Systematic review of guidelines on abdominal aortic aneurysm screening

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Objective: **Usually, physicians base their practice on guidelines, but recommendations on the same topic may vary across guidelines. Given the uncertainties regarding abdominal aortic aneurysm (AAA) screening, physicians should be able to identify systematically and transparently developed recommendations. We performed a systematic review of AAA screening guidelines to assist physicians in their choice of recommendations.**

Methods: **Guidelines in English published between January 1, 2003 and February 26, 2010 were retrieved using MEDLINE, CINAHL, the National Guideline Clearinghouse, the National Library for Health, the Canadian Medication Association Infobase, and the G-I-N International Guideline Library. Guidelines developed by national and international medical societies from Western countries, containing recommendations on AAA screening were included. Three reviewers independently assessed rigor of guideline development using the Appraisal of Guidelines Research and Evaluation (AGREE) instrument. Two independent reviewers performed extraction of recommendations.**

Results: **Of 2415 titles identified, seven guidelines were included in this review. Three guidelines were less rigorously developed based on AGREE scores below 40%. All seven guidelines contained a recommendation for one-time screening of elderly men by ultrasonography to select AAAs ≥5.5 cm for elective surgical repair. Four guidelines, of which three were less rigorously developed, contained disparate recommendations on screening of women and middle-aged men at elevated risk. There was no agreement on the management of smaller AAAs.**

Conclusions: **Consensus exists across guidelines on one-time screening of elderly men to detect and treat AAAs ≥5.5 cm. For other target groups and management of small AAAs, prediction models and cost-effectiveness analyses are needed to provide guidance. (J Vasc Surg 2012;55:1296-1305.)**

Abdominal aortic aneurysms (AAAs) contribute significantly to disease burden in developed countries, accounting for approximately 0.5% of total mortality in the United States.[1] Because rupture of an AAA is preceded by a preclinical detectable phase and because accurate tests and effective treatment are available, screening is likely to be beneficial. A recent Cochrane systematic review, including four screening trials, showed a significant decrease in AAA-related mortality in asymptomatic men aged 65 to 79 years who underwent ultrasound screening.[2] A beneficial effect on total mortality was not demonstrated and uncertainties remain regarding other target groups, the optimal screening strategy, policy toward small AAAs, cost-effectiveness, and psychological effects of screening.

In the United Kingdom, the National Health Service Abdominal Aortic Aneurysm Screening Program is being introduced gradually with a full coverage across England expected by March 2013. In this program, men aged 65 are invited for a one-time ultrasound scan examination. In the United States, an abdominal ultrasound scan study for AAA detection is offered as part of the one-time "Welcome to Medicare" preventive health examination. Medicare covers AAA screening for all men who turned 65 years of age and smoked at least 100 cigarettes and individuals with a family history of AAA.[3] In many Western countries, however, systematic, nationwide screening programs are not implemented, and decisions on screening are made on the individual level by primary care physicians. For example, in The Netherlands, systematic screening programs are only allowed in a research setting.[4] Instead, opportunistic screening of siblings of patients with an AAA is recommended.

The purpose of guidelines is to close the gap between the best available evidence and what physicians do in their practice. The usual method of disseminating and implementing guidelines is rather passive, by publication in medical journals or mailing to targeted professionals. This method does not seem to achieve the guidelines' aim: changing physicians' behavior.[5] Variations in recommendations across guidelines on the same topic may cause

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physicians to lose confidence in the construction process and validity of guidelines and lead to a further derivation from this aim. In addition, relationships with the industry can potentially influence choices made within guideline development, making the validity of recommendations even more questionable.[6] Given the potential uncertainties regarding AAA screening, physicians require recommendations that have been developed systematically and transparently.[7]

Our purpose was to assist physicians in their choice of recommendations on AAA screening by a systematic review and critical appraisal of current guidelines.

METHODS

Data sources and searches. The literature search, used for a previous article on cardiovascular risk assessment,[8] was updated to identify guidelines of interest. Briefly, MEDLINE, CINAHL, and four guideline-specific databases: the National Guideline Clearinghouse (United States), the National Library for Health on Guideline Finder (United Kingdom), Canadian Medical Association Infobase (Canada), and the G-I-N International Guideline Library (http://www.g-i-n.net) were searched. Guidelines published from January 1, 2003, to February 26, 2010, and in the English language were considered. Additional guidelines were sought by searching websites of guideline development organizations. See Appendix, online only, for the exact search.

Study selection. A guideline was only considered if it met the Institute of Medicine definition for clinical practice guidelines. In order to meet this definition, a guideline has to contain "systematically developed statements to assist practitioner and patient decisions about appropriate health care for specific clinical circumstances." In order to meet inclusion criteria, guidelines had to: (1) be developed on behalf of a national or international medical specialty society; (2) contain recommendations for an asymptomatic population with no previous diagnosis of AAA; and (3) originate from or apply to Western countries (eg, the United States, Canada, Australia, New Zealand, or the United Kingdom).

Titles and abstracts were reviewed independently by two reviewers (B.S.F. and E.B.C.). Articles were only excluded if both reviewers agreed on the decision. Discrepancies were resolved by consensus. The first author made the final selection of articles based on full text.

Data extraction and quality assessment. Relevant recommendations from the included guidelines were independently extracted by two reviewers (B.S.F. and N.G). Discrepancies were resolved by consensus. Each guideline provided one or more relevant recommendations. Data extracted included the reported methodology for evidence synthesis, formulating of recommendations, consideration of cost-effectiveness, the target population, the strategy for delivery of the test, recommended tests, and test thresholds for intervention and follow-up. In addition, the recommendation was classified as "for," "consider," "not for not against," "insufficient evidence," or "against."

The quality of development of each included guideline was determined using the "Rigor of Development" domain of the Appraisal of Guidelines Research and Evaluation (AGREE) instrument, a seven item score.[9] This score looks at: (1) methods to search for evidence; (2) criteria for selecting the evidence; (3) methods for formulating the recommendations; (4) consideration of health benefits, side effects, and risks; (5) supporting evidence; (6) procedures for external peer review; and (7) the update process. Each item is rated on a 4-point Likert scale. Three reviewers (B.S.F., N.G., and J.J.V.) independently scored each guideline. Additional information on development was also examined by these three reviewers by perusing websites of guideline developers. For each reviewer, AGREE scores were calculated as a percentage using the sum of the seven items and the maximum possible score. Final rigor scores were calculated by averaging the AGREE scores from all reviewers (see Table I, online only, for AGREE item scores per guideline). Reproducibility of the three reviewers' average rigor scores was measured with an intraclass correlation coefficient. We ranked included guidelines according to their average score. Editorial independence from funding body, external funding, and disclosure of relationships with industry by individual guideline group members were assessed (B.S.F.) and checked (N.G.). Discrepancies were resolved by consensus. SRS version 4.0 (Mobius, Ottawa, Ontario, Canada), a web-based software package developed for systematic review data management, was used to remove duplicates, store citations and track results at title, abstract, quality assessment, and data extraction levels.

Data synthesis and analysis. We constructed a table to compare the recommendations from the included guidelines. The table was divided into the following sections: (1) methodology of guideline development; (2) consideration of cost-effectiveness regarding the recommendation; (3) target group and delivery of AAA screening; (4) tests considered; and (5) thresholds for intervention and follow-up.

RESULTS

Selection and assessment of guidelines. We screened 2415 guidelines for eligibility at title level, of which 416 were included for review at abstract level (Fig 1). Of these, seven guidelines relevant to AAA screening were eligible for full data extraction. Table II summarizes the selected guidelines, together with rigor scores and conflict of interest results. Most guidelines (six of seven) were developed in North America. AGREE scores varied from 17% to 79% with three guidelines (Canadian Cardiovascular Society [CCS], Society for Vascular Surgery [SVS]1, and SVS2) having an AGREE score below the median, 40%. Reproducibility of the AGREE scores by the three reviewers was good, with an intraclass correlation coefficient of 0.86. In two of the seven guidelines (American College of Cardiology [ACC], SVS2), at least one panel member declared having a relevant financial relationship with the industry. None of these guidelines reported exclusion of group members from voting or discussions. Only one guideline (United States Preventive Services Task Force [USPSTF])

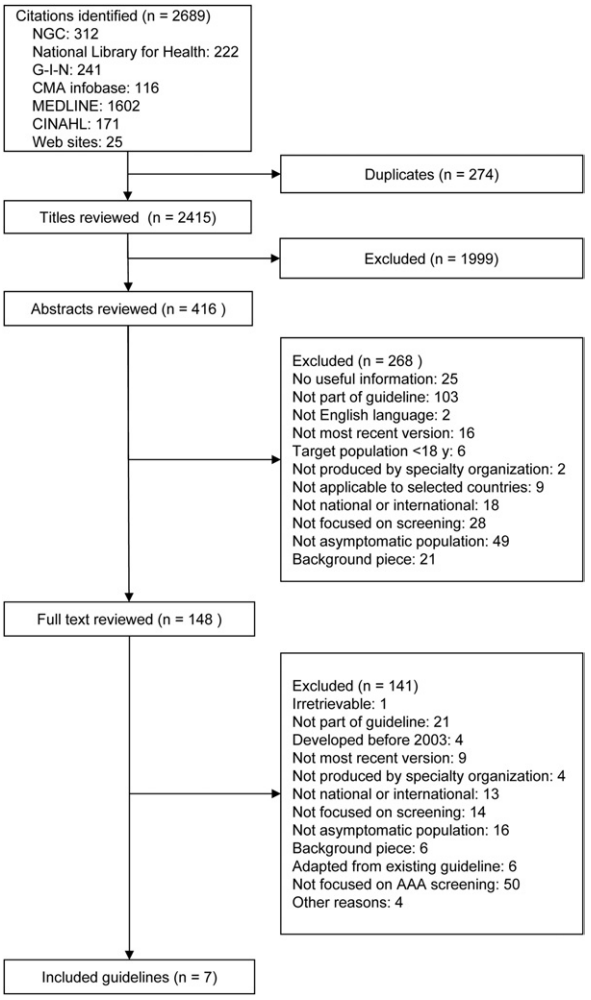

Fig 1. Literature search and selection. Numbers of guidelines of each step of the process are indicated. Group totals may exceed the reported numbers for the excluded articles at abstract and full text level because several reasons for exclusion were allowed. *AAA,* Abdominal aortic aneurysm; *CMA,* Canadian Medical Association; *NGC,* National Guideline Clearinghouse.

contained a statement of being developed independently from the funding organization. Two guidelines (National Screening Committee [NSC] and CCS) neither reported that they were developed independently from funding organization(s), nor did they report a statement about conflicts of interest of group members. The seven included guidelines contained 12 recommendations on AAA screening (Table III). Two (USPSTF and ACC) of the seven guidelines were developed on the basis of a systematic review of the medical literature. The remaining five guidelines were developed using a non-systematic selection of previously developed systematic reviews or primary research. Evaluation of cost-effectiveness of AAA screening strategies was done in six of seven guidelines by reviewing existing decision modeling studies.

Areas of agreement and disagreement among recommendations. All guidelines contained at least one recommendation that supported AAA screening in elderly men. Although guideline groups (six of seven) generally agreed on the age at which screening should be started in elderly men (that is 65 years of age), they disagreed on whether a smoking history should be present or not. In recommendations from two (USPSTF and ACC) of the seven guidelines, ever smoking (current or past smoking) was required. In the other five guidelines, screening was recommended for elderly men regardless of smoking habits.

Three guidelines (USPSTF, ACC, and NSC) only contained recommendations for AAA screening in elderly men or recommended explicitly against screening women. These three guidelines had the highest AGREE scores. Guidelines with lower AGREE scores also contained recommendations for other target groups. Four guideline groups (Canadian Society for Vascular Surgery [CSVS], CCS, SVS1, and SVS2) recommended screening in women if risk factors for development of AAA were present. Although in two of these guidelines (CSVS and CCS) multiple risk factors were required, in two guidelines (SVS1 and SVS2) the presence of one risk factor was considered sufficient reason to screen. Three guidelines (CCS, SVS1, and SVS2) recommended screening of middle-aged men (that is 50 or 55 years) if a family history of AAA is present. Although not all guideline groups reported an age criterion when screening should no longer be offered, in most guidelines (four of seven) 75 years of age was considered as the upper age limit.

Abdominal ultrasonography was unanimously advocated as the primary screening test and only one guideline group (ACC) recommended physical examination as a useful screening tool in addition to ultrasonography. All guideline groups recommended elective surgical repair at an abdominal aortic diameter of 5.5 cm in elderly men. Some guideline groups advocated using a lower threshold (ie, 5.0 cm) for women (CCS and SVS2) or young healthy patients (SVS2) as an indication for surgical repair.

Except for the USPSTF guideline, all guidelines contained recommendations for surveillance of those with aneurysms smaller than 5.5 cm in diameter. These recommendations, however, varied across the guidelines with respect to the intensity of follow-up and aorta diameter cutoff values for the monitoring intervals. The two Canadian guideline groups (CSVS and CCS) were unique in recommending periodic rescreening for individuals with abdominal aortic diameters below 3 cm; the remaining guideline groups recommended one-time screening.

DISCUSSION

In summary, we identified seven guidelines on AAA screening. A majority of guidelines lacked a systematic method for the evaluation of the evidence or achieved a low AGREE score for rigor of development. Most guidelines contained recommendations that were in favor of one-time AAA screening for men 65 years and older using ultrasonography scans. Four guidelines, of which three had low

Table II. Characteristics of seven guidelines on AAA screening

Guideline, year[Reference]	*Organization(s) responsible for guideline development*	*Country that guideline applies to*	*AGREE rigor score*	*Conflicts of interest*
USPSTF, 2005[29]	U.S. Preventive Services Task Force	United States of America	79%	EI
ACC, 2005[30]	American College of Cardiology, and American Heart Association	United States of America	63%	SCI[a]
NSC, 2007[31]	National Screening Committee	United Kingdom	41%	—
CSVS, 2007[32]	Canadian Society for Vascular Surgery	Canada	40%	SCI
CCS, 2005[33]	Canadian Cardiovascular Society	Canada	38%	—
SVS2, 2009[34]	Society for Vascular Surgery	United States of America	25%	SCI[a]
SVS1, 2004[35]	Society for Vascular Surgery, American Association of Vascular Surgery, and Society for Vascular Medicine and Biology	United States of America	17%	SCI

AAA, Abdominal aortic aneurysm; *AGREE,* Appraisal of Guidelines Research and Evaluation; *EI,* editorial independence declared; *SCI,* statement about conflicts of interest of group members present.
[a]Relationship with industry reported by any group member.

AGREE scores, also contained disparate recommendations on screening women and middle-aged men at elevated risk, whereas guidelines with higher AGREE scores did not. Although an abdominal aortic diameter of 5.5 cm was unanimously used as criterion for elective surgical repair in elderly men, no consensus existed on management of smaller AAAs.

A previously published review already summarized and discussed a selection of three guidelines on AAA screening, but the review was neither systematic nor were the selected guidelines appraised on quality.[10] We used a sensitive search strategy to identify guidelines and we assessed the included guidelines by a validated tool, the AGREE instrument. Our article can also have additive value to guideline summaries provided by the National Guideline Clearinghouse, as this database has only summarized some of the guidelines that we reviewed, and does not appraise guidelines on quality of development.[11] We tried to create awareness of differences across guidelines from Western countries, which generally have a comparable population health status and access to medical resources.[12] The differences, which we identified, can have major implications for clinical practice. Because most guidelines were produced by North American organizations, this report is most valuable to guide physicians from this region in choosing which recommendations to follow. Physicians may decide based on AGREE scores and their specific clinical context which recommendations to adopt or to avert.

Despite these strengths, we have to face certain limitations of our review. First, we neither evaluated the source nor the quality of the underlying evidence that supported the recommendations, but instead assessed the guidelines' construction processes. For example, disparate evidence cited by guideline developers could provide possible causes for variation in recommendations. Transparent development methods and complete information on how judgments were made increase the reliability of recommendations and allow physicians to make more informed decisions on adopting them. Which recommendations would result in better outcomes can be determined in comparative effectiveness research,[13] but this was beyond the scope of our review. Second, the AGREE instrument only considers the details of reporting information related to the development of the guideline. The true quality of the guideline can, therefore, not be fully captured. For example, a guideline group which performs a systematic search for evidence and which does not report detailed information on the search strategy followed, will receive a low AGREE score for this item. In reality, the search followed may be adequate for identifying solid evidence. Although we did search the organization's website for additional background information, we did not contact guideline developers for additional information that was lacking in the guideline document or on the website. Third, the AGREE instrument provides a quality score on a linear scale. This means that each item is weighed equally. We believe that all items of the AGREE Rigor of Development domain are relevant, supporting equal weighting across items. The contribution of each individual item to the total quality of a guideline is, however, difficult to assess. Fourth, it was difficult to quantify the true degree of influence by industry relationships. We had to rely on the disclosures that were believed to be relevant for decision-making by group members themselves. We also could not assess the size of entanglements with industry, because guidelines did not report the payment amounts received.

Although all guidelines agreed upon screening elderly men, some guidelines advocated a more selective screening regime based on smoking history. Selective screening instead of whole population screening could result in too many missed AAAs.[14] Nevertheless, a modeling study showed that selective screening of men aged 65 to 75 years who have ever smoked, as recommended by the USPSTF and ACC, did not severely affect the detection rate.[15] Using ever-smoking as a preselection tool, however, potentially has the disadvantage that ever-smoking not only acts on prevalence of AAA, but also on comorbidities.[16] The expected gain in life years by AAA screening could then be nullified by the raised competing risk due to other death causes. This was not taken into account for calculation of

Table III. Recommendations (n = 12) in guidelines (n = 7) on screening for abdominal aortic aneurysm

	USPSTF	*USPSTF*	*USPSTF*	*ACC*	*NSC*
AGREE rigor score	79%	79%	79%	63%	41%
Method to evaluate evidence	Meta-analysis; systematic review	Meta-analysis; systematic review	Meta-analysis; systematic review	Systematic review	Review of published systematic reviews, meta-analyses or guidelines; review
Method to formulate recommendations	Expert consensus	Expert consensus	Expert consensus	Expert consensus	Expert consensus
Consideration of costs	Systematic review of cost-effectiveness studies	Systematic review of cost-effectiveness studies	Systematic review of cost-effectiveness studies	Review of cost-effectiveness studies	Review of cost-effectiveness studies
Target group	Men aged 65-75 years who have ever smoked[a]	Men aged 65-75 years who have never smoked	Women	Men aged ≥60 years who are siblings or offspring of patients with AAAs; men aged 65-75 years who ever smoked[a]	Men aged 65 years
Strategy	Opportunistic screening/case-finding	Opportunistic screening/case-finding	Opportunistic screening/case-finding	Not reported	Population-based/mass screening
Recommendation	For	Not for not against	Against	For	For
Primary screening tests	Abdominal ultrasonography	Abdominal ultrasonography	Abdominal ultrasonography	Abdominal ultrasonography; physical examination	Abdominal ultrasonography
Intervention(s)	Endovascular repair or open surgical repair if AAA ≥5.5 cm	Endovascular repair or open surgical repair if AAA ≥5.5 cm	Endovascular repair or open surgical repair if AAA ≥5.5 cm	Surgical repair if infrarenal or juxtarenal AAAs ≥5.5 cm (repair is probably indicated in patients with suprarenal or type IV thoracoabdominal aortic aneurysms 5.5-6.0 cm); no intervention if infrarenal or juxtarenal AAAs 4.0-5.4 cm, but repair can be beneficial in patients with infrarenal or juxtarenal AAAs 5.0-5.4 cm	Referral to a vascular surgeon if AAA ≥5.5 cm
Surveillance	Not reported	Not reported	Not reported	Monitoring by ultrasound or computed tomographic scans every 6-12 months to detect expansion if infrarenal or juxtarenal AAAs 4.0-5.4 cm; monitoring by ultrasound examination every 2-3 years is reasonable if AAAs smaller than 4.0 cm in diameter	A follow-up will be arranged in 3 months if AAA 4.5-5.4 cm; a follow-up will be arranged in one year if AAA measures 3.0-4.4 cm
Screening intervals	One-time screening	One-time screening	One-time screening	One-time screening if not in above categories	One-time screening if not in above categories

	CSVS	*CSVS*	*CSVS*	*CSVS*
AGREE rigor score	40%	40%	40%	40%
Method to evaluate evidence	Review of published systematic reviews, meta-analyses or guidelines; review	Review of published systematic reviews, meta-analyses or guidelines; review	Review of published systematic reviews, meta-analyses or guidelines; review	Review of published systematic reviews, meta-analyses or guidelines; review
Method to formulate recommendations	Expert consensus	Expert consensus	Expert consensus	Expert consensus

Table III. Continued

	CSVS	*CSVS*	*CSVS*	*CSVS*
Consideration of costs	Review of cost-effectiveness studies and published systematic review of cost-effectiveness studies; cost-effectiveness analysis using projection of real cost data	Review of cost-effectiveness studies and published systematic review of cost-effectiveness studies; cost-effectiveness analysis using projection of real cost data	Review of cost-effectiveness studies and published systematic review of cost-effectiveness studies; cost-effectiveness analysis using projection of real cost data	Review of cost-effectiveness studies and published systematic review of cost-effectiveness studies; cost-effectiveness analysis using projection of real cost data
Target group	Men aged 65-75 years who are candidates for surgery and are willing to participate	Women aged >65 years and multiple RFs[b]	Women aged >65 years, adult population aged <65 years	Deducted from text: men aged >75 years and multiple RFs[b]
Strategy	Population-based/mass screening	Individualized investigation	Population-based/mass screening	Individualized investigation
Recommendation	For	Consider	Against	Consider
Primary screening tests	Abdominal ultrasonography	Abdominal ultrasonography	Abdominal ultrasonography	Abdominal ultrasonography
Intervention(s)	Deducted from text: surgical repair at ≥5.5 cm	Deducted from text: surgical repair at ≥5.5 cm	Deducted from text: surgical repair at ≥5.5 cm	Deducted from text: surgical repair at ≥5.5 cm
Surveillance	Policy not clearly described in guideline if AAA 4.4-5.4 cm; an annual abdominal ultrasound is an acceptable practice if AAA 3.0-4.4 cm. The true effective interval of rescreening is unknown for this group and it is likely that every 2 years is also acceptable for the smaller aneurysms	Policy not clearly described in guideline if AAA 4.4-5.4 cm; an annual abdominal ultrasound is an acceptable practice if AAA 3.0-4.4 cm. The true effective interval of rescreening is unknown for this group and it is likely that every 2 years is also acceptable for the smaller aneurysms	Policy not clearly described in guideline if AAA 4.4-5.4 cm; an annual abdominal ultrasound is an acceptable practice if AAA 3.0-4.4 cm. The true effective interval of rescreening is unknown for this group and it is likely that every 2 years is also acceptable for the smaller aneurysms	Policy not clearly described in guideline if AAA 4.4-5.4 cm; an annual abdominal ultrasound is an acceptable practice if AAA 3.0-4.4 cm. The true effective interval of rescreening is unknown for this group and it is likely that every 2 years is also acceptable for the smaller aneurysms
Screening intervals	No follow-up ultrasound is necessary before 3-5 years if aortic diameter <3.0 cm	No follow-up ultrasound is necessary before 3-5 years if aortic diameter <3.0 cm	No follow-up ultrasound is necessary before 3-5 years if aortic diameter <3.0 cm	No follow-up ultrasound is necessary before 3-5 years if aortic diameter <3.0 cm

	CCS	*SVS2*	*SVS1*
AGREE rigor score	38%	25%	17%
Method to evaluate evidence	Review	Review	Review
Method to formulate recommendations	Expert consensus	Expert consensus	Expert consensus
Consideration of costs	Review of cost-effectiveness studies	Review of cost-effectiveness studies, but not for AAA screening	Review of cost-effectiveness studies
Target group	Men aged 65-74 years; women aged 65 years with cardiovascular disease and positive family history of AAA; men aged ≥50 years and positive family history of AAA	Men aged ≥65 years; men aged ≥55 years and family history of AAA; women aged ≥65 years and family history of AAA or who have smoked	Men aged 60-85 years; women aged 60-85 years and cardiovascular risk factors (not specified); men and women aged >50 years and family history of AAA
Strategy	Population-based/mass screening	Population-based/mass screening	Population-based/mass screening
Recommendation	For	For	For
Primary screening tests	Abdominal ultrasonography	Abdominal ultrasonography	Abdominal ultrasonography
Intervention(s)	Referral to vascular surgeon if AAA ≥4.5 cm; surgical repair if men AAA >5.5 cm and if women AAA >5.0 cm; consider surgical repair if >1-cm growth in 1 year	Surgical repair if fusiform AAA ≥5.5 cm, saccular AAA,[c] young healthy patients, and especially women, with AAA 5.0-5.4 cm[c]; statins,[c] smoking cessation, ACE inhibitors/angiotensin receptor blockers[c] if surveillance (AAA 3.5-5.4 cm: not clearly described)	Referral to a vascular specialist if AAA >4.5 cm; surgical repair if >5.5 cm: policy not clearly described

Table III. Continued

	CCS	*SVS2*	*SVS1*
Surveillance	Repeat ultrasound every 6 months if AAA ≥4.5 cm; repeat ultrasound in 1 year if AAA 4.0-4.5 cm; repeat ultrasound in 2 year if AAA 3.5-3.9 cm; repeat ultrasound in 3 years if AAA 3.1-3.4 cm	Repeat ultrasound every 6 months if AAA 4.5-5.4 cm; repeat ultrasound in 1 year if AAA 3.5-4.4 cm; repeat ultrasound in 3 years if AAA 3.0-3.4 cm; repeat ultrasound in 5 years if AAA 2.6-2.9 cm	Repeat ultrasound every 6 months if AAA 4.0-4.5 cm; annual ultrasound examination if AAA 3.0-4.0 cm
Screening intervals	Repeat ultrasound follow-up in 3-5 years if aortic diameter <3.0 cm	One time screening if aortic diameter <2.6 cm and 65 years of age or older; not reported if aortic diameter <2.6 cm and age 55-65 years of age	One time screening if aortic diameter <3.0 cm

AAA, Abdominal aortic aneurysm; *ACC,* American College of Cardiology; *AGREE,* Appraisal of Guidelines Research and Evaluation; *CCS,* Canadian Cardiovascular Society; *CSVS,* Canadian Society for Vascular Surgery; *NSC,* National Screening Committee; *RFs,* risk factors; *SVS,* Society for Vascular Surgery; *USPSTF,* United States Preventive Services Task Force.

[a]Past or current smokers.

[b]Family history of AAA, smoking history, cerebrovascular disease, age >70 years old.

[c]Level of recommendation is weak, or benefit is uncertain.

the effectiveness of screening in the previously mentioned modeling study.[15] Other guideline groups recommended screening also in populations other than men aged 65 to 75 years if risk factors are present (eg, men aged 50 to 65 years, men older than 75 years, and women). For these populations, no clear evidence exists from experimental research for such a recommendation.[2] The reasoning is that the risk of having an AAA is markedly increased if risk factors are present. The odds ratio, however, generally needs to be high before a risk factor can be used for risk classification.[17] The odds ratios of single risk factors other than smoking are low for clinically relevant large AAAs.[14,18] Therefore, combining risk factors may be warranted to avoid unnecessary ultrasonographies and over-diagnosis of small AAAs for which the optimal treatment strategy is unclear.[19,20] On the other hand, when screening is recommended both at a younger age if risk factors are present and at an older age regardless of risk factors, such as in ACC, CCS, SVS1, and SVS2 guidelines, then a bias similar to lead time bias could occur. Only the AAAs that are vulnerable to rupture in the short term contribute to benefit of screening at an earlier age. Slowly growing AAAs would most likely be identified at the older screening age. The additional benefit of screening in middle-aged men and women at elevated risk can be explored by comparing the different screening strategies in a decision analysis.

The variation in recommendations for policy toward small asymptomatic AAAs is relevant because with screening approximately 90% of the detected AAAs will be smaller than 5.5 cm in diameter.[18,21] Two guideline groups (CCS and SVS2) suggested using smaller diameters for women and healthy young patients as the threshold for elective surgical repair. Two meta-analyses did not show an improvement of overall survival in the immediate surgical repair group as compared to those allocated to surveillance.[19,20] There was insufficient power to identify subgroups that might benefit from immediate repair. A recent published trial not included in the two meta-analyses also did not demonstrate a benefit on overall mortality after immediate endovascular repair, although this trial was stopped earlier because the event rate of the primary outcome measure of rupture or aneurysm-related death was too low to achieve sufficient statistical power.[22] According to the Cochrane review,[20] an individual patient-level data meta-analysis is under way to conduct subgroup analyses, which are expected to elucidate risks and benefits of each treatment option for aneurysm size subgroups, and age subgroups (for example ≤69 years, and >69 years). Multivariable prediction models of rupture and operative risk could also be used to identify those expected to benefit from immediate surgical repair. Multiple predictors determine rupture[23,24] and operative risk[25] and, therefore, variation in treatment effect is difficult to be captured by single patient characteristics. The use of prediction models for rupture risk and operative risks has the advantage that predictors that influence both, for example, female gender,[26] can be taken into account. A combination of a high-predicted rupture risk and a low-predicted operative risk is then likely to result in a survival benefit from immediate surgical repair. In the absence of experimental evidence for a survival benefit, the trade-off between immediate surgical repair and surveillance can be based on costs and quality of life by using decision modeling and cost-effectiveness analyses. In addition, the optimal screening and monitoring intervals can then be evaluated.

Although methods are available for integrating various recommendations into a single guideline, our purpose was not to create a new "universal" AAA screening guideline. However, a summarizing screening algorithm comprising the recommendations that the guidelines had in common and our suggestions for future research is depicted in Fig 2. The actual implementation of these recommendations in primary care is critical in optimizing patient outcomes. Methods to measure and improve the delivery and adher-

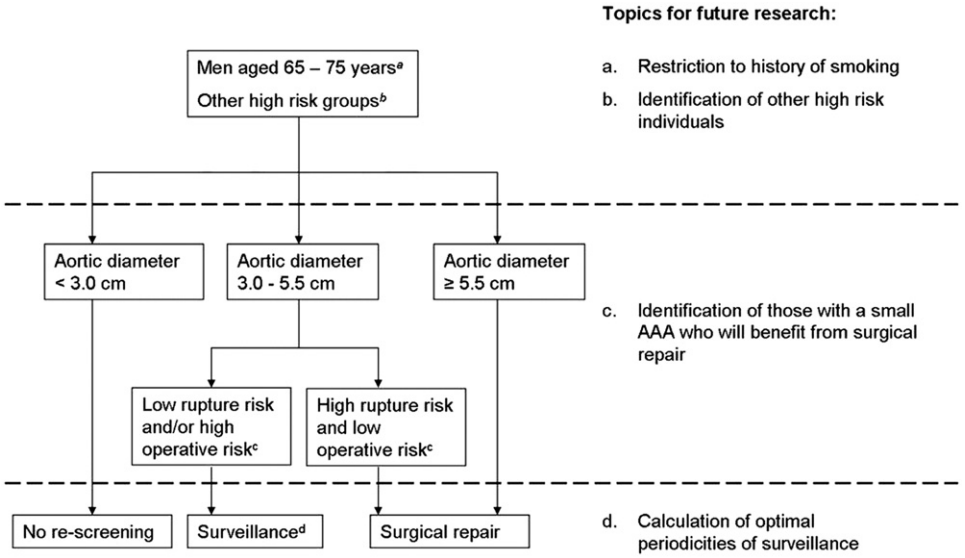

Fig 2. Summarizing screening algorithm and suggestions for future research. [a] Restricting this target group by adding a history of smoking requires the reduced life expectancy caused by smoking to be taken into consideration in decision analysis. [b] Multivariable modeling to predict abdominal aortic aneurysm (*AAA*) risk can be used to identify groups at high risk within men 50 to 65 years, men >75 years, and women >60 years. Variables to consider are age, gender, family history of AAA, history of smoking, history of cardiovascular disease, other cardiovascular risk factors.[14,18] The expected benefit of screening these groups can be calculated by decision analysis. [c] Prediction models considering variables such as age, gender, aortic diameter size, smoking status, blood pressure, history of cardiovascular disease, pulmonary and renal impairment can estimate these risks.[23-25] [d] The optimal intervals for periodic ultrasound scan surveillance can be calculated with cost-effectiveness analysis.

ence of AAA screening interventions are, for example, performance measures and decision support systems, but these are still topics for further research.[27,28]

CONCLUSIONS

Consensus exists across guidelines on one-time screening of elderly men to detect and treat AAAs ≥5.5 cm. For strategies toward other target groups, and management of small AAAs, prediction models and cost-effectiveness analyses are needed to provide guidance.

AUTHOR CONTRIBUTIONS

Conception and design: BF, ES, MH
Analysis and interpretation: BF, NG, MS, SS, MH
Data collection: BF, NG, EC, JV
Writing the article: BF, NG
Critical revision of the article: EC, JV, MS, SS, ES, MH
Final approval of the article: BF, NG, EC, JV, MS, SS, ES, MH
Statistical analysis: BF
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Overall responsibility: MH

REFERENCES

1. Heron MP, Hoyert DL, Murphy SL, Xu JQ, Kochanek KD, Tejada-Vera B. Deaths: final data for 2006. National vital statistics reports; vol 57 no 14. Hyattsville, MD: National Center for Health Statistics; 2009.
2. Cosford PA, Leng GC. Screening for abdominal aortic aneurysm. Cochrane Database Syst Rev 2007;18:CD002945.
3. Medicare website. Abdominal Aortic Aneurysm (AAA) Screening. 2010 http://www.medicare.gov. Accessed April 19, 2010.
4. Koelemay MJ, Henebiens M, Vahl AC; Nederlandse Vereniging voor Vaatchirugie. [Guideline 'Diagnosis and treatment of abdominal aortic aneurysm']. [Article in Dutch] Ned Tijdschr Geneeskd 2009;153: A572.
5. Feder G, Eccles M, Grol R, Griffiths C, Grimshaw J. Clinical guidelines: using clinical guidelines. BMJ 1999;318:728-30.
6. Sniderman AD, Furberg CD. Why guideline-making requires reform. JAMA 2009;301:429-31.
7. Oxman AD, Glasziou P, Williams JW Jr. What should clinicians do when faced with conflicting recommendations? BMJ 2008;337: a2530.
8. Ferket BS, Colkesen EB, Visser JJ, Spronk S, Kraaijenhagen RA, Steyerberg EW, et al. Systematic review of guidelines on cardiovascular risk assessment: which recommendations should clinicians follow for a cardiovascular health check? Arch Intern Med 2010;170:27-40.
9. The Agree Collaboration. Development and validation of an international appraisal instrument for assessing the quality of clinical practice guidelines: the AGREE project. Qual Saf Health Care 2003;12:18-23.
10. Pande RL, Beckman JA. Abdominal aortic aneurysm: populations at risk and how to screen. J Vasc Interv Radiol 2008;19(6 Suppl):S2-8.
11. National Guideline Clearinghouse Website; 2010 http://www.guideline.gov. Accessed April 19, 2010.
12. World Health Organization. World health statistics 2010. Geneva: World Health Organization; 2010.
13. Manuel DG, Kwong K, Tanuseputro P, Lim J, Mustard CA, Anderson GM, et al. Effectiveness and efficiency of different guidelines on statin treatment for preventing deaths from coronary heart disease: modelling study. BMJ 2006;332:1419.
14. Spencer CA, Jamrozik K, Norman PE, Lawrence-Brown MM. The potential for a selective screening strategy for abdominal aortic aneurysm. J Med Screen 2000;7:209-11.

15. Fleming C, Whitlock EP, Beil TL, Lederle FA. Screening for abdominal aortic aneurysm: a best-evidence systematic review for the U.S. Preventive Services Task Force. Ann Intern Med 2005;142:203-11.
16. Lederle FA, Nelson DB, Joseph AM. Smokers' relative risk for aortic aneurysm compared with other smoking-related diseases: a systematic review. J Vasc Surg 2003;38:329-34.
17. Wald NJ, Hackshaw AK, Frost CD. When can a risk factor be used as a worthwhile screening test? BMJ 1999;319:1562-5.
18. Lederle FA, Johnson GR, Wilson SE, Chute EP, Littooy FN, Bandyk D, et al. Prevalence and associations of abdominal aortic aneurysm detected through screening. Aneurysm Detection and Management (ADAM) Veterans Affairs Cooperative Study Group. Ann Intern Med 1997;126:441-9.
19. Lederle FA, Kane RL, MacDonald R, Wilt TJ. Systematic review: repair of unruptured abdominal aortic aneurysm. Ann Intern Med 2007;146: 735-41.
20. Ballard DJ, Filardo G, Fowkes G, Powell JT. Surgery for small asymptomatic abdominal aortic aneurysms. Cochrane Database Syst Rev 2008;8:CD001835.
21. Ashton HA, Buxton MJ, Day NE, Kim LG, Marteau TM, Scott RA, et al. The Multicentre Aneurysm Screening Study (MASS) into the effect of abdominal aortic aneurysm screening on mortality in men: a randomised controlled trial. Lancet 2002;360:1531-9.
22. Ouriel K, Clair DG, Kent KC, Zarins CK; Positive Impact of Endovascular Options for treating Aneurysms Early (PIVOTAL) Investigators. Endovascular repair compared with surveillance for patients with small abdominal aortic aneurysms. J Vasc Surg 2010;51:1081-7.
23. Brown PM, Zelt DT, Sobolev B. The risk of rupture in untreated aneurysms: the impact of size, gender, and expansion rate. J Vasc Surg 2003;37:280-4.
24. Brown LC, Powell JT. Risk factors for aneurysm rupture in patients kept under ultrasound surveillance. UK Small Aneurysm Trial Participants. Ann Surg 1999;230:289-96; discussion 296-7.
25. Steyerberg EW, Kievit J, de Mol Van Otterloo JC, van Bockel JH, Eijkemans MJ, Habbema JD. Perioperative mortality of elective abdominal aortic aneurysm surgery. A clinical prediction rule based on literature and individual patient data. Arch Intern Med 1995; 155:1998-2004.
26. Grootenboer N, van Sambeek MR, Arends LR, Hendriks JM, Hunink MG, Bosch JL. Systematic review and meta-analysis of sex differences in outcome after intervention for abdominal aortic aneurysm. Br J Surg 2010;97:1169-79.
27. Fonarow GC, Abraham WT, Albert NM, Stough WG, Gheorghiade M, Greenberg BH, et al. Association between performance measures and clinical outcomes for patients hospitalized with heart failure. JAMA 2007;297:61-70.
28. Wells S, Furness S, Rafter N, Horn E, Whittaker R, Stewart A, et al. Integrated electronic decision support increases cardiovascular disease risk assessment four fold in routine primary care practice. Eur J Cardiovasc Prev Rehabil 2008;15:173-8.
29. U.S. Preventive Services Task Force. Screening for abdominal aortic aneurysm: recommendation statement. Ann Intern Med 2005;142: 198-202.
30. Hirsch AT, Haskal ZJ, Hertzer NR, Bakal CW, Creager MA, Halperin JL, et al. ACC/AHA 2005 practice Guidelines for the management of patients with peripheral arterial disease (lower extremity, renal, mesenteric, and abdominal aortic): a collaborative report from the American Association for Vascular Surgery/Society for Vascular Surgery, Society for Cardiovascular Angiography and Interventions, Society for Vascular Medicine and Biology, Society of Interventional Radiology, and the ACC/AHA Task Force on Practice Guidelines (Writing Committee to Develop Guidelines for the management of patients with peripheral Arterial Disease): endorsed by the American Association of Cardiovascular and Pulmonary Rehabilitation; National Heart, Lung, and Blood Institute; Society for Vascular Nursing; TransAtlantic Inter-Society Consensus and Vascular Disease Foundation. Circulation 2006;113: e463-654.
31. Abdominal aortic aneurysm screening, in UK National Screening Committee Website; 2007. Accessed April 19, 2010.
32. Mastracci TM, Cina CS; Canadian Society for Vascular Surgery. Screening for abdominal aortic aneurysm in Canada: review and position statement of the Canadian Society for Vascular Surgery. J Vasc Surg 2007;45:1268-76.
33. Abramson BL, Huckell V, Anand S, Forbes T, Gupta A, Harris K, et al. Canadian Cardiovascular Society Consensus Conference: peripheral arterial disease − executive summary. Can J Cardiol 2005;21:997-1006.
34. Chaikof EL, Brewster DC, Dalman RL, Makaroun MS, Illig KA, Sicard GA, et al. The care of patients with an abdominal aortic aneurysm: the Society for Vascular Surgery practice guidelines. J Vasc Surg 2009;50(4 Suppl):S2-49.
35. Kent KC, Zwolak RM, Jaff MR, Hollenbeck ST, Thompson RW, Schermerhorn ML, et al. Screening for abdominal aortic aneurysm: a consensus statement. J Vasc Surg 2004;39:267-9.

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Additional material for this article may be found online at www.jvascsurg.org.

INVITED COMMENTARY

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Clinical practice guidelines for the care of a patient with an abdominal aortic aneurysm (AAA) have been published from a variety of sources, including disparate specialty groups and government-sponsored organizations. Although each published guideline is the end result of a comprehensive review of the available clinical evidence, recommendations are often not uniform. In large measure, this reflects a reality in which the evidence for many clinical decisions is lacking or of limited quality and simple rules for weighing the validity of any individual randomized controlled trial or observational study do not exist. As such, expert panels are called upon to assess the available evidence and provide consensus recommendations. Cognitive biases and differences in values are inherent in any set of recommendations, particularly in efforts directed at averting loss of life, weighing the risks and benefits of intervention, and optimizing cost-effective care. Limiting bias, improving the quality of decisions, and enhancing forecasts in a world where information is incomplete is an area of active investigation. In one important effort to address the need for explicit statements of uncertainty in clinical practice guidelines, the Grading of Recommendations, Assessment, Development and Evaluation (GRADE) system was introduced to note the strength of any given recommendation, as well as the quality of the available evidence. Although these and other tools have some value in determining whether a practitioner should adopt a specific guideline, the burden to carefully evaluate both the stated rationale and the related content that forms the basis for the recommendation remains on the clinician. For many areas, particularly where the data may be incomplete, this requires a measure of effort and an appreciation of the unique context of one's practice.

Recently, academicians from the field of public health and epidemiology, largely from the UK, The Netherlands, and Canada have offered to ease the cognitive burden of primary care providers and government policy makers when presented with varying practice guidelines through the introduction of a new instrument, the Appraisal of Guidelines, REsearch and Evaluation (AGREE) tool. This tool has been designed to assess the process of guideline development and how well this process is reported, as the primary means of appraising the quality of clinical practice guidelines. The

Appendix (online only). Exact Search Strategies

WEBSITES SEARCHED 2003 TO February 26, 2010:

- American Academy of Family Physicians, USA (http://www.aafp.org/online/en/home.html)
- American Association of Clinical Endocrinologists, USA (http://www.aace.com/pub/guidelines/)
- American College of Cardiology, USA (http://www.acc.org/)
- American College of Physicians, USA (http://www.acponline.org/)
- American College for Preventive Medicine, USA (http://www.acpm.org/)
- (ADA) American Diabetes Association and http://www.diabetes,org/home.jsp
- American Geriatrics Society (AGS), USA (http://www.americangeriatrics.org/)
- American Heart Association (AHA), USA (http://www.americanheart.org/)
- American Medical Association (AMA), USA (http://www.ama-assn.org/)
- American Stroke Association, USA (http://www.strokeassociation.org/)
- Australian Diabetes Society (ADS), AUS (http://www.racp.edu.au/ads/research_case.htm)
- Australian Medical Association (AMA), AUS (http://www.ama.com.au/web.nsf/)
- British Cardiac Society (BCS), UK (http://www.bcs.com/pages/default.asp)
- British Hypertension Society (BHS), UK (http://www.bhsoc.org/default.stm)
- Canadian Hypertension Society (CHS), CAN (http://www.hypertension.ca/)
- Canadian Task Force on Preventive Health Care (CTFPHC), CAN (http://www.ctfphc.org/)
- Cardiac Society of Australia, New Zealand (CSANZ), AUS (http://www.csanz.edu.au/)
- Centers for Disease Control and Prevention (CDC), USA (http://www.cdc.gov/)
- Department of Health (DOH), UK (http://www.dh.gov.uk/en/index.htm)
- European Society of Cardiology (http://www.escardio.org/)
- European Society of Hypertension (http://www.eshonline.org/)
- International Diabetes Federation (IDF) (http://www.idf.org/)
- International Society of Hypertension (http://www.ish-world.com/)
- National Health and Medical Research Council (NHMRC), AUS (http://www.nhmrc.gov.au/index.htm)
- National Heart Foundation, AUS (http://www.heartfoundation.org.au/index.htm)
- National Heart Lung and Blood Institute, USA and http://www.nhlbi, http://nih.gov/guidelines/index.htm
- National Institute for Health and Clinical Excellence (NICE), UK (http://www.nice.org.uk/)
- New Zealand Guidelines Group, NZ (http://www.nzgg.org.nz/index.cfm?)
- Royal College of General Practitioners (RCGP), UK (http://www.rcgp.org.uk/default.aspx)
- Scottish Intercollegiate Guidelines Network (SIGN), UK (http://www.sign.ac.uk/)
- U.S. Preventive Services Task Force (USPSTF), USA (http://www.ahrq.gov/clinic/uspstfix.htm)
- World Heart Federation and http://www.world-heart-federation.org/
- World Health Organization, (http://www.who.int/en/)
- World Hypertension League, (http://www.worldhypertensionleague.org/Pages/Home.aspx)

NATIONAL GUIDELINE CLEARINGHOUSE

DISEASE/CONDITION

cardiovasc* OR, coronary OR, heart OR, cerebrovasc* OR, arteri* OR, peripher* OR, vascular OR, stroke* OR, CVA* OR, aneurysm OR, atherosclerosis OR arteriosclerosis OR hypertension OR hyperlipid* OR dyslipid* OR cholesterol OR diabetes OR (metabolic syndrome)

GUIDELINE CATEGORIES: ***Prevention, risk assessment, screening***

AGE RANGE: ***Adult (19-44 years), Aged (65-79 years), Aged, 80 and over, Middle Age (45-64 years)***

PUBLICATION DATE(S): ***2010, 2009, 2008, 2007, 2006, 2005, 2004, 2003***

SORT ORDER: ***by publication date***

NATIONAL LIBRARY FOR HEALTH

SEARCH: (cardiovasc* OR coronary OR heart OR cerebrovasc* OR arteri* OR peripher* OR vascular OR stroke* OR CVA* OR aneurysm OR atherosclerosis OR arteriosclerosis OR hypertension OR hyperlipid* OR dyslipid* OR cholesterol OR diabetes OR metabolic syndrome) AND (prevent* OR risk OR screen* OR early OR periodic examination* OR periodic evaluation* OR periodic check*)

SORT BY: ***publication date***

CANADIAN MEDICAL ASSOCIATION INFOBASE

1. Vascular OR coronary OR myocardial
2. Arterial OR peripheral OR aneurysm
3. Heart OR stroke OR CVA

4. Arteriosclerosis OR atherosclerosis
5. Hypertension OR lipid OR cholesterol
6. Diabetes OR metabolic syndrome

TARGET POPULATION: ***adult, elderly, general***
DOMAIN: ***diagnosis, preventive***
LANGUAGE: ***English***
PUBLISHED: ***from: 2003/01/01 to 2010/01/01***
DISPLAY: ***50 results***
SORT BY: ***date***

G-I-N INTERNATIONAL GUIDELINE LIBRARY (http://g-i-n.net)
DISEASE/CONDITION: ***cardiovascular disorders (MeSH C14), diabetes mellitus (MeSH C19.246), glucose metabolism disorders (MeSH C18.452.394), hyperlipidemia (MeSH C18.452.494)***
DATE OF PUBLICATION: (RANGE): ***from: 1 January 2003 to: 26 February 2010***
LANGUAGES: ***English***
PUBLICATION SCOPE: ***screening, prevention***
PUBLICATION STATUS: ***published***
PUBLICATION TYPE: ***guideline***
COUNTRY(S) THAT THE PUBLICATION APPLIES TO: ***Australia, Canada, international, New Zealand, United Kingdom, United States***

MEDLINE (OVID)

1. cardiovascular diseases
2. exp coronary disease
3. exp cerebrovascular disorders
4. exp aortic aneurysm
5. peripheral vascular diseases
6. heart failure
7. exp arteriosclerosis
8. (cardiovascular adj3 disease$).tw.
9. (coronary adj3 disease$).tw.
10. heart disease$.tw.
11. (stroke$ or cerebrovasc$ or cva$).tw.
12. (abort$ adj5 aneurysm).tw.
13. (abdominal adj5 aneurysm).tw.
14. (thoracoabdominal adj5 aneurysm).tw.
15. (arteri$ adj3 (occlusi$ or stenosis)).tw.
16. (peripher$ adj5 (occlusi$ or arteri$ or vascular)).tw.
17. heart failure.tw.
18. atherosclerosis.tw.
19. arteriosclerosis.tw.
20. hypertension/
21. exp hyperlipidemias/
22. exp diabetes mellitus/
23. hypertension.tw.
24. hyperlipid?emia.tw.
25. dyslipid?emia.tw.
26. cholesterol.tw.
27. diabetes.tw.
28. metabolic syndrome.tw.
29. or/1 to 28
30. exp cardiovascular diseases/pc
31. exp primary prevention/
32. preventive medicine/
33. exp risk assessment/
34. exp mass screening/
35. early diagnosis/

36. prevent$.tw.
37. (risk adj3 (reduc$ or manage$ or managing or intervent$ or assess$)).tw.
38. early adj3 interven$.tw.
39. early adj3 detect$.tw.
40. early adj3 diagnos$.tw.
41. periodic adj3 (examination$ or evaluat$ or check$).tw.
42. screen$.tw.
43. or/30 to 42
44. guideline.pt.
45. practice guideline.pt.
46. guideline$. ti.
47. guidance$. ti.
48. (position paper or position stand). ti.
49. statement$. ti.
50. recommendation$. ti.
51. consensus development conference.pt.
52. consensus. ti.
53. practice parameter$. ti.
54. standards. ti.
55. or/44 to 54
56. 29 and 43 and 55
57. animals/
58. human/
59. 57 not (57 and 58)
60. comment.pt.
61. letter.pt.
62. editorial.pt.
63. or/59 to 62
64. 56 not 63
65. limit 64 to (english language and yr = "2003-2010")

CINAHL (EBSCOhost)

(MH "Cardiovascular Diseases") OR (MH "Aortic Aneurysm+") OR (MH "Myocardial Ischemia+") OR (MH "Arteriosclerosis+") OR (MH "Cerebrovascular Disorders+") OR (MH "Peripheral Vascular Diseases") OR (MH "Heart Failure, Congestive+") OR (TX (cardiovascular N3 disease*) OR (TX (coronary N3 disease*) OR (TX heart disease*) OR (TX (stroke* or cerebrovasc* or cva*) OR (TX [abort* N5 aneurysm]) OR (TX [abdominal N5 aneurysm]) OR (TX [thoracoabdominal N5 aneurysm]) OR (TX [arteri* N3 occlusi*]) OR (TX [arteri* N3 stenosis]) OR (TX [peripher* N5 occlusi*]) OR (TX [peripher* N5 arteri*]) OR (TX [peripher* N5 vascular]) OR (TX heart failure) OR (TX atherosclerosis) OR (TX arteriosclerosis) OR (MH "Hypertension") OR (MH "Hyperlipidemia") OR (MH "Diabetes Mellitus") OR (TX hypertension) OR (TX hyperlipid? emia) OR (TX dyslipid? emia) OR (TX cholesterol) OR (TX diabetes) OR (TX metabolic syndrome)

And

(MH "Cardiovascular Diseases/PC") OR (MH "Preventive Health Care") OR (MH "Health Screening") OR (MH "Risk Assessment") OR (MH "Cardiovascular Risk Factors") OR (MH "Early Intervention") OR (TX prevent*) OR (TX [risk N3 reduc*]) OR (TX [risk N3 manage*]) OR (TX [risk N3 managing]) OR (TX [risk N3 intervent*]) OR (TX [risk N3 assess*]) OR (TX early N3 interven*) OR (TX early N3 detect*) OR (TX early N3 diagnos*) OR (TX screen*) OR (TX [periodic N3 examination*]) OR (TX [periodic N3 evaluat*]) OR (TX [periodic N3 check*])

And

(PT Practice Guidelines) OR (TI guideline*) OR (TI guidance*) OR (TI (position paper or position stand)) OR (TI statement*) OR (TI recommendation*) OR (TI consensus) OR (TI practice parameter*) OR (TI standards)

Not

(PT commentary) OR (PT letter) OR (PT editorial)

Limit results to English language and publication year 2003-2010

Table I (online only). AGREE instrument rigor of development domain results

Guidelines	*Reviewer*	*Methods to search for evidence*	*Criteria for selecting the evidence*	*Methods for formulating the recommendations*	*Health benefits, side effects and risks*	*Supporting evidence*	*Procedures for external expert review*	*Update process*	*Domain score, %*[a]
USPSTF	A	4	4	3	4	4	3	4	90.5
	B	4	3	4	3	4	3	2	76.2
	C	4	3	2	2	3	4	4	71.4
ACC	A	3	1	2	4	4	3	4	66.7
	B	3	3	3	3	3	3	3	66.7
	C	1	1	3	3	3	4	4	57.1
NSC	A	4	1	1	1	4	1	3	38.1
	B	2	2	2	3	1	2	2	33.3
	C	4	4	1	1	4	3	1	52.4
CSVS	A	1	1	1	4	4	1	3	38.1
	B	2	1	2	2	3	2	2	33.3
	C	1	1	2	4	3	3	3	47.6
CCS	A	1	1	1	4	4	2	1	33.3
	B	1	1	2	2	3	2	2	28.6
	C	2	2	3	3	4	2	2	52.4
SVS2	A	1	1	1	3	3	1	1	19.0
	B	1	1	2	2	2	1	1	23.8
	C	1	1	2	2	2	2	2	33.3
SVS1	A	1	1	1	3	3	1	1	19.0
	B	1	1	1	2	3	1	1	14.3
	C	1	1	1	3	3	1	1	19.0

AGREE, Appraisal of Guidelines Research and Evaluation; *USPSTF,* United States Preventive Services Task Force; *ACC,* American College of Cardiology; *NSC,* National Screening Committee; *CSVS,* Canadian Society for Vascular surgery; CCS, Canadian Cardiovascular Society; SVS, Society for Vascular Surgery.
4 = strongly agree; 3 = agree; 2 = disagree; 1 = strongly disagree.
[a]Domain scores are calculated as (Σ item scores −7)/(28-7).