

1 **Title Page**2 **Cardiovascular Risk Assessment:**3 **A Systematic Review of Guidelines**4 Mohammed Y. Khanji<sup>\*,†</sup> MB BCh, Vinícius V. S. Bicalho<sup>‡</sup> MD, Claudia N. van Waardhuizen<sup>§</sup> MSc,5 Bart S. Ferket<sup>||</sup> PhD, Steffen E. Petersen<sup>\*</sup> DPHIL, M. G. Myriam Hunink<sup>§,¶</sup> PhD6 **Authors**

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50 **Abstract**

51 **Background:**

52 A number of guidelines exist for primary prevention cardiovascular screening and risk assessment  
53 for the apparently healthy population.

54 **Purpose:**

55 To systematically review current primary prevention guidelines on adult cardiovascular risk  
56 assessment and highlight the similarities and differences in order to aid clinician's decision-  
57 making.

58 **Data sources:**

59 Publications in MEDLINE and CINAHL between May 3, 2009 and June 30, 2016 were identified. In  
60 addition on June 30, 2016 we searched the G-I-N International Guideline Library, National  
61 Guidelines Clearing-house, National Library for Health, Canadian Medical Association InfoBase and  
62 websites of organizations responsible for guidelines development.

63 **Study selection:**

64 Two reviewers screened titles and abstracts to identify guidelines from Western countries  
65 containing recommendations for cardiovascular risk assessment for healthy adults.

66 **Data extraction:**

67 Two reviewers independently assessed rigor of guideline development using AGREE II and one  
68 extracted the recommendations.

69 **Data synthesis:**

70 Of the 21 guidelines, 17 showed considerable rigor of guideline development. The rigorously  
71 developed recommendations address assessment of total cardiovascular risk (5 guidelines),  
72 dysglycemia (7), dyslipidemia (2), and hypertension (3). All recommendations, with the exception  
73 of one, advocate screening and the majority include prediction models integrating multiple,  
74 relatively simple risk factors either for deciding on further screening or to guide subsequent

75 management. There is no consensus on the strategy for screening, recommended target  
76 population, screening tests or treatment thresholds.

77 **Limitations:**

78 Only guidelines developed by Western national or international medical organizations are  
79 included.

80 **Conclusion:**

81 Considerable discrepancies in recommendations still exist in cardiovascular screening guidelines  
82 with no consensus on optimum screening strategies or treatment threshold.

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85 As part of a Barts Charity large project grant. The charity had no input in the preparation or editing  
86 of the manuscript.

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100 **Introduction**

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102 Many national and international bodies highlight primary prevention of cardiovascular disease  
103 (CVD), through risk factor reduction, as a potential solution to reduce future burden (1). The  
104 optimal target group and intervention that maximize benefit, however, remain unclear.

105 Cardiovascular screening through health checks are now widely implemented in many Western  
106 countries to systematically detect high-risk individuals who may require aggressive risk reduction  
107 through pharmacotherapy and/or lifestyle interventions. Guidelines advocate use of screening  
108 with the aim of making the apparently healthy population healthier and reducing risk factors for  
109 future CVD. The institute of medicine (IOM) defines clinical practice guidelines as “systematically  
110 developed statements to assist practitioners and patient decisions about the appropriate health  
111 care for specific clinical circumstances” (2). However, to date an internationally agreed guideline  
112 for cardiovascular health checks does not exist.

113

114 Primary care physicians maintain a central role in the prevention of CVD but still find  
115 implementation of prevention strategies challenging and management of those with increased  
116 CVD risk remains suboptimal (3). Time constraints, lack of perceived usefulness, inadequate  
117 knowledge, and inconsistency in published recommendations have been cited as common reasons  
118 for not using CVD prevention guidelines or global CVD risk assessment tools (4). Concerns exist  
119 regarding poor uptake of the program by those invited with only about 50% attending for a  
120 National Health Service health check, much lower than the 75% government target (5).

121 Additionally, there are doubts raised concerning the morbidity and mortality benefits from such  
122 programs posed by a Cochrane review and a subsequent Danish randomized controlled trial (6,7).

123

124 Ferket et al performed a systematic review in 2010, identifying differences amongst guidelines  
125 that would lead to variations in allocation of resources for prevention between different Western  
126 health care systems (8). Since that time, the reviewed guidelines were revised and replaced and  
127 new evidence has also become available on statin and blood pressure lowering therapy in low risk  
128 individuals (9,10). This systematic review revisits the CVD risk assessment guidelines and the  
129 selection of appropriate screening interventions based on currently available evidence.

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149 **Methods**

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151 We conducted an updated systematic review, using our previous search strategy (8), of guidelines  
152 containing recommendations for CVD risk assessment in the apparently healthy adult population  
153 not already receiving treatment for high-risk cardiovascular conditions such as diabetes,  
154 hypertension and hypercholesterolemia.

155

156 **Data source and searches**

157 A systematic literature search was performed to identify appropriate guidelines following the  
158 methods of our previous publication(8). We searched for published guidelines using MEDLINE and  
159 CINAHL between May 3, 2009 and June 30, 2016 (see Appendix for search strategy). We  
160 supplemented this search by using the following 4 guidelines specific databases; The National  
161 Guideline Clearinghouse (US), National Library for Health on Guidelines Finder (United Kingdom),  
162 Canadian Medical Association InfoBase (Canada), and G-I-N International Guideline Library  
163 ([www.g-i-n.net](http://www.g-i-n.net)). We also carried out a search of a number of websites of guidelines development  
164 organizations, including websites affiliated with all the guidelines included in our previous  
165 publication, to find additional or updated guidelines that were relevant (see Appendix Table 1).  
166 Our search was restricted to national guidelines from the United States, Canada, the United  
167 Kingdom, Australia and New Zealand and to international guidelines written in English.

168

169 **Study selection**

170 References that met the Institute of Medicine definition of a guideline were included. Guidelines  
171 were excluded if they (1) did not contain recommendations involving the healthy adult population,  
172 (2) were entirely focused on early detection of CVD, (3) were not produced on behalf of a  
173 professional organization, or (4) were not applicable to Western countries. In addition, only

174 guidelines produced or updated as of May 2009 were eligible for inclusion to avoid overlap with  
175 our previous systematic review and to ensure that only current guidelines were included.

176

### 177 **Data extraction and quality assessment**

178 Titles and abstracts were assessed by 2 independent reviewers (MK and VB). Articles were only  
179 excluded if both reviewers agreed they were ineligible. Discrepancies between the reviewers were  
180 resolved by consensus following discussion. Both reviewers performed the final selection for full  
181 data extraction.

182

183 We used the latest 23-item Appraisal of Guidelines for Research and Evaluation (AGREE) II  
184 instrument to determine the rigor of development for each guideline (11). The Rigor of  
185 development domain considers the reporting of (1) methods to search for evidence, (2) criteria for  
186 selection of evidence, (3) strengths and limitations of the body of evidence, (4) methods for  
187 formulating the recommendations, (5) health benefits, side effects, and risks, (6) explicit link  
188 between recommendations and the evidence, (7) procedures for external expert peer review, and  
189 the (8) updating process. Each item is rated on a 7-point Likert scale. Conforming to the  
190 instructions of the AGREE II tool, 2 reviewers (MK and CV) independently rated the 8 items. Both  
191 reviewers assessed background information on the guideline development process from  
192 developers' websites. Average rigor scores were obtained by expressing the sum of the individual  
193 scores as a percentage of the maximum possible score and reproducibility of the 2 reviewers  
194 scores was good, with an interclass correlation of 0.75. We ranked the guidelines according to  
195 their scores. Editorial independence from the funding body, external funding and disclosure of  
196 relationships with industry by individual guideline group members were also assessed.

197

### 198 **Data synthesis and analysis**



199 One reviewer (MK) extracted all the relevant recommendations from the guidelines that had an  
200 AGREE II score above 50%. General lifestyle advice was not included. A recommendation matrix  
201 was produced grouped by the conditions being detected by screening. Each matrix was divided  
202 into (1) a methods section, (2) target group and delivery of screening, (3) recommended screening  
203 test, and (4) thresholds for the follow up. Consistent with our previous format, the strength of  
204 recommendation was classified as “for”, “consider”, “not for not against”, “insufficient evidence”  
205 and “against”. If feasible cardiovascular risk factors were classified into major, underlying and  
206 emerging risk factors according to the World Heart and Stroke Forum scientific statement (12).

207

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214 decision to approve publication of the finished manuscript.

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224 **Results**

225

226 Our search retrieved 3553 titles, of which 180 were identified as potentially eligible. On the basis  
227 of the abstracts 133 were excluded and on review of the full reports a further 26 were excluded.

228 Guidelines such as the United States Preventative Service Task Force (USPSTF) guidelines on  
229 aspirin use were excluded as they did not include recommendations on the screening of healthy  
230 adult population (13). Finally 21 guidelines on cardiovascular risk assessment were included  
231 (Appendix Figure 1). Table 1 summarizes the selected guidelines, along with rigor score and  
232 conflicts of interest

233

234 17 of the 21 guidelines had a rigor score greater than or equal to 50%. Guidelines were  
235 categorized according to the main purpose of the screening. These included 5 guidelines on total  
236 cardiovascular screening (Table 2), 7 guidelines for dysglycemia screening (Appendix Table 2), 2  
237 guidelines for dyslipidemia screening (Appendix Table 3) and 3 guidelines for hypertension  
238 screening (Appendix Table 4).

239

240 **Areas of agreement**

241 Recommendations from 16 of the 17 guidelines supported CVD risk assessment, either as the  
242 primary approach (five guidelines) or as a secondary step (eleven guidelines). In general there was  
243 consensus on how screening tests should be administered in the general population. A selective  
244 screening system based on knowledge of prior patient characteristics (record based screening) or  
245 during non-preventive patient visits (case finding or opportunistic screening) was advocated in 14  
246 of the 17 guidelines. Two guidelines did not explicitly specify a screening method (Centre for  
247 Disease Control (CDC)/ American Heart Association (AHA) and USPSTF hypertension).

248

249 Most guidelines recommended integrating age, sex, smoking, blood pressure and lipid levels into  
250 CVD risk assessment by using prediction models. However there was no consensus on which  
251 prediction model to use. All seven dysglycemia guidelines recommended selecting individuals at  
252 high-risk of type 2 diabetes mellitus through formal short-term (10- year) or informal diabetes risk  
253 algorithms based on antecedent risk factors along with the often used threshold of 40 years.  
254 Diabetes risk algorithms were also used to decide on whether further formal diabetes screening  
255 with blood testing was required. The most commonly mentioned risk assessment tool for diabetes  
256 was the Finland Diabetes Risk Assessment Questionnaire or a modified version tailored to the  
257 country implementing it.

258

259 The majority of guidelines agreed on the need to consider ethnicity as a risk factor for CVD risk  
260 and citing specific high-risk ethnic groups. The United Kingdom (National Institute for Health and  
261 Clinical Excellence (NICE)) and the American (American College of Cardiology (ACC)/ AHA)  
262 guidelines use ethnicity in global CVD risk scoring algorithms. The United Kingdom-based CVD risk  
263 score (QRISK2) calculator advocated by NICE includes multiple ethnic groups. In the dysglycemia  
264 guidelines the United Kingdom, Australian and Canadian diabetes risk assessment questionnaires  
265 all incorporate ethnicity in the prediction of type 2 diabetes onset.

266

267 There is general consensus on the limited role of novel biomarkers (e.g. C reactive protein, Apo  
268 lipoprotein and prothrombin markers) and markers of subclinical atherosclerosis (e.g. ankle  
269 brachial index (ABI), Coronary artery calcium score and carotid ultrasound). The European Society  
270 of Cardiology (ESC) and ACC/AHA are the two main guidelines that consider the use of these  
271 markers in limited situations. The ACC/AHA suggests that in selected individuals who are not in  
272 one of the four statin benefit groups, and for whom a decision to initiate statin therapy is

273 otherwise unclear, additional factors may be considered to inform treatment decision-making.

274 These additional factors include high-sensitivity C-reactive protein >2 mg/L, coronary artery  
275 calcium score  $\geq 300$  Agatston units or  $\geq 75$  percentile for age, sex, and ethnicity and ankle-brachial  
276 index <0.9. The ESC states that routine use of novel biomarkers is not recommended for  
277 refinement of CVD risk stratification. Carotid atheroma using ultrasound, measurement of  
278 coronary artery calcification and the ankle brachial index may be considered as a risk modifier in  
279 CVD risk assessment but is only useful in individuals near thresholds for risk categorization.

280

281 Thresholds for initiating treatment are predominantly based on 5-or 10-year absolute risk for CVD  
282 or based on combining age and additional CVD risk factors. There were often exceptions made for  
283 those with extreme levels of a single risk factor or those considered in a high-risk category (kidney  
284 disease, diabetes mellitus).

285

286 A conservative approach to aspirin use in primary prevention is taken. Of the 8 guidelines that  
287 make recommendations on aspirin use, 3 do not recommend routine use in primary prevention, 3  
288 of the dysglycemia guidelines recommend considering aspirin therapy but only in the presence of  
289 additional factors putting patients in a high-risk category and only 2 guidelines based the  
290 recommendation of aspirin use on age alone. The CDC/AHA guideline, which is the only guideline  
291 in this review that is gender specific, makes recommendations for women only, suggests aspirin  
292 use in women over 65 years and the Canadian Hypertension Education Program recommends its  
293 use in hypertensive patients over 55 years, both with the caveat that aspirin use should be guided  
294 by individual factors. The latest USPSTF guideline on aspirin use in primary prevention, in contrast,  
295 recommends aspirin for all adults aged 50 to 59 years with a 10-year cardiovascular disease risk of  
296 10% or more, who are not at increased risk of bleeding, have a life expectancy of over 10 years  
297 (13).

298

299 There was a general consensus on the importance of addressing lifestyle factors in all target  
300 groups independent of pharmacotherapy. Recommendations on who should receive intensive  
301 lifestyle counseling differed between the guidelines with no consensus based on global risk scores.  
302 The dysglycemia guidelines do, however, advocate that all those at high risk for developing  
303 diabetes (impaired fasting glucose or impaired glucose tolerance) should receive intensive lifestyle  
304 intervention to prevent the onset of diabetes.

305

306 There were no firm statements regarding screening intervals. However, the total CVD risk  
307 guidelines advocated 5-yearly screening in low risk individuals. Recommended dysglycemia  
308 screening intervals in those without evidence of diabetes was 3-5 years. One dyslipidemia  
309 guideline recommended 5-yearly intervals for adults less than 45 years and 1-2 yearly for those  
310 older. For those identified as having impaired fasting glucose or impaired glucose tolerance, there  
311 was a general consensus that subsequent annual monitoring be undertaken.

312

### 313 **Areas of disagreement**

314 There was no consensus on the target population for screening between the recommendations.  
315 The American guidelines for total cardiovascular risk (ACC/AHA, CDC/AHA), dyslipidemia  
316 (American Association of Clinical Endocrinologists) and dysglycemia (American Diabetes  
317 Association) combined with the Canadian dysglycemia (Canadian Task Force on Preventive Health  
318 Care) and hypertension (Canadian Hypertension Education Program and Canadian Task Force on  
319 Preventive Health Care) guidelines advocate screening at a younger age (20 years). The European,  
320 United Kingdom and Australian guidelines advocate an older target population of over 40-year  
321 olds.

322

323 Although guidelines mostly agree on the use of risk prediction models as part of the risk  
324 assessment process or in guiding therapy there is no consensus on which model to use particularly  
325 with regards to total CVD risk. All 5 total CVD risk guidelines use different risk scores including the  
326 QRISK2 (NICE), Systematic Coronary Risk Estimation (SCORE, ESC), 5-year Framingham (National  
327 Vascular Disease Prevention Alliance), Pooled Cohort Equation (ACC/AHA), 10-year Framingham or  
328 Reynolds (CDC/AHA). These risk models differed in the end points, and the risk factors they  
329 consider in their development.

330

331 Guidelines on total cardiovascular risk differ regarding when to initiate statin treatment. There  
332 was no consensus regarding CVD risk threshold although direct comparison is challenging as all 5  
333 guidelines used different risk prediction models. The more recent American (ACC/AHA) and United  
334 Kingdom (NICE) recommendations on total cardiovascular risk have lowered their threshold for  
335 initiation of statins. However, these two updated guidelines have also changed the CVD risk  
336 equations that they now utilize which makes direct comparison to older thresholds difficult due to  
337 different datasets or endpoints that are used in developing the algorithms. The NICE guideline  
338 now advocates the use of the QRISK2 algorithm and the ACC/AHA now advocates the Pooled  
339 Cohort Equation predicting general CVD whereas previously they both used the Framingham risk  
340 score. The 2016 ESC guideline has maintained the same statin thresholds as recommended in the  
341 2012 version. Statin recommendations were made in 3 out of the 7 dysglycemia guidelines with  
342 only one using age over 40-years as a sole deciding factor in those diagnosed with diabetes.

343

344 The recommendations on initiating antihypertensive medication varied between guidelines with  
345 no consensus on what global risk threshold or blood pressure level to use. Most of the guidelines

346 did, however, agree on the importance of considering antihypertensive medications in diabetic  
347 patients but again varied on the blood pressure threshold used to guide this.

348

349 There was no consensus on the use of lifetime or relative risk in young adults to overcome the  
350 problem of using a 5 to 10-year time horizon for predictions. The ACC/AHA advocate the use of  
351 lifetime risk to guide intensive lifestyle intervention in the young. The ESC recommends the use of  
352 relative risk charts for informing young individuals of risk whereas the NICE guideline generally  
353 advises against using lifetime risk tools.

354

355 With regard to subclinical atherosclerosis screening tests there was no agreement between the  
356 guidelines regarding which tests to use. Only 2 total CVD risk guidelines (ACC/AHA and ESC)  
357 suggested utilizing imaging tests (coronary artery calcium scoring and carotid ultrasound for  
358 atheroma detection) but this was only in select individuals to guide management decisions. The  
359 Australian guideline (National Vascular Disease Prevention Alliance) was the only total CVD  
360 guideline to recommend assessing left ventricular hypertrophy in the primary risk assessment.

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371 **Discussion**

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373 We identified 21 guidelines, of which 17 were rigorously developed, on cardiovascular screening  
374 interventions that could be performed within a cardiovascular health check program. The aim of  
375 this systematic review was not to provide a comprehensive integration of the guidelines but rather  
376 a summary of rigorously developed national and international guidelines available to physicians in  
377 the form of a quick reference, which allows easy comparison. There was a general consensus with  
378 regard to undertaking CVD risk screening and use of prediction models for risk stratification and  
379 guiding treatment. They also agreed on the use of relatively simple risk markers including age,  
380 gender, ethnicity and smoking history. Novel biomarkers or markers of subclinical atherosclerosis  
381 are generally not recommended except in very select subgroup of individuals. A conservative  
382 approach to aspirin initiation in primary prevention was advocated and there was a general  
383 agreement on intervals for repeat screening. Guidelines differ with respect to selection of the  
384 ideal target population, which risk prediction model to use and which thresholds to utilize to  
385 initiate statin or antihypertensive treatment.

386

387 We performed a broad search utilizing major medical publication repositories, guideline library  
388 websites and manually searching individual guideline development group websites. In contrast to  
389 our previous paper, this review only summarizes recommendations from guidelines. Other reports  
390 such as position and scientific statements are not in the remit of the AGREE II instrument, and  
391 were excluded. All the guidelines included in this review were published in the last 7 years and  
392 represent the most recent recommendations. None of the current 21 guidelines were included in  
393 our previous review.

394



395 Guidelines generally recommend that decisions on management be based on global cardiovascular  
396 risk that considers multiple risk factors. However, they differ regards risk thresholds to utilize. This  
397 is partly because the risk models advocated in the guidelines vary over the use of data sets,  
398 predictors used and their end points. The SCORE model (ESC) uses only hard end points of CVD  
399 mortality whereas the Framingham (CDC/ AHA, National Vascular Disease Prevention Alliance)  
400 utilizes the broadest end points consisting of coronary death, myocardial infarction, coronary  
401 insufficiency, angina, ischemic stroke, hemorrhagic stroke, transient ischemic attack, peripheral  
402 artery disease, and heart failure. Furthermore, the risk threshold for initiating a statin used by the  
403 ACC/AHA of 7.5% is based on the newer Pooled Cohort Equation which uses the 10-year non-fatal  
404 myocardial infarction, coronary heart disease death, or stroke end points (18). This variability can  
405 lead to different groups receiving treatment, makes comparison between different health care  
406 systems challenging and could also lead to inequality of health care. The AHA/ACC guidelines for  
407 example, would recommend statins for nearly all men and two-thirds of women over the age of  
408 55-years, exceeding the proportions that would be eligible based on other guidelines such as the  
409 ESC, when tested in a European cohort (38). Standardization of various risk scoring systems, with  
410 validation and calibration, may help improve clinical outcomes in individuals at risk of developing  
411 CVD (39). Risk scoring systems would need to be developed/updated for different countries due to  
412 country/ region specific differences in event rates and mortality.

413

414 There are many challenges faced by programs that attempt to provide population-based  
415 interventions that determine the overall impact achieved. The diversity in guidelines on CVD may  
416 partly reflect the uncertainty on benefit of screening. Although there is evidence to support the  
417 effectiveness of particular interventions to appropriate individuals the difficulties in screening  
418 programs include the achievement of high enough uptake rates to invitations, the ability to deliver  
419 effective interventions and patient adherence to recommendations.

420 Most guidelines recommended a selective screening strategy with some newer guidelines  
421 advocating a lower threshold for initiating treatment such as statin therapy, citing recent meta-  
422 analysis and the reduced costs of statins due to patent expiry, as the main reasons for this shift(9).  
423 Thresholds utilized for deciding high risk are often arbitrary and at best decided on by  
424 mathematical modeling. Studies that show modest benefit have mainly been based on  
425 improvements in surrogate markers rather than CVD events, with inherent limitations (40).

426

427 A MEDLINE search identified four previous systematic reviews relevant to our study, published  
428 between January 1, 2009 and June 30, 2016 (see appendix for search strategy). Two were from our  
429 group including the previous (now outdated) version of this review and another focused on  
430 guidelines of screening for peripheral vascular disease only (8,41). The remaining two publications  
431 were limited to guidelines on primary CVD prevention in the elderly (searches up to December  
432 2013) (42) or the diagnosis, assessment and management of hypertension (searches up to  
433 September 2011).

434

435 This systematic review represents contemporary guidelines with a broad inclusion of conditions  
436 eligible for cardiovascular risk assessment in apparently healthy adults along with an assessment  
437 of the guidelines rigor of development. Compared to our previous publication from 6 years ago,  
438 the target populations, risk prediction models and its consequences are still areas of disagreement  
439 across guidelines (8). Over the last 6 years there has been a trend towards advocating a lower  
440 threshold for initiating intensive lifestyle modification and statin therapy. Risk prediction models  
441 have been updated with a move away from the Framingham risk score, which previously  
442 predominated. There is a more conservative approach to aspirin, with most guidelines generally  
443 advocating against its use in primary prevention. The use of tests for assessment of subclinical

444 atherosclerosis has been further restricted.

445

446 The optimal strategy for systematic screening for the apparently healthy remains to be answered.

447 Some advocate continuing with the current strategy of screening with the aim of trying to mold it

448 into a system that eventually shows benefit whereas others are asking for the programs to be

449 halted until such a time that the evidence of benefit justifies the resources invested in screening

450 (43,44). Recent publications addressing some of these gaps and future research in identifying the

451 most effective strategies will help shape future guideline recommendations (45-47).

452

453 There are some limitations that could bias our findings and limit generalizability. Only guidelines

454 developed by Western national or international medical organizations were reviewed. We

455 controlled for selection bias by having a comprehensive search strategy, as previously generated

456 with a librarian and the articles were selected and appraised by two independent researchers.

457 However, researchers were not blinded to the organization names or countries of origin. Finally,

458 we considered the guideline development process but did not assess the clinical validity of the

459 recommendation or review recommendations for specific lifestyle interventions as it was beyond

460 the scope of this review.

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467 **Conclusion**

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469 Considerable discrepancies in recommendations still exist in cardiovascular screening guidelines  
470 with no consensus on optimum screening strategies or treatment threshold. Physicians should  
471 assess the strength of the recommendations and the level of evidence to decide which of the  
472 discrepant recommendations they may implement.

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End of manuscript text

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519 Statistical Code: Not applicable

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521 request from authors)

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**Table 1. Characteristics of 21 Guidelines**

Guideline by Medical Condition, year	Organization Responsible for Guideline Development	Country Applied	AGREE2 Rigor score, %	Conflicts of Interest
<b>Total Cardiovascular risk</b>				
NICE (14), 2014	National Institute for Health and Clinical Excellence	UK	86	EI,SCI*†
ESC (15), 2012	European Society of Cardiology	Europe	86	SCI*
NVDPA (16), 2012	National Vascular Disease Prevention Alliance	Australia	85	EI,SCI†
ACC/AHA (17-19), 2013	American College of Cardiology	United States	83	SCI*†
CDC (20), 2011	Centres for Disease Control and Prevention	United States	65	EI,SCI*†
BCS (21), 2014	British Cardiovascular Society	UK	45	SCI*
NZGG (22), 2012	New Zealand Guidelines Group	New Zealand	20	EI,SCI‡
<b>Dyslipidemia</b>				
ESC (23), 2011	European Society of Cardiology	Europe	72	SCI*
ACCE (24), 2012	American Association of Clinical Endocrinologists	United States	64	SCI*
CCS (25), 2013	Canadian Cardiovascular society	Canada	42	EI,SCI*
<b>Dysglycemia</b>				
ADS/DAGDC (26), 2009	Australian Diabetes Society	Australia	87	SCI‡
CDA (27), 2013	Canadian Diabetes Association	Canada	83	EI,FIP,SCI*†
ADA (28), 2014	American Diabetes Association	United States	68	SCI*
USPSTF (29), 2015	U.S. Preventative Services Task Force	United States	76	EI, SCI
NICE (30), 2012	National Institute for Health and Clinical Excellence	UK	73	
CTFPHC (31), 2012	Canadian Task Force on Preventive Health Care	Canada	68	EI,SCI*
ESC (32), 2013	European Society of Cardiology	Europe	66	SCI*
IDF (33), 2012	International Diabetes Federation	International	47	FIP, SCI§
<b>Hypertension</b>				
CHS (34,35), 2015	Canadian Hypertension Society	Canada	90	EI,SCI*†
USPSTF (36),2015	U.S. Preventative Services Task Force	United States	79	EI, SCI
CTFPHC (37), 2013	Canadian Task Force on Preventive Health Care	Canada	78	SCI

Abbreviations: AGREE2, Appraisal of Guidelines Research and Evaluation II; EI, editorial; independence declared; FIP, funding by industrial partner reported; SCI, statement about conflicts of interest of group members present; UK, United Kingdom

\*Relationship with industry is reported by any group member;

† A group member is reported recused when a relevant area is under discussion;

‡ Conflicts of interest only available on request;

§ Conflicts of interest only reported to the group

**Table 2. Recommendations for Screening in Total CVD Risk in 5 Guidelines**

	ESC	NICE	NVDPA	ACC/ AHA	CDC/ AHA
Country	Europe	UK	Australia	USA	USA
Year	2016	2014	2012	2013	2011
AGREE 2 Score	86%	86%	85%	83%	65%
Method to evaluate evidence	Systematic review	Systematic review	Systematic review	Systematic review	Systematic review
Methods to formulate recommendations	Formal consensus	Formal consensus	Formal consensus	Formal consensus	Formal consensus and voting
Consideration of costs	Review of CEA studies	Systematic review of published literature/ Performed CEA	Review of CEA studies	Not performed	Review of CEA studies
Target Group	Men > 40 y, Women >50 y or post menopausal	Aged 40-74 (NHS Health Check)	All adults aged >45 y or Aboriginal & Torres Strait Islanders >35y	Aged 21 and above	Women ≥20 y
Strategy	Opportunistic screening/ case finding	Opportunistic screening/ case finding/ record based	Opportunistic screening/ case finding	Opportunistic screening/ case finding	NR
Strength of recommendation	For	For	For	For	Not for and not against
<b>Major risk factors prediction model</b>	SCORE, general ASCVD mortality at 10 y	QRISK2, CHD/stroke/TIA events at 10 y	Framingham, CHD/stroke events at 5 y	Pooled Cohort Equations, CHD/stroke events at 10 y if age 40-79 y or lifetime (30 y) risk for 20-59 y with 10 y risk ≤ 7.5%	Framingham/ Reynolds Risk Score, CHD/stroke at 10 y
Age	√1	√1	√1	√1	√1
Sex	√1	√1	√1	√1	√1
Blood pressure	√1	√1	√1	√1	√1
TC level	√1	√1	√1	√1	√1
LDL-C level	√2	√2	√2		
HDL-C level	√1	√1	√1	√1	√1
TC:HDL-C ratio	√1	√1	√1	√1	
Smoking	√1	√1	√1	√1	√1
Glucose levels		√2	√2		
<b>Underlying risk factors</b>					
Overweight/obesity	√2	√1	√2		√1
Physical inactivity	√2		√2		√1
Atherogenic diet					
Socioeconomic factors	√2	√1	√2		
Family history of premature CVD	√2	√1	√2	√3	√1
Genetic/racial factors	√2	√1	√2	√1	√1
Diabetes	√2	√1	√1	√1	√1
Antihypertensives	√2	√1		√1	
<b>Emerging risk factors</b>					
TG levels	√2	√2	√2		
Renal function	√2	√1	√2		√1

<b>Table 2. Recommendations for Screening in Total CVD Risk in 5 Guidelines (continued).</b>					
	<b>ESC</b>	<b>NICE</b>	<b>NVDPA</b>	<b>ACC/ AHA</b>	<b>CDC/ AHA</b>
Heart rate	√2				
Apo/lipoprotein levels	√4				
Glucose therapy for insulin resistance					
Prothrombotic markers	√4				
C-reactive protein level	√4			√3	
Subclinical atherosclerosis	√4 (ABI, CAC score, carotid US for plaque)		√1 (LVH)	√3 (ABI, CAC score)	
<b>Thresholds</b>					
Aspirin	Not recommended in primary prevention	Not applicable	Not recommended in primary prevention	Not applicable	Useful in women ≥65 depending on risk benefit; reasonable in DM
Statins	10 y CVD mortality ≥10% and LDL-C level ≥70 mg/dL; 10 y risk 5%-10% and LDL-C level ≥100 mg/dL; consider if 10 y risk <5% and LCL-C >115mg/dL; DM2 or DM1 and age >40 y	10 y CHD/stroke/TIA risk ≥10%; DM2 and 10 y CVD risk ≥10% (according to UKPDS tool); DM1; CKD with eGFR <60	5 y CHD/stroke risk ≥15%; persistent BP ≥160/100 mmHg; TC >7.5mmol/L; 5 y CHD/stroke risk 10%-15% and family history of premature CVD	40 -75 y with 10 y CHD/stroke risk ≥7.5% and LDL-C 70-189 mg/dL; 40-75 y with DM and LDL-C 70-189mg/dL; LDL-C level ≥190 mg/dL	10 y risk >20%; DM
Antihypertensives	10 y CVD mortality ≥10% and BP ≥140/90 mmHg; consider if 10 y risk 5-10% and BP ≥140/90 mmHg; DM1 or DM2 and BP ≥140/85 mmHg; over 60 y and systolic BP >150mmHg or more than 80 y and systolic BP >160mmHg; BP ≥180/110 mmHg	NR	5 y FRS ≥ 15%; FRS 10-15% and BP persistently ≥ 160/100/ FHx CVD, high risk ethnicity; consider if FRS <10% but BP persistently ≥160/100 mmHg	NR	BP ≥140/90 mmHg; >130/85 in CKD and DM
Intensive Lifestyle Counseling	10 y CVD mortality >1% or LDL-C >100mg/dL	10 y CHD/stroke/TIA risk ≥10%	5 y CHD/stroke risk ≥10%.	10 y CHD/ stroke risk ≥7.5% and LDL-C 70-189 mg/dL; DM1 or DM2; LDL-C level ≥190 mg/dL	NR

**Table 2. Recommendations for Screening in Total CVD Risk in 5 Guidelines (continued).**

	ESC	NICE	NVDPA	ACC/ AHA	CDC/ AHA
High-risk Monitoring	NR	NR	Monitor risk profile according to clinical context if 5 y CHD/stroke risk $\geq 15\%$ . Monitor risk profile every 6-12 months if 5 y CHD/stroke risk 10 -15%	NR	NR
Screening Intervals	NR	Further risk assessment on an on going basis. 5 yearly as per NSF	Further risk assessment every 2 y if 5 y CHD/stroke risk $<10\%$	Further risk assessment every 4-6 y if 10 y CHD/stroke risk $<7.5\%$	NR

Abbreviations: ABI, ankle brachial index; ASCVD, atherosclerotic cardiovascular disease; CEA, cost-effectiveness analysis; CAC, coronary artery calcium; CHD, coronary heart disease; CKD, chronic kidney disease; CVD, cardiovascular disease; DM - diabetes mellitus; FHx, family history; HDL-C, high density lipoprotein cholesterol; LDL-C, low density lipoprotein cholesterol; LVH, left ventricular hypertrophy; NHS, National Health Service; NR, not reported; NSF, National Service Framework; SCORE, Systematic Coronary Risk Evaluation; TC, total cholesterol; TG, triglyceride; TIA, transient ischemic attack; UK, United Kingdom; US, ultrasound; y, years;

√1, Formal screening test (included in the prediction model);

√2, Additional screening test

√3, In selected individuals who are not in 1 of the 4 main statin benefit groups, and for who a decision to initiate statin therapy is otherwise unclear, additional factors may be considered to inform treatment decision-making. These factors include; 1. Primary LDL-C  $\geq 160$  mg/dL or other evidence of genetic hyperlipidemias, 2. First degree relative with premature ASCVD, 3. High-sensitivity C-reactive protein  $>2$  mg/L, 4. CAC score  $\geq 300$  Agatston units or  $\geq 75$  percentile for age, sex, and ethnicity, 5. Ankle-brachial index  $<0.9$ , or 6. Elevated lifetime risk of ASCVD.

√4, Novel biomarkers have only limited additional value when added to CVD risk assessment with the SCORE algorithm in come limited cases.

**Appendix Table 1: Website searches of guideline development organizations, including websites affiliated with all the guidelines included in our previous publication**

<b>Organization Responsible for Guideline Development</b>	<b>Country</b>	<b>Website Searched</b>
American Academy of Family Physicians (AAFP)	United States	<a href="http://www.aafp.org/online/en/home.html">http://www.aafp.org/online/en/home.html</a>
American Association of Clinical Endocrinologists	United States	<a href="http://www.aace.com">www.aace.com</a>
American College of Cardiology	United States	<a href="http://www.acc.org/">http://www.acc.org/</a>
American College of Physicians	United States	<a href="http://www.acponline.org/">http://www.acponline.org/</a>
American College for Preventive Medicine	United States	<a href="http://www.acpm.org/">http://www.acpm.org/</a>
American Diabetes Association (ADA)	United States	<a href="http://www.diabetes.org/">http://www.diabetes.org/</a>
American Geriatrics Society (AGS)	United States	<a href="http://www.americangeriatrics.org/">http://www.americangeriatrics.org/</a>
American Heart Association (AHA)	United States	<a href="http://www.americanheart.org/">http://www.americanheart.org/</a>
American Medical Association (AMA)	United States	<a href="http://www.ama-assn.org/">http://www.ama-assn.org/</a>
American Stroke Association	United States	<a href="http://www.strokeassociation.org/">http://www.strokeassociation.org/</a>
Australian Diabetes Society (ADS)	Australia	<a href="https://www.diabetessociety.com.au/">https://www.diabetessociety.com.au/</a>
Australian Medical Association (AMA)	Australia	<a href="http://www.ama.com.au/web.nsf/">http://www.ama.com.au/web.nsf/</a>
British Cardiac Society (BCS)	United Kingdom	<a href="http://www.bcs.com/pages/default.asp">http://www.bcs.com/pages/default.asp</a>
British Hypertension Society (BHS)	United Kingdom	<a href="http://www.bhsoc.org/default.stm">http://www.bhsoc.org/default.stm</a>
Canadian Diabetes Association	Canada	<a href="http://guidelines.diabetes.ca/">http://guidelines.diabetes.ca/</a>
Canadian Hypertension Society (CHS)	Canada	<a href="http://www.hypertension.ca/">http://www.hypertension.ca/</a>
Canadian Task Force on Preventive Health Care (CTFPHC)	Canada	<a href="http://canadiantaskforce.ca/">http://canadiantaskforce.ca/</a>
Cardiac Society of Australia and New Zealand (CSANZ)	Australia	<a href="http://www.csanz.edu.au/">http://www.csanz.edu.au/</a>
Centers for Disease Control and Prevention (CDC)/ AHA	United States	<a href="http://www.cdc.gov/">http://www.cdc.gov/</a>
Department of Health (DOH)	United Kingdom	<a href="http://www.dh.gov.uk/en/index.htm">http://www.dh.gov.uk/en/index.htm</a>
European Society of Cardiology	Europe	<a href="http://www.escardio.org/">http://www.escardio.org/</a>
International Diabetes Federation (IDF)	International	<a href="http://www.idf.org/">http://www.idf.org/</a>
International Society of Hypertension	International	<a href="http://www.ish-world.com/">http://www.ish-world.com/</a>
National Health and Medical Research Council (NHMRC)	Australia	<a href="http://www.nhmrc.gov.au/index.htm">http://www.nhmrc.gov.au/index.htm</a>
National Heart Foundation	Australia	<a href="http://www.heartfoundation.org.au/index.htm">http://www.heartfoundation.org.au/index.htm</a>
National Heart Lung and Blood Institute	United States	<a href="http://www.nhlbi.nih.gov/guidelines/index.htm">http://www.nhlbi.nih.gov/guidelines/index.htm</a>
National Institute for Health and Clinical Excellence (NICE)	United Kingdom	<a href="http://www.nice.org.uk/">http://www.nice.org.uk/</a>
New Zealand Guidelines Group	New Zealand	<a href="http://www.nzgg.org.nz/index.cfm?">http://www.nzgg.org.nz/index.cfm?</a>
Royal College of General Practitioners (RCGP)	United Kingdom	<a href="http://www.rcgp.org.uk/default.aspx">http://www.rcgp.org.uk/default.aspx</a>



**Appendix Table 1: Website searches of guideline development organizations, including websites affiliated with all the guidelines included in our previous publication (continued)**

<b>Organization Responsible for Guideline Development</b>	<b>Country</b>	<b>Website Searched</b>
Scottish Intercollegiate Guidelines Network (SIGN)	United Kingdom	<a href="http://www.sign.ac.uk/">http://www.sign.ac.uk/</a>
U.S. Preventive Services Task Force (USPSTF)	United States	<a href="http://www.ahrq.gov/clinic/uspstfix.htm">http://www.ahrq.gov/clinic/uspstfix.htm</a>
World Heart Federation	International	<a href="http://www.world-heart-federation.org/">http://www.world-heart-federation.org/</a>
World Health Organisation (WHO)	International	<a href="http://www.who.int/en/">http://www.who.int/en/</a>
World Hypertension League	International	<a href="http://www.worldhypertensionleague.org/Pages/Home.aspx">http://www.worldhypertensionleague.org/Pages/Home.aspx</a>
International Diabetes Federation European Region	International	<a href="http://diabetespreventionforum.org/index.php/projects/6-image-project">http://diabetespreventionforum.org/index.php/projects/6-image-project</a>

**Appendix Table 2. Recommendations for Screening for Dysglycemia in 6 Guidelines**

	DAGDC	CDA	ADA	USPSTF	NICE PH38	CTFPHC	ESC
Country	Australia	Canada	USA	USA	UK	Canada	Europe
Year	2009	2013	2016	2015	2012	2012	2013
AGREE 2 Score	87%	83%	82%	76%	73%	68%	66%
Method to evaluate evidence	Systematic review	Systematic review	Systematic review	Systematic review	Systematic review	Systematic review	Systematic review
Methods to formulate recommendations	Formal consensus	Formal consensus	Formal consensus	Consensus	Consensus	Formal consensus	Formal consensus
Consideration of costs	Review of CEA studies	Review of CEA studies	Review of CEA studies	Review of CEA studies	Review of CEA studies	Systematic review of published literature/ Performed CEA	NR
Target Group	All adults aged ≥40y or Aboriginal & Torres Strait Islanders ≥18y	All adults aged ≥40y or high risk groups using risk calculator	All adults over 45 y or all Adults with BMI ≥25 (or ≥23 kg/m <sup>2</sup> in Asian Americans) and 1 additional DM risk factor	Adults aged 40-70 y with BMI ≥25	> 40 y; 25-39 y South Asian, Chinese, Black with high risk scores	Asymptomatic adults	FINDRISC ≥ 15/26 (high risk for DM)
Strategy	Opportunistic screening	Opportunistic screening/ case finding	Opportunistic screening/ case finding	Opportunistic screening	Opportunistic screening including during NHS Health Checks; case finding/ record based	Opportunistic screening	Case finding/ Patient completed questionnaire based information
Strength of recommendation	For	For	For	For - moderate overall benefit for screening and implementing intensive lifestyle intervention	For - only in high risk groups	For - only in high risk groups	For - only in high risk group

**Appendix Table 2. Recommendations for Screening for Dysglycemia in 6 Guidelines (continued)**

	DAGDC	CDA	ADA	USPSTF	NICE PH38	CTFPHC	ESC4
<b>Major risk factors prediction model</b>	Diabetes risk assessment, e.g. AUSDRISK $\geq 15$ high risk	Diabetes risk assessment	Diabetes risk assessment	NR	Diabetes UK score	FINDRISC, 10 y DM risk or other validated risk score (e.g. CANRISK)	FINDRISC, 10 y DM risk
Age	√1	√1	√1	√1	√1	√1	√1
Sex	√1			√1	√1	√1	√1
Blood pressure			√1				√1
TC level							
HDL-C level	√2	√1	√1				
TC:HDL-C ratio				√1			
Smoking	√1		√1	√1			
Glucose levels	√2	√1 (or HBA1C)	√1		√2 (or HBA1C)	√2 (or HBA1C)	
<b>Underlying risk factors</b>							
Overweight/obesity	√1	√1	√1	√1	√1	√1	√1
Physical inactivity	√1		√1	√1		√1	√1
Atherogenetic diet						√1	
Family history of premature CVD		√1	√1				
Genetic/racial factors	√1	√1	√1	√1	√1	√1	
Antihypertensive Therapy	√1	√1	√1	√1		√1	√1
<b>Emerging risk factors</b>							
TG levels	√2	√1	√1				
Renal function							
<b>Thresholds</b>							
Aspirin	NR	Not routinely recommended. May be used in presence of other CVD risk factors	Consider if DM with 10 y ASCVD risk $\geq 10\%$ . Consider aspirin in women $\geq 50$ y. Clinical judgment required for antiplatelet use if $< 50$ y with multiple risk factors and 10 y ASCVD risk 5-10%	Not recommended	NR	NR	Consider in high risk DM patients on an individual basis

**Appendix Table 2. Recommendations for Screening for Dysglycemia in 6 Guidelines (continued)**

	DAGDC	CDA	ADA	USPSTF	NICE PH38	CTFPHC	ESC4
Statins	NR	If found diabetic in men > 40 y; < 40 y with microvascular complications, diabetes for >15 y and >30 y old	Consider moderate or high intensity statin if DM and 40-75 y, DM and > 75 y or if DM and < 40 y with one or more other ASCVD risk factors (family history of premature ASCVD, hypertension, smoking, overweight or obese, LDL >100mg/dL; High intensity statin if 40-75 y with additional ASCVD risk factor. Moderate to high intensity statin if >75 y and additional ASCVD risk factors	NR	NR	NR	Very high risk; Severe renal disease, 1 other CVD risk factor or target organ damage and LDL-C >70mg/dL; T2DM and LDL-C >100mg/dL
Antihypertensives	NR	If found diabetic and BP>130/80 mmHg	DM and BP >140/90mmHg	NR	NR	NR	DM and BP >140/85mmHg
Intensive Lifestyle Counseling	IFG; IGT	IFG; IGT	IGT or IFG or A1C 5.7-6.4 mmol/L	For those with abnormal blood glucose (IGT, IFG or diabetes); BMI >25 kg/ m2 and additional CVD risk factors; BMI ≥ 30 kg/ m2	High risk and IFG/HBA1C 42 -47	NR	High risk for developing DM
High-risk Monitoring	Yearly if IFG/ IGT	Yearly if IFG/ IGT	Annual screening if IGT or IFG or A1C 5.7-6.4 mmol/L	NR	Every year if high risk and IFG or HBA1C 42 -47 mmol/mol	Annual screening if very high risk (e.g. FIND RISK >20)	Depending on clinical context

**Appendix Table 2. Recommendations for Screening for Dysglycemia in 6 Guidelines (continued).**

	DAGDC	CDA	ADA	USPSTF	NICE PH38	CTFPHC	ESC4
Screening Intervals	3 y; annual if IFG/IGT	3 y; annual if IFG/IGT	3 y if normal; 6-12 postpartum if GDM then every 3 years if normal	3 y if normal glucose levels	At least 5 y starting with risk assessment tool for low risk; 3 yearly for those at moderate risk of diabetes	3- 5 y	NR

**Appendix Table 3. Recommendations for Screening for Dyslipidemia in 2 Guidelines**

	ESC	AACE
Country	Europe	USA
Year	2011	2012
AGREE 2 Score	72%	64%
Method to evaluate evidence	Systematic review	Review of published systematic reviews and RCTs; literature identified by panel members
Methods to formulate recommendations	Formal consensus	Formal consensus
Consideration of costs	NR	Review of CEA studies
Target Group	DM, hypertension, smokers, BMI $\geq$ 30, FHx premature CVD, FHx of familial hypercholesterolemias, CKD, Chronic inflammatory conditions, Men > 40 y, Women >50 y or post menopausal	Aged $\geq$ 20 y
Strategy	Opportunistic screening/ case finding	Opportunistic screening/ case finding
Strength of recommendation	For	For
<b>Major risk factors prediction model</b>	SCORE, general ASCVD mortality at 10 y	Framingham/ Reynolds Risk Score, CHD/stroke at 10 y
Age	√1	√1
Sex	√1	√1
Blood pressure	√1	√1
TC level	√1	√1
LDL-C level	√1	√1
HDL-C level	√1	√1
TC:HDL-C ratio	√1	√1
Smoking	√1	√1
<b>Underlying risk factors</b>		
Family history of premature CVD		√1
Diabetes		√1
<b>Emerging risk factors</b>		
TG levels	√1	√2
Apo lipoprotein/lipoprotein levels	√2	√2
Glucose therapy for insulin resistance		√1
Prothrombotic markers		√3
C-reactive protein level		√3
<b>Thresholds</b>		
Aspirin	NR	NR
Statins	10 y CVD mortality risk $\geq$ 10% and LDL-C level $\geq$ 70 mg/dL; 10 y CVD mortality 5%-9% and LDL-C level $\geq$ 100 mg/dL; (Type 1 DM or Type 2 DM) and LDL-C level $\geq$ 70 mg/dL; very high CV risk (Type 2 DM, Type 1 DM with target organ damage, CKD)	Treat to target based on personalized risk LDL-C to < 100mg/dL if average or elevated LDL; other parameters based on target levels
Antihypertensives	NR	NR
Intensive Lifestyle Counseling	10 y CVD mortality >1% or LDL-C > 100mg/dL	10 y risk $\geq$ 20%
High-risk Monitoring	NR	NR
Screening Intervals	NR	Every 5 y if risk aged $\geq$ 20 y, every 1-2 y if aged $\geq$ 45 male or aged $\geq$ 55 y female

Abbreviations: ABI, ankle brachial index; ASCVD, atherosclerotic cardiovascular disease; CEA, cost-effectiveness analysis; CHD, coronary heart disease; CKD, chronic kidney disease; CVD,

cardiovascular disease; DM - diabetes mellitus; FHx, family history; HDL-C, high density lipoprotein cholesterol; LDL-C, low density lipoprotein cholesterol; LVH, left ventricular hypertrophy; NR, not reported; RCT, randomized controlled trial; SCORE, Systematic Coronary Risk Evaluation; TC, total cholesterol; TG, triglyceride; TIA, transient ischemic attack; y, years;

√1, Formal screening test (included in the prediction model);

√2, Additional screening test

√3, In selected individuals who are not in 1 of the 4 main statin benefit groups, and for who a decision to initiate statin therapy is otherwise unclear, additional factors may be considered to inform treatment decision-making. These factors include; 1. Primary LDL-C  $\geq 160$  mg/dL or other evidence of genetic hyperlipidemias, 2. First degree relative with premature ASCVD, 3. High-sensitivity C-reactive protein  $>2$  mg/L, 4. CAC score  $\geq 300$  Agatston units or  $\geq 75$  percentile for age, sex, and ethnicity, 5. Ankle-brachial index  $<0.9$ , or 6. Elevated lifetime risk of ASCVD.

**Appendix Table 4. Recommendations for Screening for Hypertension in 2 Guidelines**

	CHEP	USPSTF	CTFPHC
Country	Canada	USA	Canada
Year	2015	2015	2013
AGREE 2 Score	90%	79%	78%
Method to evaluate evidence	Systematic review	Systematic review	Systematic review
Methods to formulate recommendations	Formal consensus	Consensus	Consensus
Consideration of costs	NR	NR	NR
Target Group	All adults	≥ 18 y with increased risk of high BP: high-normal blood pressure (130–139/85–89 mm Hg), overweight or obese, and African Americans	≥ 18 y
Strategy	Opportunistic screening at 'appropriate visits'	NR	Opportunistic screening at 'appropriate visits'/ case finding
Strength of recommendation	For	For	For
<b>Major risk factors prediction model</b>	SCORE - Canada, general ASCVD mortality at 10 y	NR	NR
Age	✓1	✓1	✓1
Sex	✓1		
Blood pressure	✓1	✓1	✓1
TC level	✓1		
HDL-C level	✓1		
Smoking	✓1		
<b>Underlying risk factors</b>			
Overweight/obesity	✓1	✓1	
Physical inactivity	✓1		
Atherogenetic diet	✓1		
Family history of premature CVD			
Genetic/racial factors		✓1	✓1
Diabetes	✓1		
<b>Emerging risk factors</b>			
Renal function	✓1		
Subclinical atherosclerosis	LVH/ resting ECG		LVH/ resting ECG
<b>Thresholds</b>			
Aspirin	Consider if ≥ 50 y and hypertensive	NR	NR
Statins	If 3 or more of - (male/ ≥55 y/ smoking/ Type 2 DM/ Total-C/HDL-C ration ≥ 6/ FHx CVD/ LVH/ ECG abnormalities/ Microalbuminuria/ PVD	NR	NR
Antihypertensives	If found diabetic and BP>130/80mmHg; High-risk for diabetes and BP >140/90; Low-risk and BP >160/100; ≥ 80 y and systolic >160	NR	NR
Intensive Lifestyle Counseling	In all with hypertension	NR	NR



**Appendix Table 4. Recommendations for Screening for Hypertension in 2 Guidelines (continued)**

	CHEP	USPSTF	CTFPHC
High-risk Monitoring	Annual if BP high normal ( $\geq$ 130/85)	Annually if $\geq$ 40 y and at increased risk for high BP	Annual if BP high normal ( $\geq$ 130/85)
Screening Intervals	NR	Annually if $\geq$ 40 y and at increased risk for high BP. Every 3 to 5 y if 18 to 39 y with normal BP (<130/85 mm Hg) and not other risk factors.	Further risk assessment based on clinical judgment

Abbreviations: ABI, ankle brachial index; ASCVD, atherosclerotic cardiovascular disease; CHD, coronary heart disease; CKD, chronic kidney disease; CVD, cardiovascular disease; DM - diabetes mellitus; FHx, family history; HDL-C, high density lipoprotein cholesterol; LDL-C, low density lipoprotein cholesterol; LVH, left ventricular hypertrophy; NR, not reported; PVD, peripheral vascular disease; SCORE, Systematic Coronary Risk Evaluation; TC, total cholesterol; TG, triglyceride; TIA, transient ischemic attack; US, ultrasound; y, years;  $\sqrt{1}$ , Formal screening test (included in the prediction model);

Appendix Figure 1.

