patel 2023 2 54 0.037 [0.009; 0.132] 4.3%
Senthil 2015 43 300 0.143 [0.106; 0.189] 5.2%
Suganya 2016 2 50 0.040 [0.008; 0.141] 4.2%
Tale 2024 10 60 0.167 [0.089; 0.288] 4.4%
Vishwakarma 2024 12 60 0.200 [0.110; 0.324] 4.4%
Random effects model 1933 0.085 [0.052; 0.124] 56.7%
Prediction interval [0.001; 0.259]
Heterogeneity: I^2 = 85%, τ^2 = 0.0100, p < 0.01
Age ≥ 50
Agarwal 2011 19 76 0.250 [0.155; 0.362] 4.6%
Ahirwar 2017 3 50 0.060 [0.013; 0.166] 4.2%
Baghel 2023 6 100 0.060 [0.020; 0.124] 4.8%
Choudhary 2016 26 200 0.130 [0.085; 0.183] 5.1%
Deshpande 2023 12 65 0.185 [0.104; 0.303] 4.4%
Gierach 2015 177 441 0.401 [0.355; 0.449] 5.3%
Saluja 2017 12 100 0.120 [0.064; 0.200] 4.8%
Shantha 2009 31 420 0.074 [0.045; 0.098] 5.3%
Sharma 2017 7 100 0.070 [0.028; 0.138] 4.8%
Random effects model 1552 0.139 [0.077; 0.216] 43.3%
Prediction interval [0.000; 0.461]
Heterogeneity: I^2 = 96%, τ^2 = 0.0206, p < 0.01
Random effects model 3485 0.107 [0.073; 0.146] 100.0%
Heterogeneity: I^2 = 93%, τ^2 = 0.0158, p < 0.01
Test for subgroup differences: χ^2_1 = 1.98, df = 1 (p = 0.16)
0 0.2 0.4 0.6 0.8 1
Prevalence

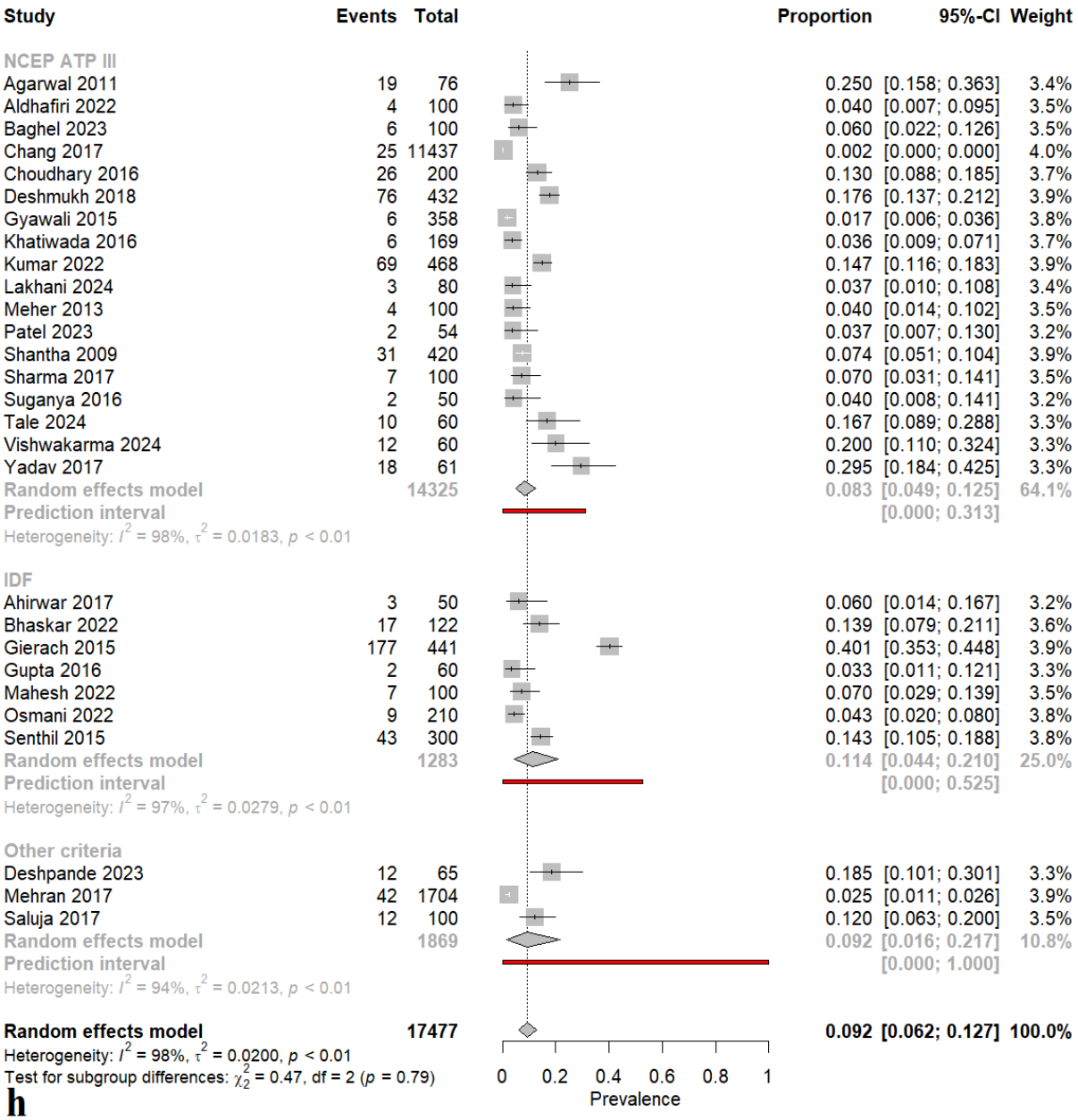
e


Study
Events
Total
Proportion
95%-CI
Weight
BMI < 30
Ahirwar 2017 3 50 0.060 [0.013; 0.165] 8.9%
Deshpande 2023 12 65 0.185 [0.101; 0.301] 9.7%
Khatiwada 2016 6 169 0.036 [0.015; 0.077] 11.8%
Meher 2013 4 100 0.040 [0.009; 0.097] 10.8%
Random effects model 384 0.069 [0.020; 0.139] 41.2%
Prediction interval [0.000; 0.491]
Heterogeneity: I^2 = 77%, τ^2 = 0.0102, p < 0.01
BMI ≥ 30
Aldhafiri 2022 4 100 0.040 [0.013; 0.101] 10.8%
Choudhary 2016 26 200 0.130 [0.088; 0.186] 12.0%
Deshmukh 2018 76 432 0.176 [0.138; 0.213] 12.8%
Kumar 2022 69 468 0.147 [0.115; 0.182] 12.9%
Lakhani 2024 3 80 0.037 [0.008; 0.106] 10.2%
Random effects model 1280 0.104 [0.055; 0.167] 58.8%
Prediction interval [0.000; 0.385]
Heterogeneity: I^2 = 85%, τ^2 = 0.0091, p < 0.01
Random effects model 1664 0.089 [0.052; 0.134] 100.0%
Heterogeneity: I^2 = 86%, τ^2 = 0.0094, p < 0.01
Test for subgroup differences: χ^2_1 = 0.61, df = 1 (p = 0.44)
0 0.2 0.4 0.6 0.8 1
Prevalence

f


Study
TSH_diagnostic_cutoff
Events
Total
Proportion
95%-CI
Weight
TSH cut-off < 5 mIU/L
Baghel 2023 4.5 6 100 0.060 [0.021; 0.125] 5.1%
Deshmukh 2018 4.5 76 432 0.176 [0.135; 0.210] 5.5%
Gierach 2015 4.2 177 441 0.401 [0.354; 0.448] 5.6%
Gupta 2016 4.2 2 60 0.033 [0.010; 0.121] 4.8%
Gyawali 2015 4.2 6 358 0.017 [0.006; 0.036] 5.5%
Sharma 2017 4.94 7 100 0.070 [0.026; 0.137] 5.1%
Tale 2024 4.5 10 60 0.167 [0.088; 0.288] 4.8%
Random effects model 1551 0.113 [0.038; 0.219] 36.5%
Prediction interval [0.000; 0.574]
Heterogeneity: I^2 = 98%, τ^2 = 0.0345, p < 0.01
TSH cut-off ≥ 5 mIU/L
Agarwal 2011 10 19 76 0.250 [0.160; 0.364] 5.0%
Ahirwar 2017 5.6 3 50 0.060 [0.020; 0.171] 4.7%
Aldhafiri 2022 5 4 100 0.040 [0.011; 0.099] 5.1%
Chang 2017 5 25 11437 0.002 [0.001; 0.003] 5.7%
Choudhary 2016 10 26 200 0.130 [0.087; 0.185] 5.4%
Khatiwada 2016 5 6 169 0.036 [0.015; 0.077] 5.3%
Kumar 2022 10 69 468 0.147 [0.114; 0.180] 5.6%
Mahesh 2022 10 7 100 0.070 [0.026; 0.137] 5.1%
Meher 2013 10 4 100 0.040 [0.015; 0.103] 5.1%
Mehran 2017 5.06 42 1704 0.025 [0.014; 0.029] 5.7%
Osmani 2022 5 9 210 0.043 [0.020; 0.080] 5.4%
Shantha 2009 10 31 420 0.074 [0.047; 0.100] 5.5%
Random effects model 15034 0.063 [0.032; 0.102] 63.5%
Prediction interval [0.000; 0.258]
Heterogeneity: I^2 = 98%, τ^2 = 0.0141, p < 0.01
Random effects model 16585 0.080 [0.045; 0.123] 100.0%
Heterogeneity: I^2 = 99%, τ^2 = 0.0222, p < 0.01
Test for subgroup differences: χ^2_1 = 1.20, df = 1 (p = 0.27)
0
0.2
0.4
0.6
0.8
1
Prevalence

g


Study
Events
Total
Proportion
95%-CI
Weight
NCEP ATP III
Agarwal 2011 19 76 0.250 [0.158; 0.363] 3.4%
Aldhafiri 2022 4 100 0.040 [0.007; 0.095] 3.5%
Baghel 2023 6 100 0.060 [0.022; 0.126] 3.5%
Chang 2017 25 11437 0.002 [0.000; 0.000] 4.0%
Choudhary 2016 26 200 0.130 [0.088; 0.185] 3.7%
Deshmukh 2018 76 432 0.176 [0.137; 0.212] 3.9%
Gyawali 2015 6 358 0.017 [0.006; 0.036] 3.8%
Khatiwada 2016 6 169 0.036 [0.009; 0.071] 3.7%
Kumar 2022 69 468 0.147 [0.116; 0.183] 3.9%
Lakhani 2024 3 80 0.037 [0.010; 0.108] 3.4%
Meher 2013 4 100 0.040 [0.014; 0.102] 3.5%
Patel 2023 2 54 0.037 [0.007; 0.130] 3.2%
Shantha 2009 31 420 0.074 [0.051; 0.104] 3.9%
Sharma 2017 7 100 0.070 [0.031; 0.141] 3.5%
Suganya 2016 2 50 0.040 [0.008; 0.141] 3.2%
Tale 2024 10 60 0.167 [0.089; 0.288] 3.3%
Vishwakarma 2024 12 60 0.200 [0.110; 0.324] 3.3%
Yadav 2017 18 61 0.295 [0.184; 0.425] 3.3%
Random effects model 14325 0.083 [0.049; 0.125] 64.1%
Prediction interval [0.000; 0.313]
Heterogeneity: I^2 = 98%, τ^2 = 0.0183, p < 0.01
IDF
Ahirwar 2017 3 50 0.060 [0.014; 0.167] 3.2%
Bhaskar 2022 17 122 0.139 [0.079; 0.211] 3.6%
Gierach 2015 177 441 0.401 [0.353; 0.448] 3.9%
Gupta 2016 2 60 0.033 [0.011; 0.121] 3.3%
Mahesh 2022 7 100 0.070 [0.029; 0.139] 3.5%
Osmani 2022 9 210 0.043 [0.020; 0.080] 3.8%
Senthil 2015 43 300 0.143 [0.105; 0.188] 3.8%
Random effects model 1283 0.114 [0.044; 0.210] 25.0%
Prediction interval [0.000; 0.525]
Heterogeneity: I^2 = 97%, τ^2 = 0.0279, p < 0.01
Other criteria
Deshpande 2023 12 65 0.185 [0.101; 0.301] 3.3%
Mehran 2017 42 1704 0.025 [0.011; 0.026] 3.9%
Saluja 2017 12 100 0.120 [0.063; 0.200] 3.5%
Random effects model 1869 0.092 [0.016; 0.217] 10.8%
Prediction interval [0.000; 1.000]
Heterogeneity: I^2 = 94%, τ^2 = 0.0213, p < 0.01
Random effects model 17477 0.092 [0.062; 0.127] 100.0%
Heterogeneity: I^2 = 98%, τ^2 = 0.0200, p < 0.01
Test for subgroup differences: χ^2_2 = 0.47, df = 2 (p = 0.79)
0
0.2
0.4
0.6
0.8
1
Prevalence

h

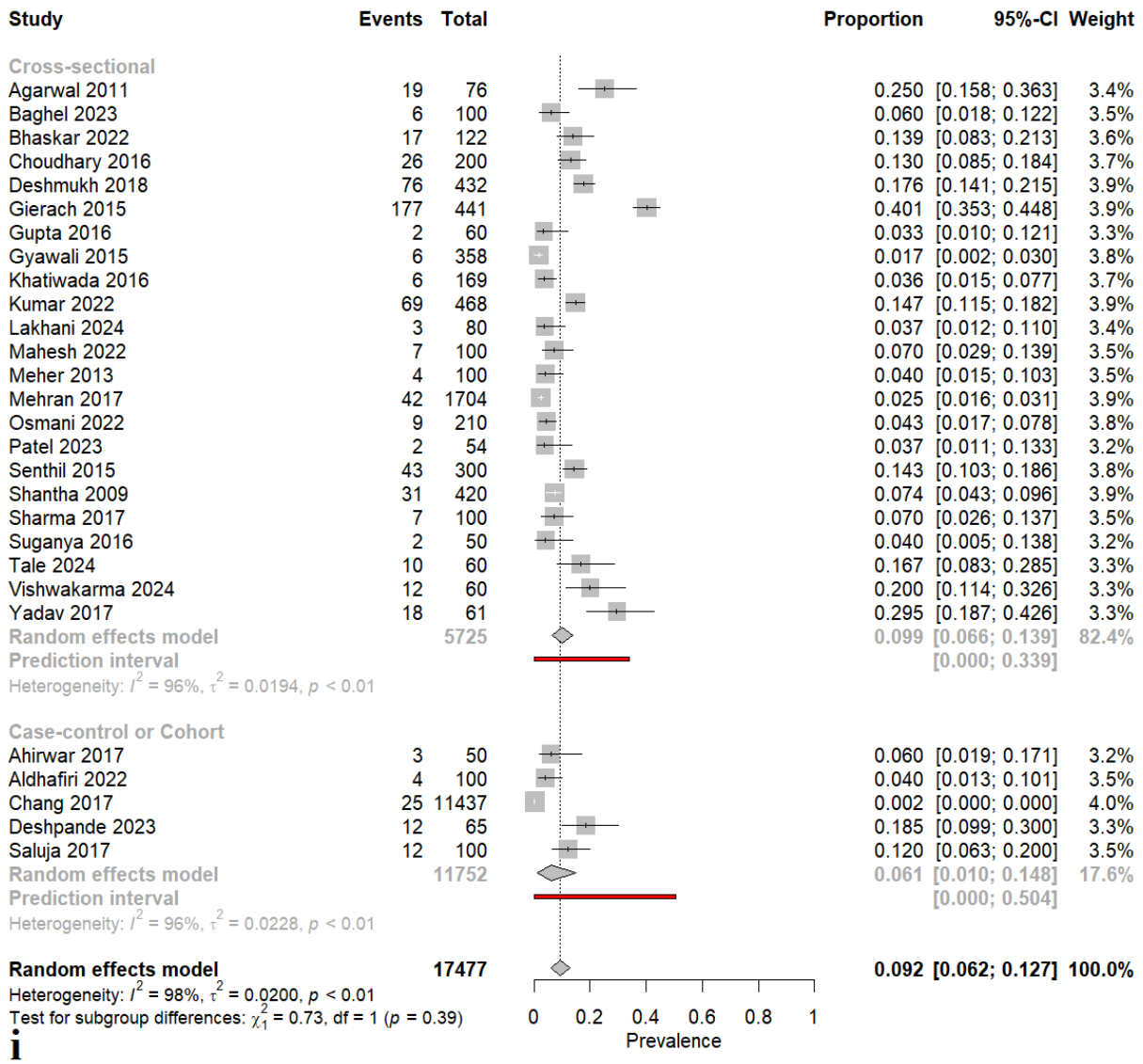
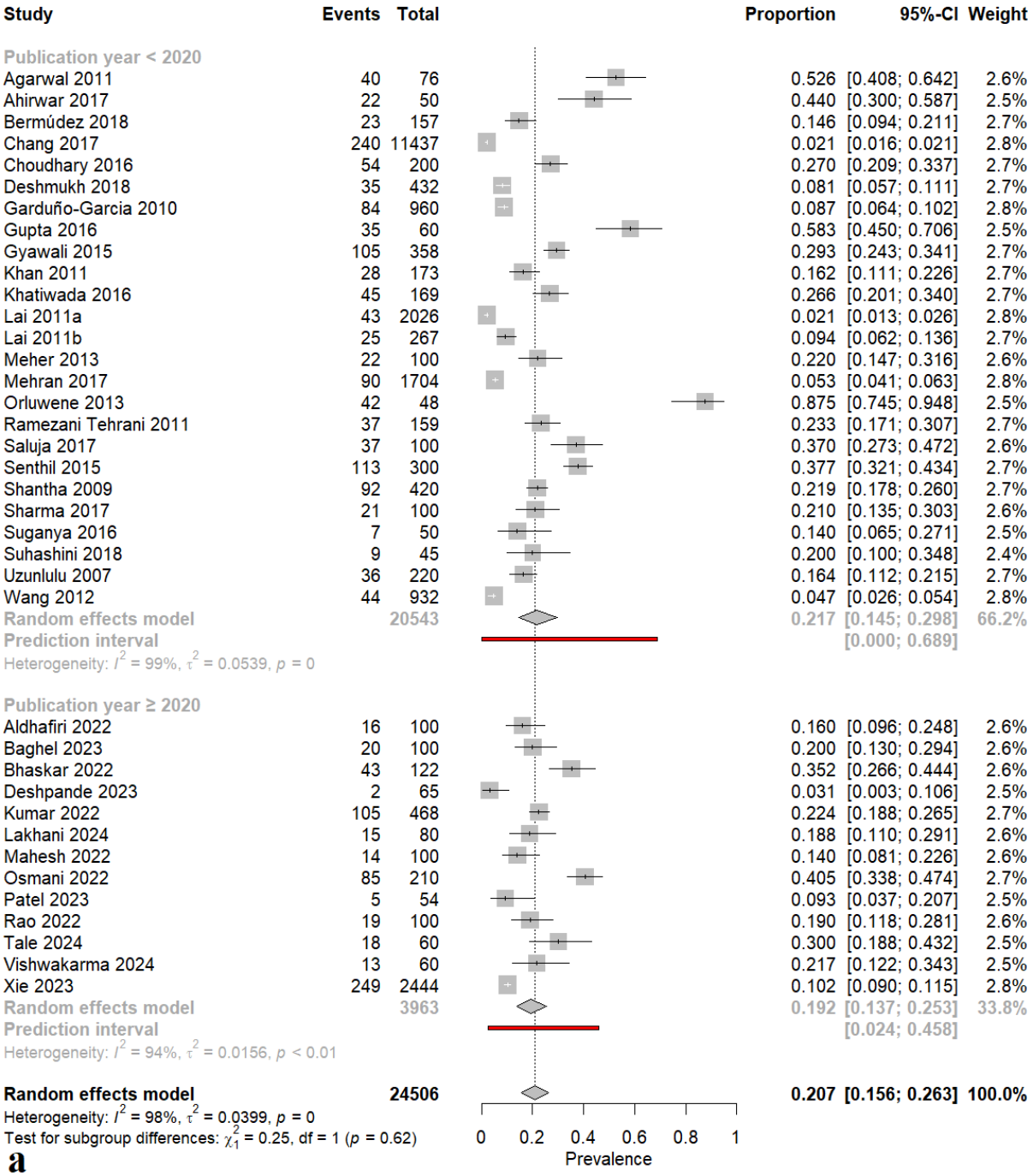
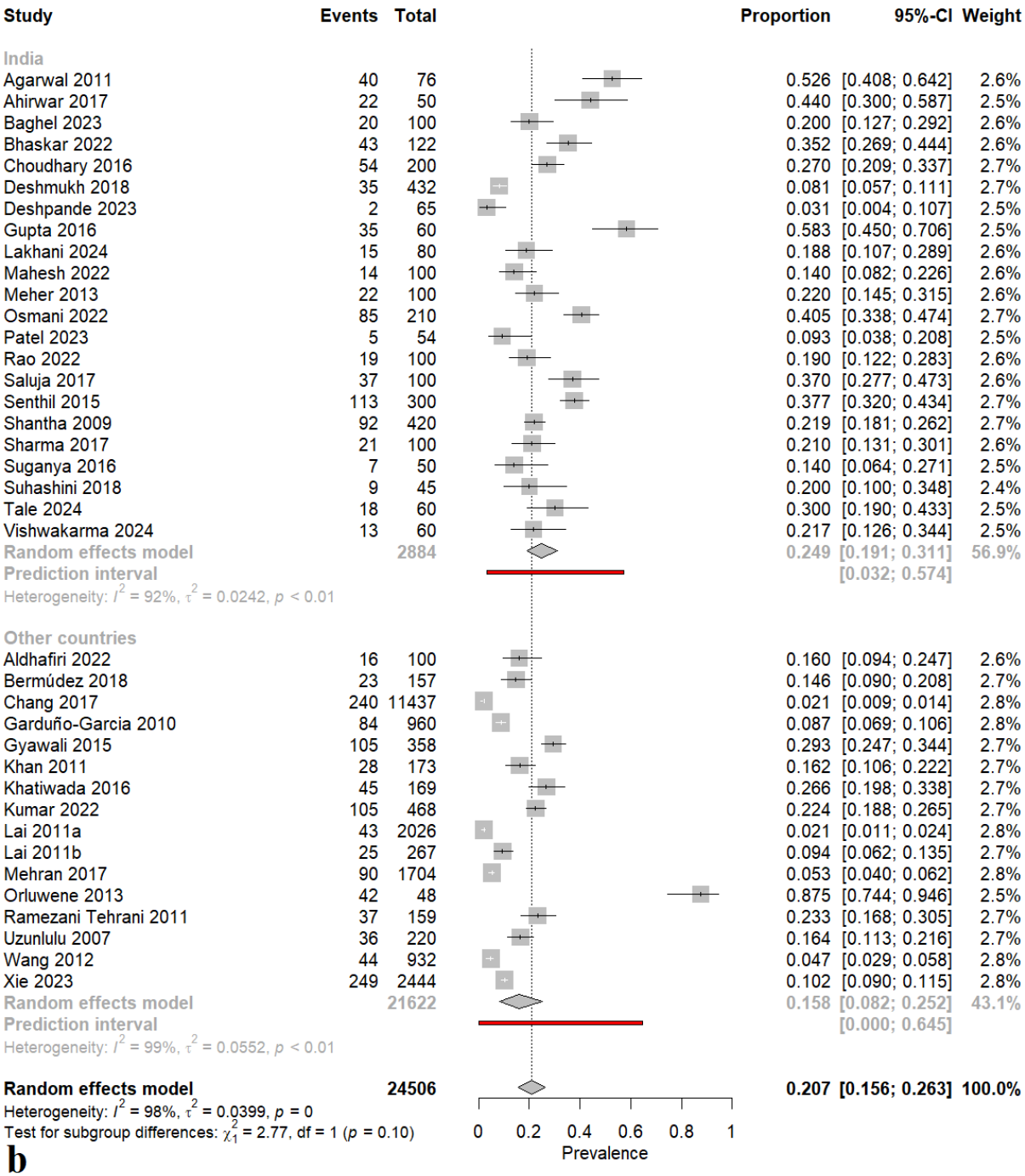


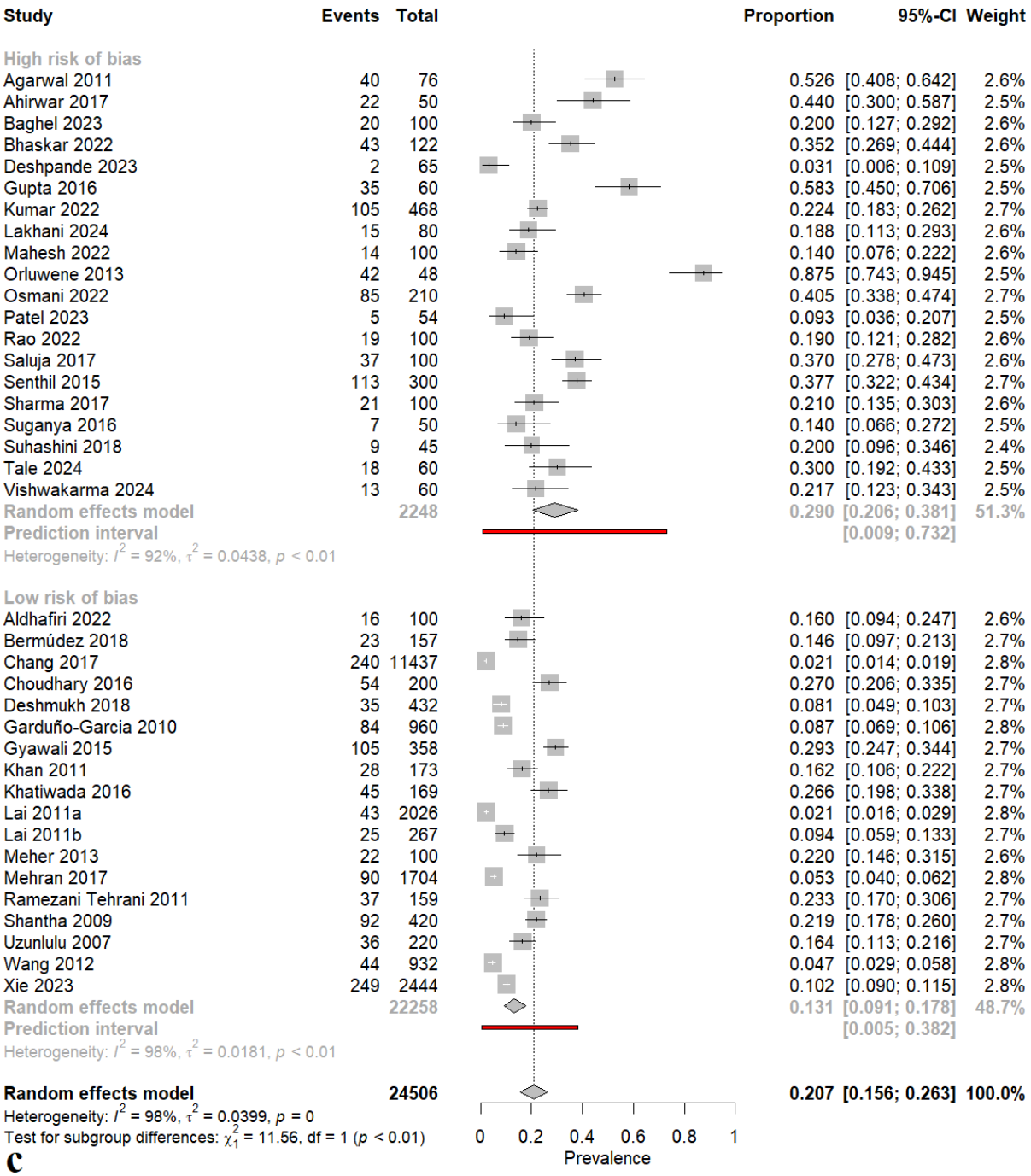
Fig. S5 forest plot showing the pooled prevalence of overt hypothyroidism with subgroup analysis based on a) publication year, b) country, c) risk of bias, d) sample size, e) mean age, f) mean BMI, g) TSH diagnostic cut-off, h) MetS diagnostic criteria, i) Study design


Study
Events
Total
Proportion
95%-CI
Weight
Publication year < 2020
Agarwal 2011 40 76 0.526 [0.408; 0.642] 2.6%
Ahirwar 2017 22 50 0.440 [0.300; 0.587] 2.5%
Bermúdez 2018 23 157 0.146 [0.094; 0.211] 2.7%
Chang 2017 240 11437 0.021 [0.016; 0.021] 2.8%
Choudhary 2016 54 200 0.270 [0.209; 0.337] 2.7%
Deshmukh 2018 35 432 0.081 [0.057; 0.111] 2.7%
Garduño-Garcia 2010 84 960 0.087 [0.064; 0.102] 2.8%
Gupta 2016 35 60 0.583 [0.450; 0.706] 2.5%
Gyawali 2015 105 358 0.293 [0.243; 0.341] 2.7%
Khan 2011 28 173 0.162 [0.111; 0.226] 2.7%
Khatiwada 2016 45 169 0.266 [0.201; 0.340] 2.7%
Lai 2011a 43 2026 0.021 [0.013; 0.026] 2.8%
Lai 2011b 25 267 0.094 [0.062; 0.136] 2.7%
Meher 2013 22 100 0.220 [0.147; 0.316] 2.6%
Mehran 2017 90 1704 0.053 [0.041; 0.063] 2.8%
Orluwene 2013 42 48 0.875 [0.745; 0.948] 2.5%
Ramezani Tehrani 2011 37 159 0.233 [0.171; 0.307] 2.7%
Saluja 2017 37 100 0.370 [0.273; 0.472] 2.6%
Senthil 2015 113 300 0.377 [0.321; 0.434] 2.7%
Shantha 2009 92 420 0.219 [0.178; 0.260] 2.7%
Sharma 2017 21 100 0.210 [0.135; 0.303] 2.6%
Suganya 2016 7 50 0.140 [0.065; 0.271] 2.5%
Suhashini 2018 9 45 0.200 [0.100; 0.348] 2.4%
Uzunlulu 2007 36 220 0.164 [0.112; 0.215] 2.7%
Wang 2012 44 932 0.047 [0.026; 0.054] 2.8%
Random effects model 20543 0.217 [0.145; 0.298] 66.2%
Prediction interval [0.000; 0.689]
Heterogeneity: I^2 = 99%, τ^2 = 0.0539, p = 0
Publication year ≥ 2020
Aldhafiri 2022 16 100 0.160 [0.096; 0.248] 2.6%
Baghel 2023 20 100 0.200 [0.130; 0.294] 2.6%
Bhaskar 2022 43 122 0.352 [0.266; 0.444] 2.6%
Deshpande 2023 2 65 0.031 [0.003; 0.106] 2.5%
Kumar 2022 105 468 0.224 [0.188; 0.265] 2.7%
Lakhani 2024 15 80 0.188 [0.110; 0.291] 2.6%
Mahesh 2022 14 100 0.140 [0.081; 0.226] 2.6%
Osmani 2022 85 210 0.405 [0.338; 0.474] 2.7%
Patel 2023 5 54 0.093 [0.037; 0.207] 2.5%
Rao 2022 19 100 0.190 [0.118; 0.281] 2.6%
Tale 2024 18 60 0.300 [0.188; 0.432] 2.5%
Vishwakarma 2024 13 60 0.217 [0.122; 0.343] 2.5%
Xie 2023 249 2444 0.102 [0.090; 0.115] 2.8%
Random effects model 3963 0.192 [0.137; 0.253] 33.8%
Prediction interval [0.024; 0.458]
Heterogeneity: I^2 = 94%, τ^2 = 0.0156, p < 0.01
Random effects model 24506 0.207 [0.156; 0.263] 100.0%
Heterogeneity: I^2 = 98%, τ^2 = 0.0399, p = 0
Test for subgroup differences: χ^2_1 = 0.25, df = 1 (p = 0.62)
0
0.2
0.4
0.6
0.8
1
Prevalence

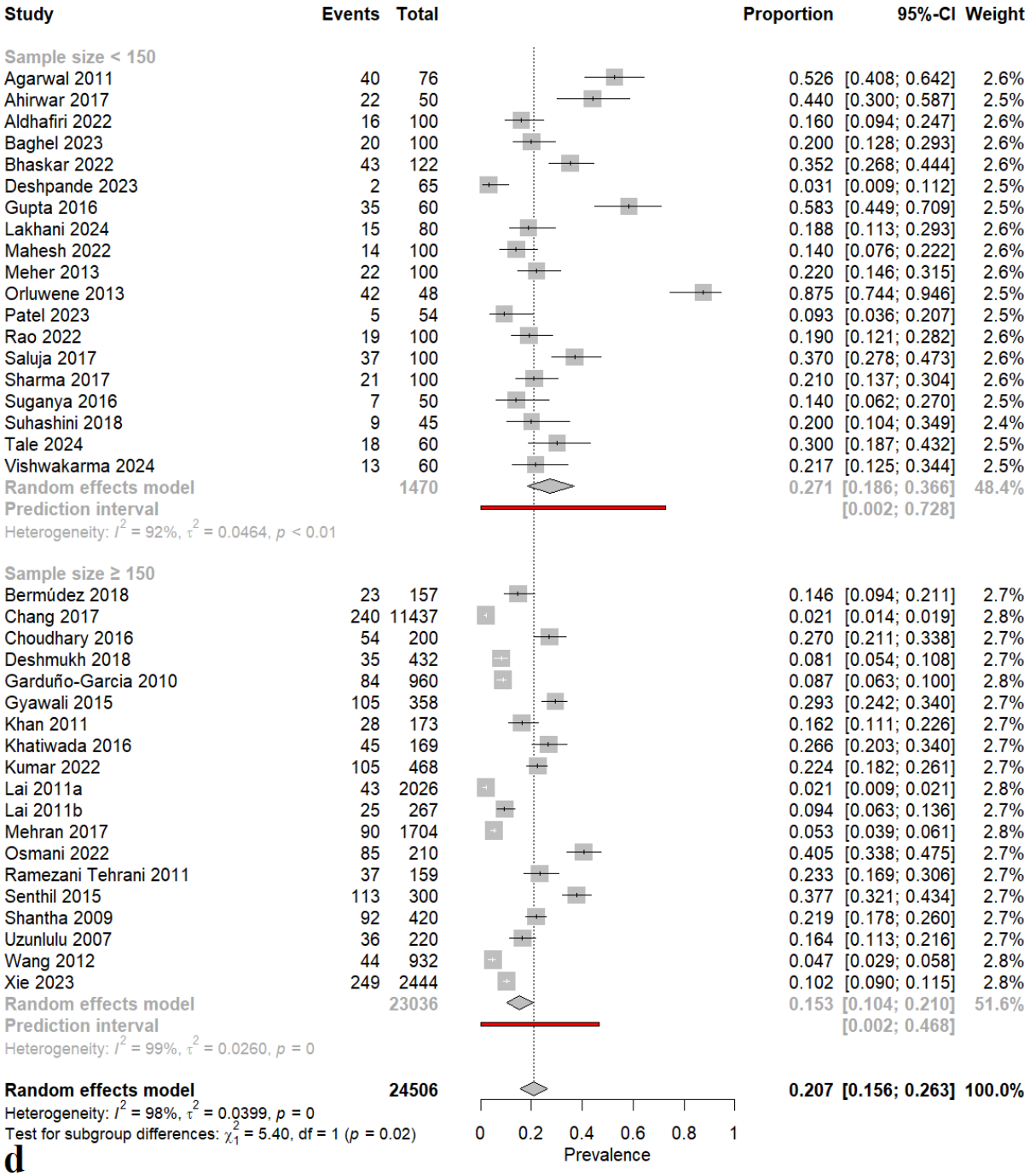
a


Study
Events
Total
Proportion
95%-CI
Weight
India
Agarwal 2011 40 76 0.526 [0.408; 0.642] 2.6%
Ahirwar 2017 22 50 0.440 [0.300; 0.587] 2.5%
Baghel 2023 20 100 0.200 [0.127; 0.292] 2.6%
Bhaskar 2022 43 122 0.352 [0.269; 0.444] 2.6%
Choudhary 2016 54 200 0.270 [0.209; 0.337] 2.7%
Deshmukh 2018 35 432 0.081 [0.057; 0.111] 2.7%
Deshpande 2023 2 65 0.031 [0.004; 0.107] 2.5%
Gupta 2016 35 60 0.583 [0.450; 0.706] 2.5%
Lakhani 2024 15 80 0.188 [0.107; 0.289] 2.6%
Mahesh 2022 14 100 0.140 [0.082; 0.226] 2.6%
Meher 2013 22 100 0.220 [0.145; 0.315] 2.6%
Osmani 2022 85 210 0.405 [0.338; 0.474] 2.7%
Patel 2023 5 54 0.093 [0.038; 0.208] 2.5%
Rao 2022 19 100 0.190 [0.122; 0.283] 2.6%
Saluja 2017 37 100 0.370 [0.277; 0.473] 2.6%
Senthil 2015 113 300 0.377 [0.320; 0.434] 2.7%
Shantha 2009 92 420 0.219 [0.181; 0.262] 2.7%
Sharma 2017 21 100 0.210 [0.131; 0.301] 2.6%
Suganya 2016 7 50 0.140 [0.064; 0.271] 2.5%
Suhashini 2018 9 45 0.200 [0.100; 0.348] 2.4%
Tale 2024 18 60 0.300 [0.190; 0.433] 2.5%
Vishwakarma 2024 13 60 0.217 [0.126; 0.344] 2.5%
Random effects model 2884 0.249 [0.191; 0.311] 56.9%
Prediction interval [0.032; 0.574]
Heterogeneity: I^2 = 92%, τ^2 = 0.0242, p < 0.01
Other countries
Aldhafiri 2022 16 100 0.160 [0.094; 0.247] 2.6%
Bermúdez 2018 23 157 0.146 [0.090; 0.208] 2.7%
Chang 2017 240 11437 0.021 [0.009; 0.014] 2.8%
Garduño-Garcia 2010 84 960 0.087 [0.069; 0.106] 2.8%
Gyawali 2015 105 358 0.293 [0.247; 0.344] 2.7%
Khan 2011 28 173 0.162 [0.106; 0.222] 2.7%
Khatiwada 2016 45 169 0.266 [0.198; 0.338] 2.7%
Kumar 2022 105 468 0.224 [0.188; 0.265] 2.7%
Lai 2011a 43 2026 0.021 [0.011; 0.024] 2.8%
Lai 2011b 25 267 0.094 [0.062; 0.135] 2.7%
Mehran 2017 90 1704 0.053 [0.040; 0.062] 2.8%
Orluwene 2013 42 48 0.875 [0.744; 0.946] 2.5%
Ramezani Tehrani 2011 37 159 0.233 [0.168; 0.305] 2.7%
Uzunlulu 2007 36 220 0.164 [0.113; 0.216] 2.7%
Wang 2012 44 932 0.047 [0.029; 0.058] 2.8%
Xie 2023 249 2444 0.102 [0.090; 0.115] 2.8%
Random effects model 21622 0.158 [0.082; 0.252] 43.1%
Prediction interval [0.000; 0.645]
Heterogeneity: I^2 = 99%, τ^2 = 0.0552, p < 0.01
Random effects model 24506 0.207 [0.156; 0.263] 100.0%
Heterogeneity: I^2 = 98%, τ^2 = 0.0399, p = 0
Test for subgroup differences: χ^2_1 = 2.77, df = 1 (p = 0.10)
0
0.2
0.4
0.6
0.8
1
Prevalence

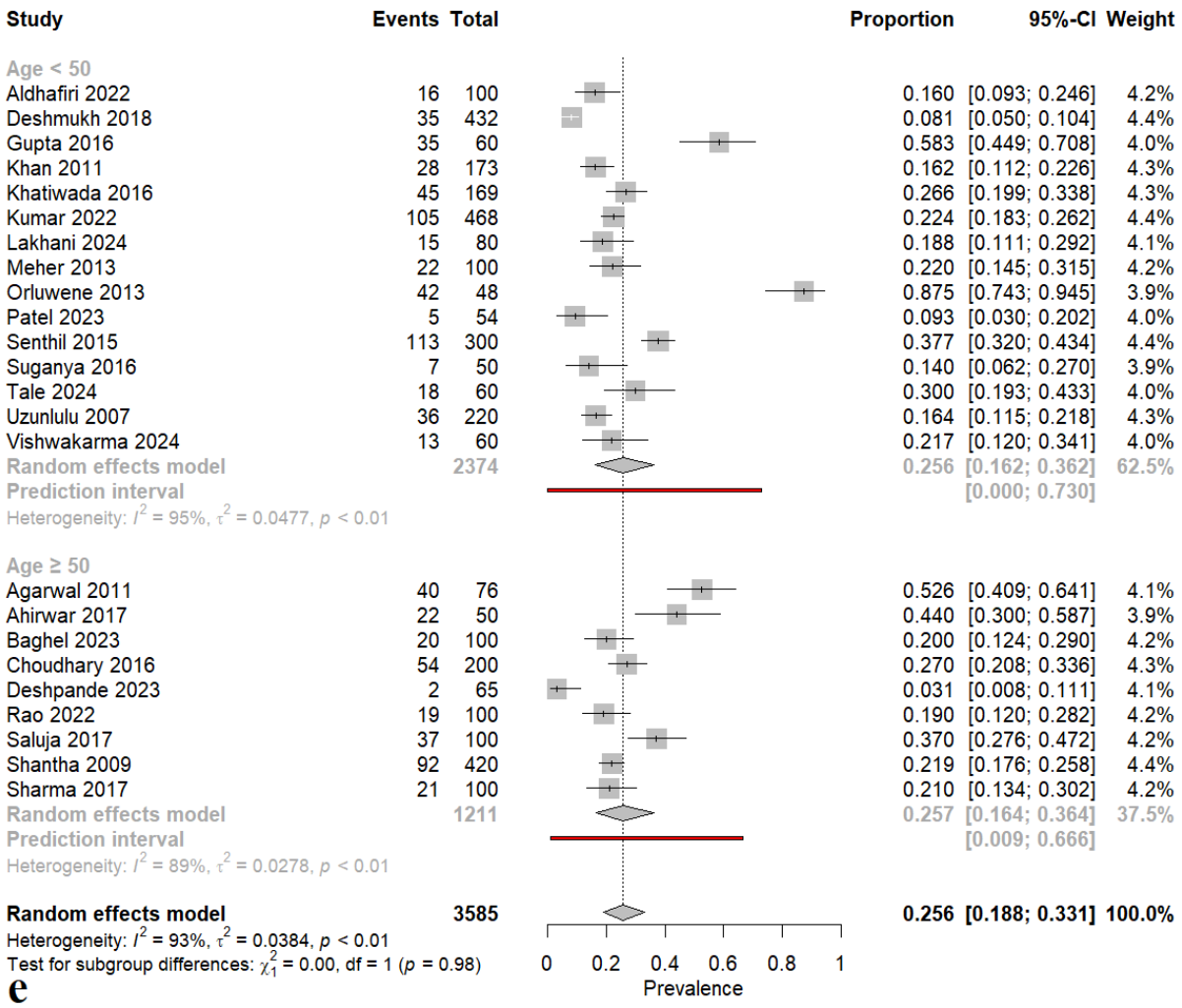
b


Study
Events
Total
Proportion
95%-CI
Weight
High risk of bias
Agarwal 2011 40 76 0.526 [0.408; 0.642] 2.6%
Ahirwar 2017 22 50 0.440 [0.300; 0.587] 2.5%
Baghel 2023 20 100 0.200 [0.127; 0.292] 2.6%
Bhaskar 2022 43 122 0.352 [0.269; 0.444] 2.6%
Deshpande 2023 2 65 0.031 [0.006; 0.109] 2.5%
Gupta 2016 35 60 0.583 [0.450; 0.706] 2.5%
Kumar 2022 105 468 0.224 [0.183; 0.262] 2.7%
Lakhani 2024 15 80 0.188 [0.113; 0.293] 2.6%
Mahesh 2022 14 100 0.140 [0.076; 0.222] 2.6%
Orluwene 2013 42 48 0.875 [0.743; 0.945] 2.5%
Osmani 2022 85 210 0.405 [0.338; 0.474] 2.7%
Patel 2023 5 54 0.093 [0.036; 0.207] 2.5%
Rao 2022 19 100 0.190 [0.121; 0.282] 2.6%
Saluja 2017 37 100 0.370 [0.278; 0.473] 2.6%
Senthil 2015 113 300 0.377 [0.322; 0.434] 2.7%
Sharma 2017 21 100 0.210 [0.135; 0.303] 2.6%
Suganya 2016 7 50 0.140 [0.066; 0.272] 2.5%
Suhashini 2018 9 45 0.200 [0.096; 0.346] 2.4%
Tale 2024 18 60 0.300 [0.192; 0.433] 2.5%
Vishwakarma 2024 13 60 0.217 [0.123; 0.343] 2.5%
Random effects model 2248 0.290 [0.206; 0.381] 51.3%
Prediction interval [0.009; 0.732]
Heterogeneity: I^2 = 92%, τ^2 = 0.0438, p < 0.01
Low risk of bias
Aldhafiri 2022 16 100 0.160 [0.094; 0.247] 2.6%
Bermúdez 2018 23 157 0.146 [0.097; 0.213] 2.7%
Chang 2017 240 11437 0.021 [0.014; 0.019] 2.8%
Choudhary 2016 54 200 0.270 [0.206; 0.335] 2.7%
Deshmukh 2018 35 432 0.081 [0.049; 0.103] 2.7%
Garduño-Garcia 2010 84 960 0.087 [0.069; 0.106] 2.8%
Gyawali 2015 105 358 0.293 [0.247; 0.344] 2.7%
Khan 2011 28 173 0.162 [0.106; 0.222] 2.7%
Khatiwada 2016 45 169 0.266 [0.198; 0.338] 2.7%
Lai 2011a 43 2026 0.021 [0.016; 0.029] 2.8%
Lai 2011b 25 267 0.094 [0.059; 0.133] 2.7%
Meher 2013 22 100 0.220 [0.146; 0.315] 2.6%
Mehran 2017 90 1704 0.053 [0.040; 0.062] 2.8%
Ramezani Tehrani 2011 37 159 0.233 [0.170; 0.306] 2.7%
Shantha 2009 92 420 0.219 [0.178; 0.260] 2.7%
Uzunlulu 2007 36 220 0.164 [0.113; 0.216] 2.7%
Wang 2012 44 932 0.047 [0.029; 0.058] 2.8%
Xie 2023 249 2444 0.102 [0.090; 0.115] 2.8%
Random effects model 22258 0.131 [0.091; 0.178] 48.7%
Prediction interval [0.005; 0.382]
Heterogeneity: I^2 = 98%, τ^2 = 0.0181, p < 0.01
Random effects model 24506 0.207 [0.156; 0.263] 100.0%
Heterogeneity: I^2 = 98%, τ^2 = 0.0399, p = 0
Test for subgroup differences: χ^2_1 = 11.56, df = 1 (p < 0.01)
0
0.2
0.4
0.6
0.8
1
Prevalence

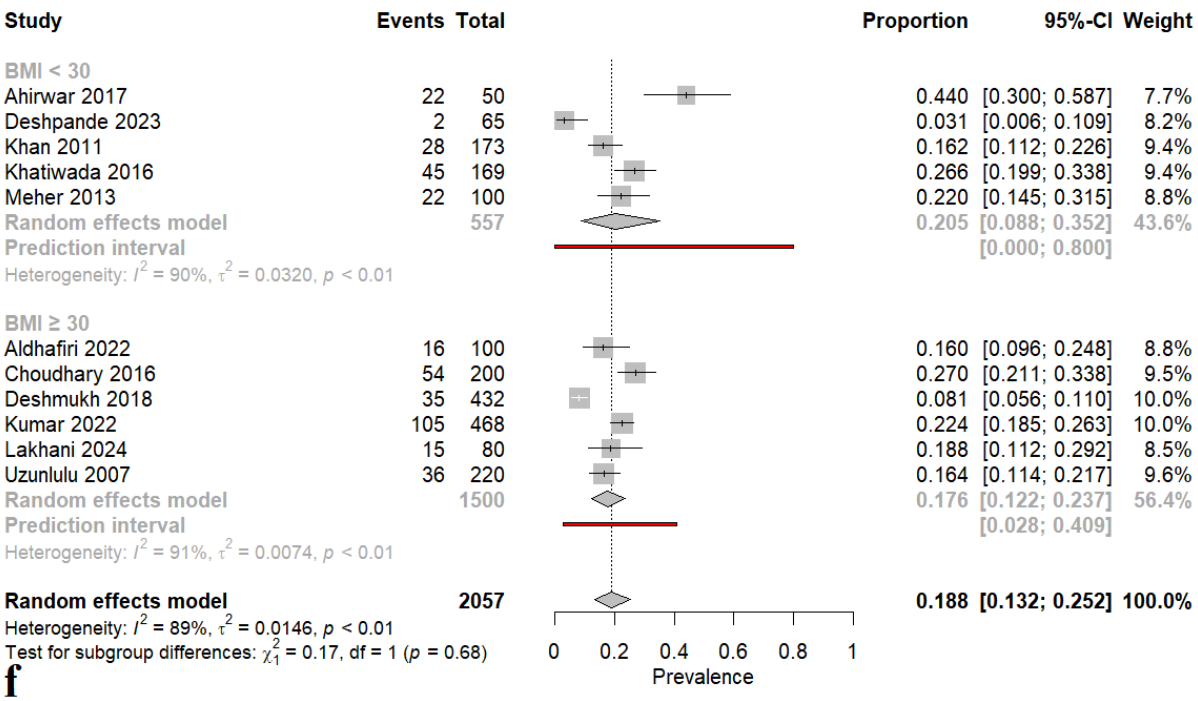
c


Study
Events
Total
Proportion
95%-CI
Weight
Sample size < 150
Agarwal 2011 40 76 0.526 [0.408; 0.642] 2.6%
Ahirwar 2017 22 50 0.440 [0.300; 0.587] 2.5%
Aldhafiri 2022 16 100 0.160 [0.094; 0.247] 2.6%
Baghel 2023 20 100 0.200 [0.128; 0.293] 2.6%
Bhaskar 2022 43 122 0.352 [0.268; 0.444] 2.6%
Deshpande 2023 2 65 0.031 [0.009; 0.112] 2.5%
Gupta 2016 35 60 0.583 [0.449; 0.709] 2.5%
Lakhani 2024 15 80 0.188 [0.113; 0.293] 2.6%
Mahesh 2022 14 100 0.140 [0.076; 0.222] 2.6%
Meher 2013 22 100 0.220 [0.146; 0.315] 2.6%
Orluwene 2013 42 48 0.875 [0.744; 0.946] 2.5%
Patel 2023 5 54 0.093 [0.036; 0.207] 2.5%
Rao 2022 19 100 0.190 [0.121; 0.282] 2.6%
Saluja 2017 37 100 0.370 [0.278; 0.473] 2.6%
Sharma 2017 21 100 0.210 [0.137; 0.304] 2.6%
Suganya 2016 7 50 0.140 [0.062; 0.270] 2.5%
Suhashini 2018 9 45 0.200 [0.104; 0.349] 2.4%
Tale 2024 18 60 0.300 [0.187; 0.432] 2.5%
Vishwakarma 2024 13 60 0.217 [0.125; 0.344] 2.5%
Random effects model 1470 0.271 [0.186; 0.366] 48.4%
Prediction interval [0.002; 0.728]
Heterogeneity: I^2 = 92%, τ^2 = 0.0464, p < 0.01
Sample size ≥ 150
Bermúdez 2018 23 157 0.146 [0.094; 0.211] 2.7%
Chang 2017 240 11437 0.021 [0.014; 0.019] 2.8%
Choudhary 2016 54 200 0.270 [0.211; 0.338] 2.7%
Deshmukh 2018 35 432 0.081 [0.054; 0.108] 2.7%
Garduño-Garcia 2010 84 960 0.087 [0.063; 0.100] 2.8%
Gyawali 2015 105 358 0.293 [0.242; 0.340] 2.7%
Khan 2011 28 173 0.162 [0.111; 0.226] 2.7%
Khatiwada 2016 45 169 0.266 [0.203; 0.340] 2.7%
Kumar 2022 105 468 0.224 [0.182; 0.261] 2.7%
Lai 2011a 43 2026 0.021 [0.009; 0.021] 2.8%
Lai 2011b 25 267 0.094 [0.063; 0.136] 2.7%
Mehran 2017 90 1704 0.053 [0.039; 0.061] 2.8%
Osmani 2022 85 210 0.405 [0.338; 0.475] 2.7%
Ramezani Tehrani 2011 37 159 0.233 [0.169; 0.306] 2.7%
Senthil 2015 113 300 0.377 [0.321; 0.434] 2.7%
Shantha 2009 92 420 0.219 [0.178; 0.260] 2.7%
Uzunlulu 2007 36 220 0.164 [0.113; 0.216] 2.7%
Wang 2012 44 932 0.047 [0.029; 0.058] 2.8%
Xie 2023 249 2444 0.102 [0.090; 0.115] 2.8%
Random effects model 23036 0.153 [0.104; 0.210] 51.6%
Prediction interval [0.002; 0.468]
Heterogeneity: I^2 = 99%, τ^2 = 0.0260, p = 0
Random effects model 24506 0.207 [0.156; 0.263] 100.0%
Heterogeneity: I^2 = 98%, τ^2 = 0.0399, p = 0
Test for subgroup differences: χ^2_1 = 5.40, df = 1 (p = 0.02)
0
0.2
0.4
0.6
0.8
1
Prevalence

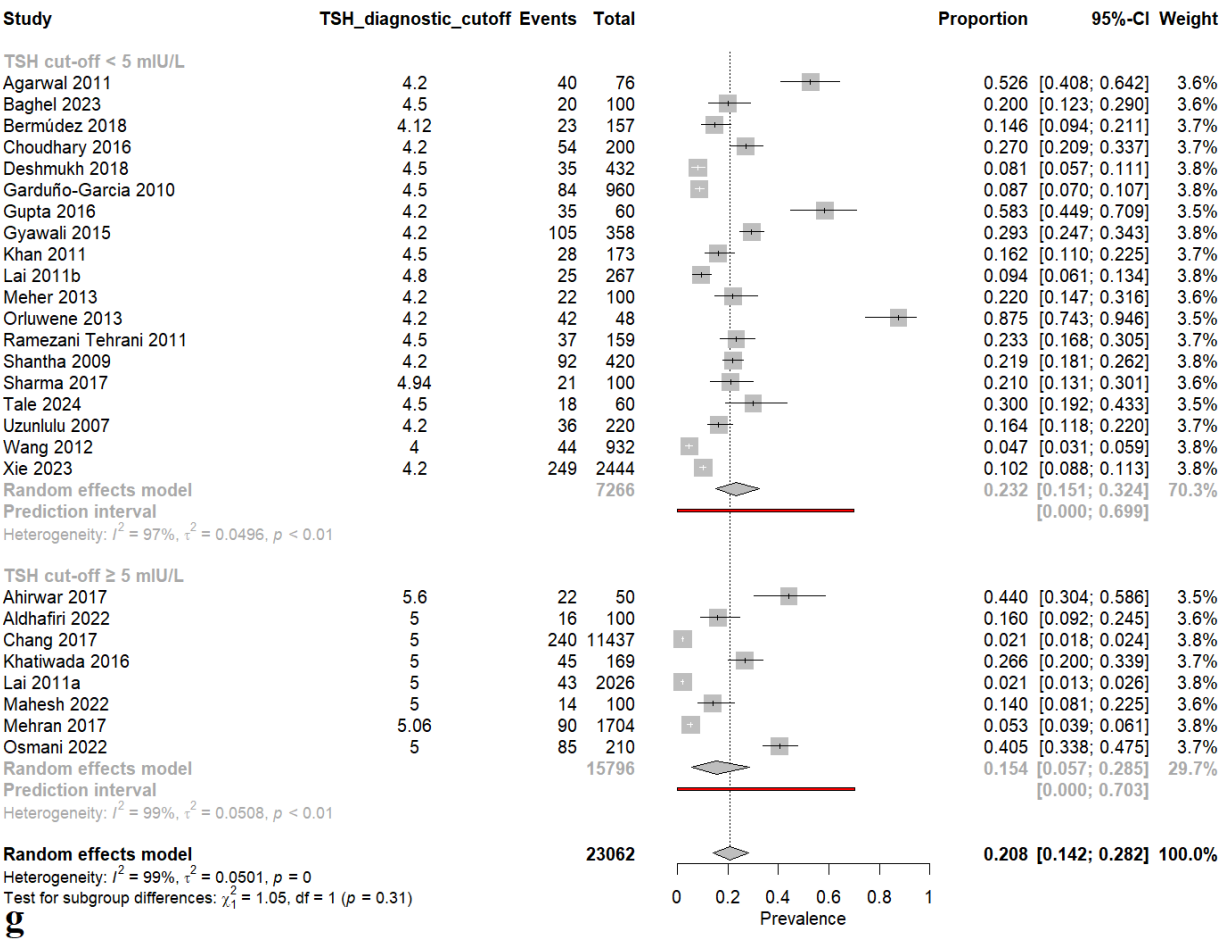
d


Study
Events
Total
Proportion
95%-CI
Weight
Age < 50
Aldhafiri 2022 16 100 0.160 [0.093; 0.246] 4.2%
Deshmukh 2018 35 432 0.081 [0.050; 0.104] 4.4%
Gupta 2016 35 60 0.583 [0.449; 0.708] 4.0%
Khan 2011 28 173 0.162 [0.112; 0.226] 4.3%
Khatiwada 2016 45 169 0.266 [0.199; 0.338] 4.3%
Kumar 2022 105 468 0.224 [0.183; 0.262] 4.4%
Lakhani 2024 15 80 0.188 [0.111; 0.292] 4.1%
Meher 2013 22 100 0.220 [0.145; 0.315] 4.2%
Orluwene 2013 42 48 0.875 [0.743; 0.945] 3.9%
Patel 2023 5 54 0.093 [0.030; 0.202] 4.0%
Senthil 2015 113 300 0.377 [0.320; 0.434] 4.4%
Suganya 2016 7 50 0.140 [0.062; 0.270] 3.9%
Tale 2024 18 60 0.300 [0.193; 0.433] 4.0%
Uzunlulu 2007 36 220 0.164 [0.115; 0.218] 4.3%
Vishwakarma 2024 13 60 0.217 [0.120; 0.341] 4.0%
Random effects model 2374 0.256 [0.162; 0.362] 62.5%
Prediction interval [0.000; 0.730]
Heterogeneity: I^2 = 95%, τ^2 = 0.0477, p < 0.01
Age ≥ 50
Agarwal 2011 40 76 0.526 [0.409; 0.641] 4.1%
Ahirwar 2017 22 50 0.440 [0.300; 0.587] 3.9%
Baghel 2023 20 100 0.200 [0.124; 0.290] 4.2%
Choudhary 2016 54 200 0.270 [0.208; 0.336] 4.3%
Deshpande 2023 2 65 0.031 [0.008; 0.111] 4.1%
Rao 2022 19 100 0.190 [0.120; 0.282] 4.2%
Saluja 2017 37 100 0.370 [0.276; 0.472] 4.2%
Shantha 2009 92 420 0.219 [0.176; 0.258] 4.4%
Sharma 2017 21 100 0.210 [0.134; 0.302] 4.2%
Random effects model 1211 0.257 [0.164; 0.364] 37.5%
Prediction interval [0.009; 0.666]
Heterogeneity: I^2 = 89%, τ^2 = 0.0278, p < 0.01
Random effects model 3585 0.256 [0.188; 0.331] 100.0%
Heterogeneity: I^2 = 93%, τ^2 = 0.0384, p < 0.01
Test for subgroup differences: χ^2_1 = 0.00, df = 1 (p = 0.98)
0
0.2
0.4
0.6
0.8
1
Prevalence

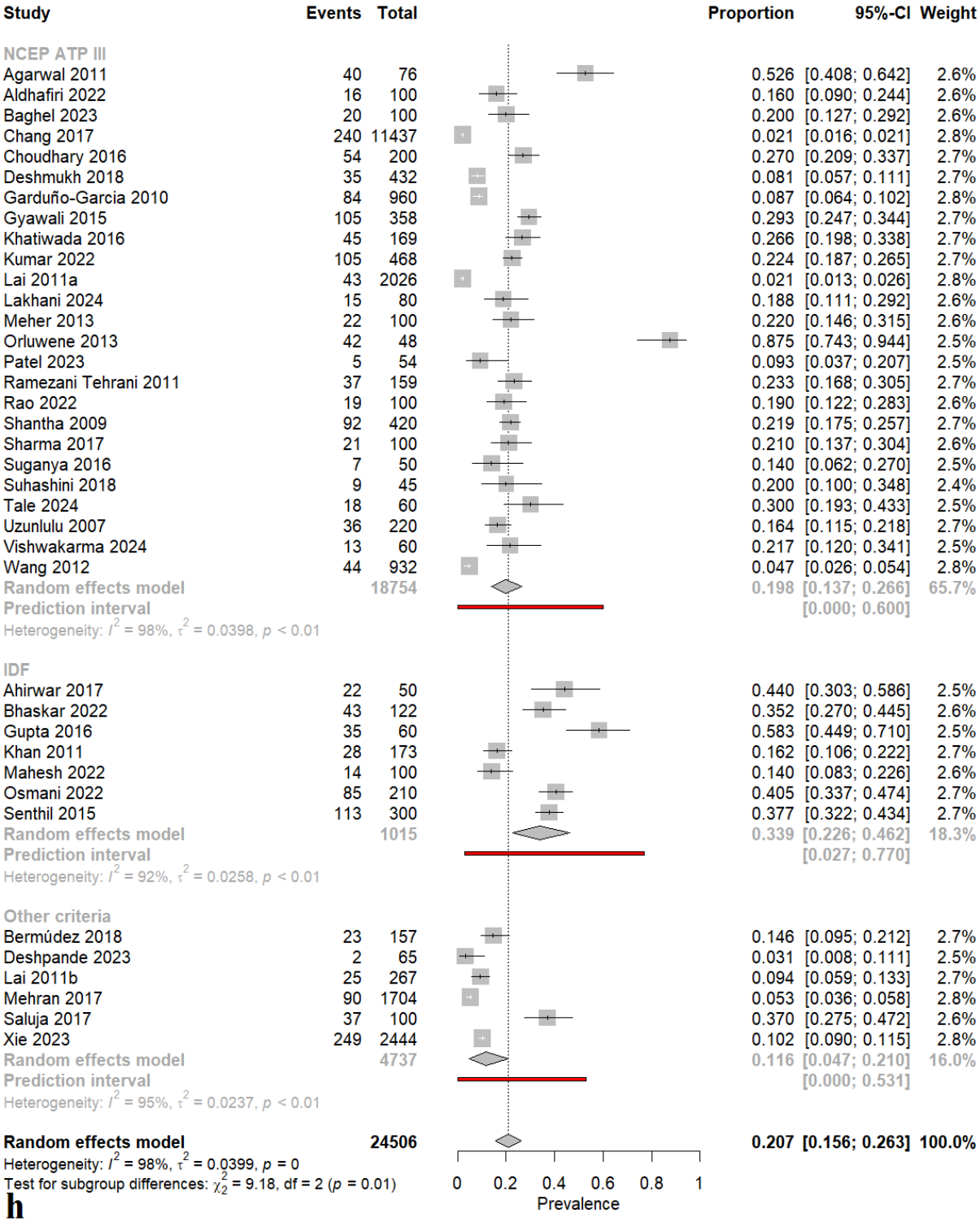
e


Study
Events
Total
Proportion
95%-CI
Weight
BMI < 30
Ahirwar 2017 22 50 0.440 [0.300; 0.587] 7.7%
Deshpande 2023 2 65 0.031 [0.006; 0.109] 8.2%
Khan 2011 28 173 0.162 [0.112; 0.226] 9.4%
Khatiwada 2016 45 169 0.266 [0.199; 0.338] 9.4%
Meher 2013 22 100 0.220 [0.145; 0.315] 8.8%
Random effects model 557 0.205 [0.088; 0.352] 43.6%
Prediction interval [0.000; 0.800]
Heterogeneity: I^2 = 90%, τ^2 = 0.0320, p < 0.01
BMI ≥ 30
Aldhafiri 2022 16 100 0.160 [0.096; 0.248] 8.8%
Choudhary 2016 54 200 0.270 [0.211; 0.338] 9.5%
Deshmukh 2018 35 432 0.081 [0.056; 0.110] 10.0%
Kumar 2022 105 468 0.224 [0.185; 0.263] 10.0%
Lakhani 2024 15 80 0.188 [0.112; 0.292] 8.5%
Uzunlulu 2007 36 220 0.164 [0.114; 0.217] 9.6%
Random effects model 1500 0.176 [0.122; 0.237] 56.4%
Prediction interval [0.028; 0.409]
Heterogeneity: I^2 = 91%, τ^2 = 0.0074, p < 0.01
Random effects model 2057 0.188 [0.132; 0.252] 100.0%
Heterogeneity: I^2 = 89%, τ^2 = 0.0146, p < 0.01
Test for subgroup differences: χ^2_1 = 0.17, df = 1 (p = 0.68)
0
0.2
0.4
0.6
0.8
1
Prevalence

f


Study
TSH_diagnostic_cutoff
Events
Total
Proportion
95%-CI
Weight
TSH cut-off < 5 mIU/L
Agarwal 2011 4.2 40 76 0.526 [0.408; 0.642] 3.6%
Baghel 2023 4.5 20 100 0.200 [0.123; 0.290] 3.6%
Bermúdez 2018 4.12 23 157 0.146 [0.094; 0.211] 3.7%
Choudhary 2016 4.2 54 200 0.270 [0.209; 0.337] 3.7%
Deshmukh 2018 4.5 35 432 0.081 [0.057; 0.111] 3.8%
Garduño-Garcia 2010 4.5 84 960 0.087 [0.070; 0.107] 3.8%
Gupta 2016 4.2 35 60 0.583 [0.449; 0.709] 3.5%
Gyawali 2015 4.2 105 358 0.293 [0.247; 0.343] 3.8%
Khan 2011 4.5 28 173 0.162 [0.110; 0.225] 3.7%
Lai 2011b 4.8 25 267 0.094 [0.061; 0.134] 3.8%
Meher 2013 4.2 22 100 0.220 [0.147; 0.316] 3.6%
Orluwene 2013 4.2 42 48 0.875 [0.743; 0.946] 3.5%
Ramezani Tehrani 2011 4.5 37 159 0.233 [0.168; 0.305] 3.7%
Shantha 2009 4.2 92 420 0.219 [0.181; 0.262] 3.8%
Sharma 2017 4.94 21 100 0.210 [0.131; 0.301] 3.6%
Tale 2024 4.5 18 60 0.300 [0.192; 0.433] 3.5%
Uzunlulu 2007 4.2 36 220 0.164 [0.118; 0.220] 3.7%
Wang 2012 4 44 932 0.047 [0.031; 0.059] 3.8%
Xie 2023 4.2 249 2444 0.102 [0.088; 0.113] 3.8%
Random effects model 7266 0.232 [0.151; 0.324] 70.3%
Prediction interval [0.000; 0.699]
Heterogeneity: I^2 = 97%, τ^2 = 0.0496, p < 0.01
TSH cut-off ≥ 5 mIU/L
Ahirwar 2017 5.6 22 50 0.440 [0.304; 0.586] 3.5%
Aldhafiri 2022 5 16 100 0.160 [0.092; 0.245] 3.6%
Chang 2017 5 240 11437 0.021 [0.018; 0.024] 3.8%
Khatiwada 2016 5 45 169 0.266 [0.200; 0.339] 3.7%
Lai 2011a 5 43 2026 0.021 [0.013; 0.026] 3.8%
Mahesh 2022 5 14 100 0.140 [0.081; 0.225] 3.6%
Mehran 2017 5.06 90 1704 0.053 [0.039; 0.061] 3.8%
Osmani 2022 5 85 210 0.405 [0.338; 0.475] 3.7%
Random effects model 15796 0.154 [0.057; 0.285] 29.7%
Prediction interval [0.000; 0.703]
Heterogeneity: I^2 = 99%, τ^2 = 0.0508, p < 0.01
Random effects model 23062 0.208 [0.142; 0.282] 100.0%
Heterogeneity: I^2 = 99%, τ^2 = 0.0501, p = 0
Test for subgroup differences: χ^2_1 = 1.05, df = 1 (p = 0.31)
0
0.2
0.4
0.6
0.8
1
Prevalence

g


Study
Events
Total
Proportion
95%-CI
Weight
NCEP ATP III
Agarwal 2011 40 76 0.526 [0.408; 0.642] 2.6%
Aldhafiri 2022 16 100 0.160 [0.090; 0.244] 2.6%
Baghel 2023 20 100 0.200 [0.127; 0.292] 2.6%
Chang 2017 240 11437 0.021 [0.016; 0.021] 2.8%
Choudhary 2016 54 200 0.270 [0.209; 0.337] 2.7%
Deshmukh 2018 35 432 0.081 [0.057; 0.111] 2.7%
Garduño-Garcia 2010 84 960 0.087 [0.064; 0.102] 2.8%
Gyawali 2015 105 358 0.293 [0.247; 0.344] 2.7%
Khatiwada 2016 45 169 0.266 [0.198; 0.338] 2.7%
Kumar 2022 105 468 0.224 [0.187; 0.265] 2.7%
Lai 2011a 43 2026 0.021 [0.013; 0.026] 2.8%
Lakhani 2024 15 80 0.188 [0.111; 0.292] 2.6%
Meher 2013 22 100 0.220 [0.146; 0.315] 2.6%
Orluwene 2013 42 48 0.875 [0.743; 0.944] 2.5%
Patel 2023 5 54 0.093 [0.037; 0.207] 2.5%
Ramezani Tehrani 2011 37 159 0.233 [0.168; 0.305] 2.7%
Rao 2022 19 100 0.190 [0.122; 0.283] 2.6%
Shantha 2009 92 420 0.219 [0.175; 0.257] 2.7%
Sharma 2017 21 100 0.210 [0.137; 0.304] 2.6%
Suganya 2016 7 50 0.140 [0.062; 0.270] 2.5%
Suhashini 2018 9 45 0.200 [0.100; 0.348] 2.4%
Tale 2024 18 60 0.300 [0.193; 0.433] 2.5%
Uzunlulu 2007 36 220 0.164 [0.115; 0.218] 2.7%
Vishwakarma 2024 13 60 0.217 [0.120; 0.341] 2.5%
Wang 2012 44 932 0.047 [0.026; 0.054] 2.8%
Random effects model 18754 0.198 [0.137; 0.266] 65.7%
Prediction interval [0.000; 0.600]
Heterogeneity: I^2 = 98%, τ^2 = 0.0398, p < 0.01
IDF
Ahirwar 2017 22 50 0.440 [0.303; 0.586] 2.5%
Bhaskar 2022 43 122 0.352 [0.270; 0.445] 2.6%
Gupta 2016 35 60 0.583 [0.449; 0.710] 2.5%
Khan 2011 28 173 0.162 [0.106; 0.222] 2.7%
Mahesh 2022 14 100 0.140 [0.083; 0.226] 2.6%
Osmani 2022 85 210 0.405 [0.337; 0.474] 2.7%
Senthil 2015 113 300 0.377 [0.322; 0.434] 2.7%
Random effects model 1015 0.339 [0.226; 0.462] 18.3%
Prediction interval [0.027; 0.770]
Heterogeneity: I^2 = 92%, τ^2 = 0.0258, p < 0.01
Other criteria
Bermúdez 2018 23 157 0.146 [0.095; 0.212] 2.7%
Deshpande 2023 2 65 0.031 [0.008; 0.111] 2.5%
Lai 2011b 25 267 0.094 [0.059; 0.133] 2.7%
Mehran 2017 90 1704 0.053 [0.036; 0.058] 2.8%
Saluja 2017 37 100 0.370 [0.275; 0.472] 2.6%
Xie 2023 249 2444 0.102 [0.090; 0.115] 2.8%
Random effects model 4737 0.116 [0.047; 0.210] 16.0%
Prediction interval [0.000; 0.531]
Heterogeneity: I^2 = 95%, τ^2 = 0.0237, p < 0.01
Random effects model 24506 0.207 [0.156; 0.263] 100.0%
Heterogeneity: I^2 = 98%, τ^2 = 0.0399, p = 0
Test for subgroup differences: χ^2_2 = 9.18, df = 2 (p = 0.01)
0
0.2
0.4
0.6
0.8
1
Prevalence

h

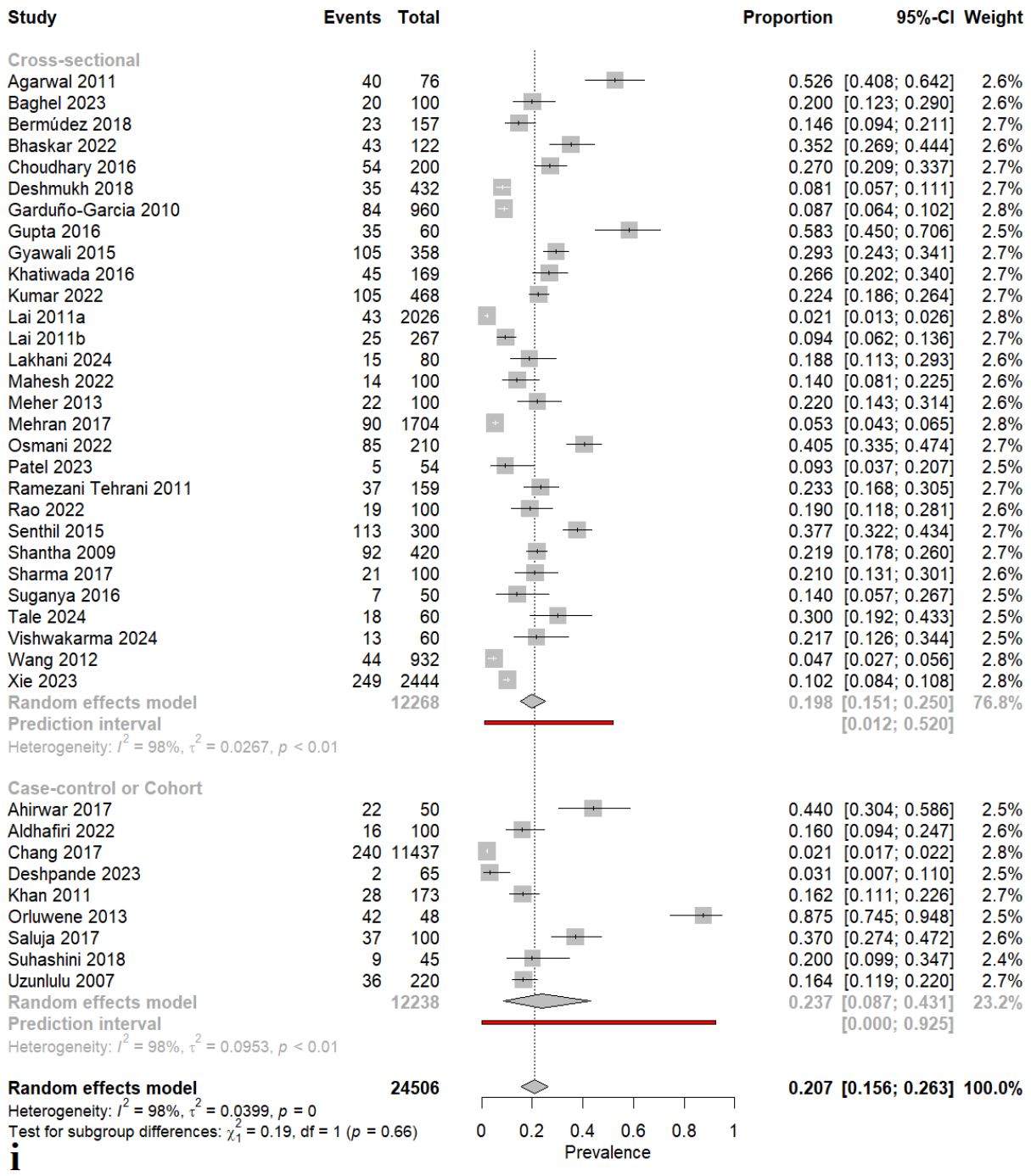


Fig. S6 forest plot showing the pooled prevalence of subclinical hypothyroidism with subgroup analysis based on a) publication year, b) country, c) risk of bias, d) sample size, e) mean age, f) mean BMI, g) TSH diagnostic cut-off, h) MetS diagnostic criteria, i) Study design

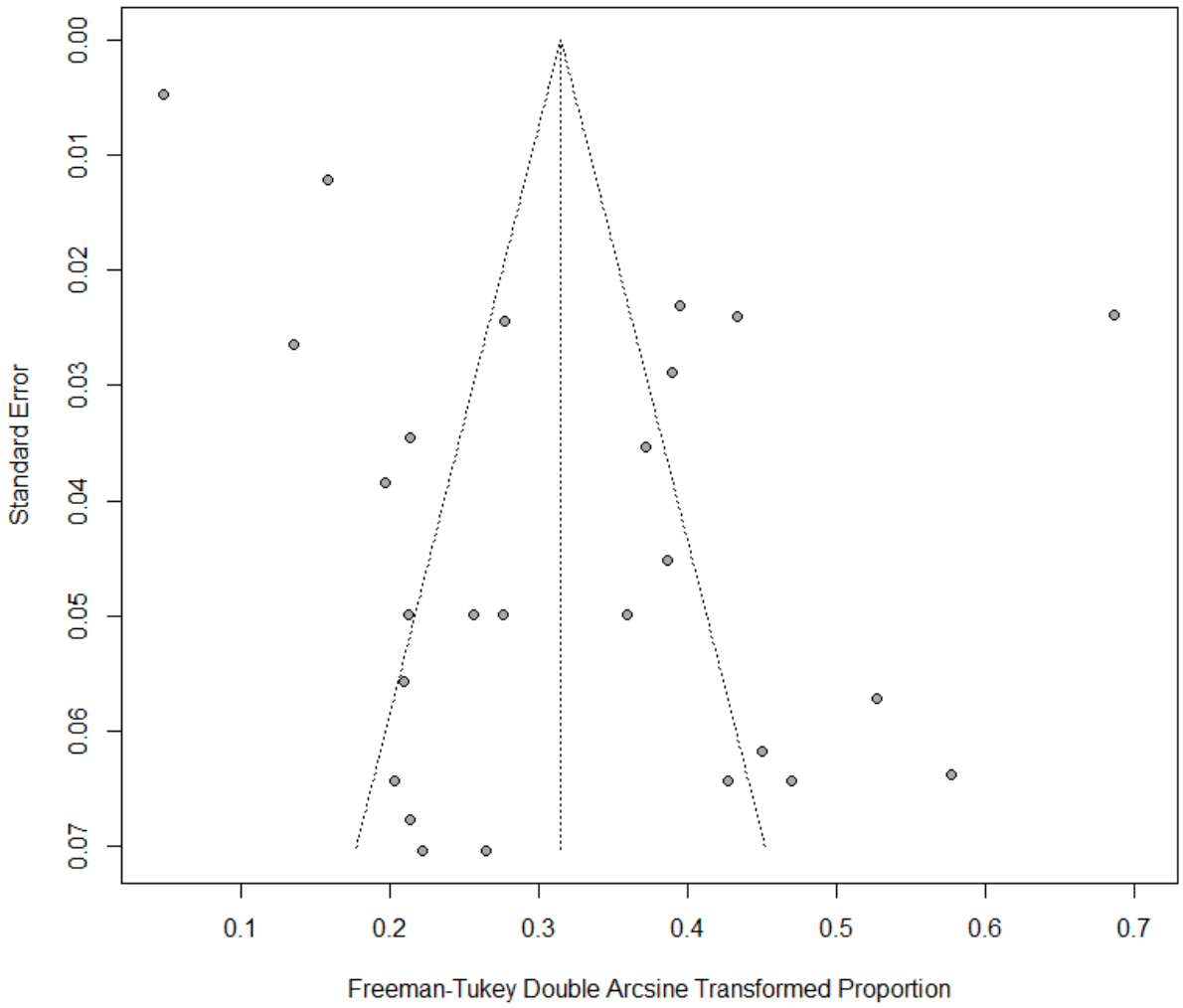


Fig. S7 Freeman-Tukey double arcsine transformed funnel plot for the prevalence of overt hypothyroidism

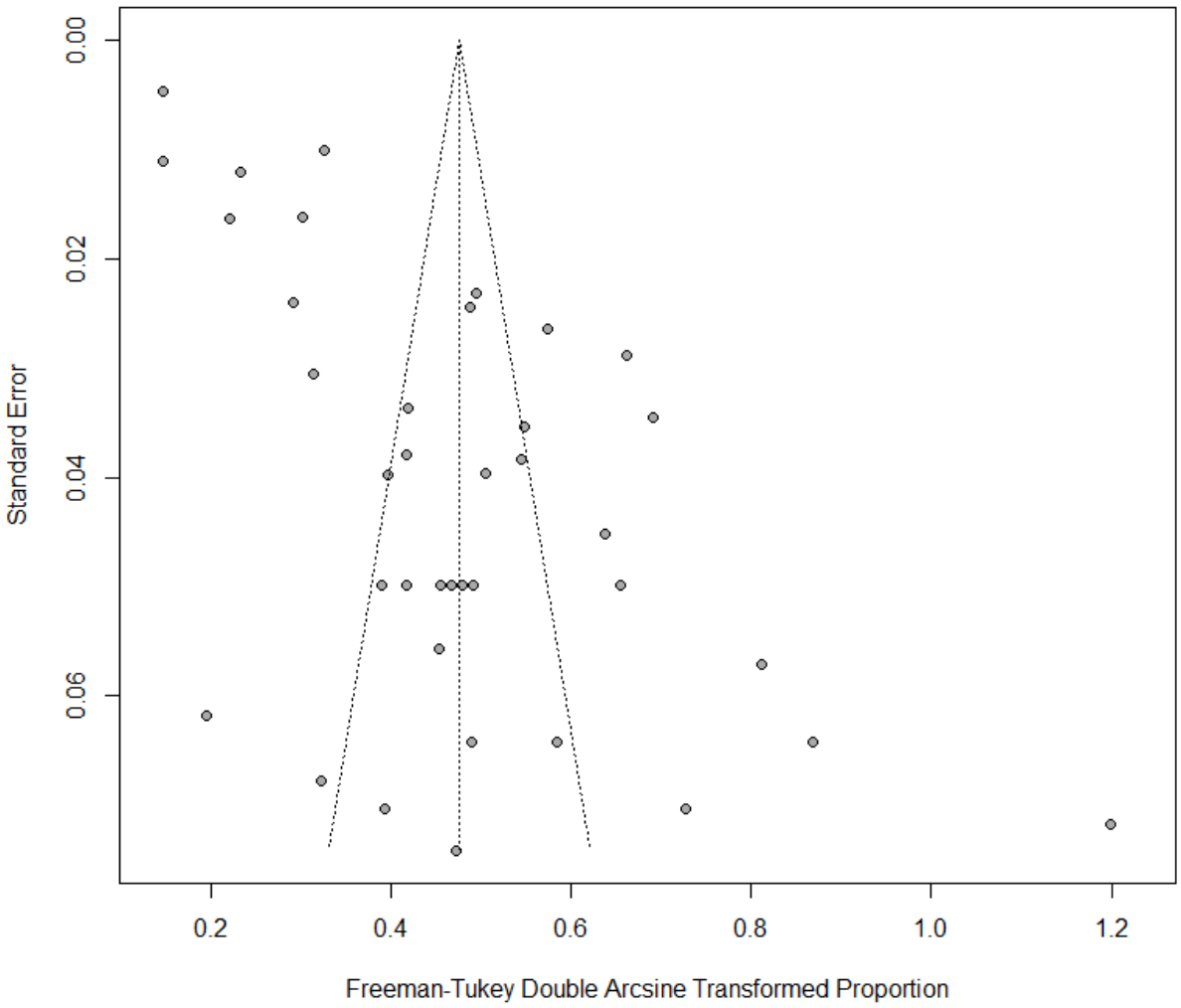


Fig. S8 Freeman-Tukey double arcsine transformed funnel plot for the prevalence of subclinical hypothyroidism

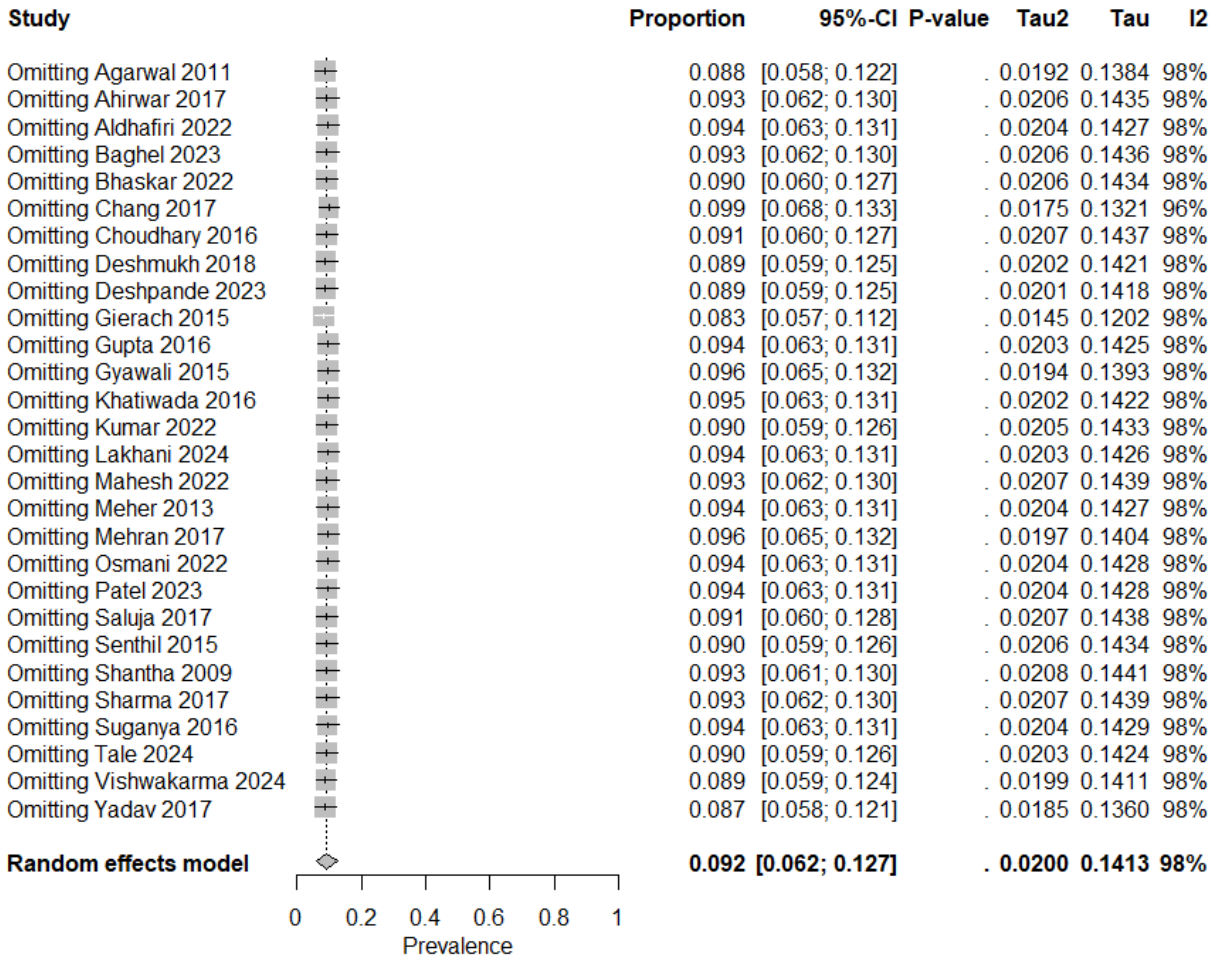


Fig. S9 Leave-one-out sensitivity analysis for overt hypothyroidism

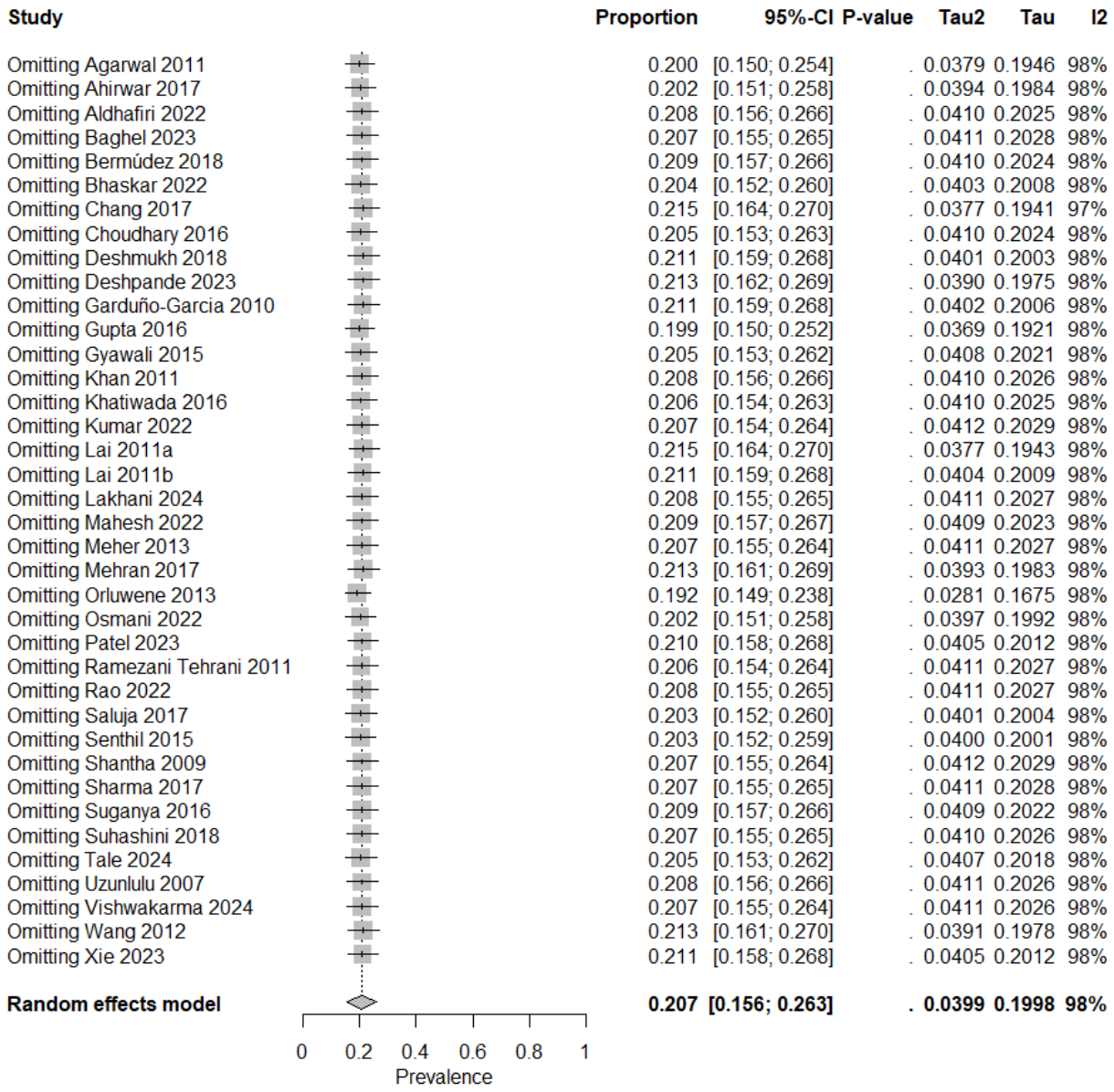


Fig. S10 Leave-one-out sensitivity analysis for subclinical hypothyroidism