Highlights

Lifestyle advice and interventions for cardiovascular risk reduction: A systematic review of guidelines

1. Guidelines are agreed on the importance of lifestyle advice and interventions for cardiovascular risk reduction.

2. Majority of guidelines for cardiovascular risk reduction through lifestyle advice and intervention show good rigor of development.

3. Guidelines are consistent and there is a consensus on the advice given for smoking cessation, physical activity levels and diet. Dietary recommendations emphasise limiting saturated fat and salt intake, avoiding transaturated-fat and sugar, particularly sugar-sweetened beverages. They encourage diets rich in fruit, vegetables, fish and wholegrains.

4. Guidelines differ on recommendations for specific dietary patterns and levels of alcohol consumption.

5. Lifestyle advice and recommendations should be actively integrated into cardiovascular risk reduction programmes with the aim of improving clinical outcomes.

Title Page

Lifestyle advice and interventions for cardiovascular risk reduction: A systematic review of guidelines

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Key words

Lifestyle advice; lifestyle intervention; cardiovascular risk reduction; systematic review; guidelines.

Manuscript word count: 3934

Abstract

Background:

Lifestyle factors are important in preventing cardiovascular disease (CVD) development. We aimed to systematically review similarities and differences between current guidelines on primary prevention of CVD and their recommendations on lifestyle advice or intervention, in order to guide primary prevention programs.

Methods:

Publications in MEDLINE, CINAHL over 7 years since May 3, 2009 were identified. G-I-N International Guideline Library, National Guidelines Clearinghouse, National Library for Health Guideline finder, Canadian Medical Association InfoBase were searched. On the February 8, 2017, we updated the search from Web sites of organizations responsible for guidelines development.

Study Selection: 2 reviewers screened the titles and abstracts to identify Guidelines from Western countries containing recommendations for lifestyle advice and interventions in primary prevention of CVD.

Data Extraction: 2 reviewers independently assessed rigor of guideline development using the AGREEII instrument, and one extracted the recommendations.

Results

Of the 7 guidelines identified, 6 showed good rigor of development (range 45-86%). The guidelines were consistent in recommendations for smoking cessation, limiting saturated fat and salt intake, avoiding transaturated-fat and sugar, with particular emphasis on sugar-sweetened beverages. Guidelines generally agreed on recommendations for physical activity

levels and diets rich in fruit, vegetables, fish and wholegrains. Guidelines differed on recommendations for specific dietary patterns and alcohol consumption.

Conclusions:

Current guidelines are agreed on the importance of lifestyle in the prevention of CVD with consensus on most factors including physical activity, smoking cessation and diet, which should be actively integrated in cardiovascular risk reduction programs aiming to improve clinical outcomes. Recommendations covering areas such as psychological factors and sleep are currently limited and should be considered for future prevention guidelines.

Abstract word count: 269

Abbreviations

AGREE = Appraisal for Guidelines and Research Evaluation

ASCVD = Atherosclerotic cardiovascular disease

CKD = Chronic kidney disease

CVD = cardiovascular disease

1.1 Introduction

Lifestyle factors such as smoking, high calorie diets, saturated fats, high salt intake, low intake of fruit and vegetables, psychological factors and being sedentary are associated with cardiovascular disease (CVD) development[1]. It is estimated that about 60% of the CVD mortality decline over the 2 decades since the 1980's was attributable to a reduction in major CVD risk factors, primarily smoking. The remaining reduction was attributed to pharmacotherapy[2,3]. A more recent analysis confirms that improvements in a number of modifiable risk factors including smoking, cholesterol and blood pressure can explain much of the reduction in coronary heart disease mortality[4].

Lifestyle interventions play an important role in prevention of a number of CVD outcomes and its promotion has been emphasized in many prevention guidelines [5-8]. Despite this, most people in many Western countries do not meet the recommendations for diet and physical activity despite known health benefits including future CVD risk reduction[9]. Prevention of CVD is a rapidly evolving field and the potential for long term health care benefits from timely, personalized risk factor assessment and intervention has been recognized, highlighted by both human and economic arguments of CVD prevention[5,10,11]. Recommended prevention strategies now predominantly use risk stratification based on absolute 10-year CVD risk prediction to guide management[12].

A systematic review from the US preventive Services Task Force concluded that counselling for diet and physical activity in persons with risk factors for CVD resulted in consistent improvements across various intermediate health outcomes up to 2 years follow up[9]. The recent American College of Cardiology (ACC) / American Heart Association (AHA) guideline on the treatment of blood cholesterol to reduce atherosclerotic cardiovascular

disease (ASCVD) risk in adults emphasized that lifestyle modification remains a critical component of health promotion and ASCVD risk reduction, both prior to and in concert with the use of cholesterol lowering drug therapies[13]. Healthy diet or lifestyle modifications were recommended as background therapy in published randomized controlled trials (RCTs) of cholesterol-lowering drug therapy[14].

The aim of this systematic review was to identify similarities and differences among recommendations on lifestyle advice and interventions from recent guidelines addressing total CVD risk in the context of primary prevention. By a critical appraisal, we sought to guide clinicians and other health care professionals that are involved in primary prevention programs and counselling.

1.2 Methods

1.2.1 Data sources and guideline selection

We conducted a systematic review, using our previously published search strategy, for guidelines containing recommendations for lifestyle interventions for a primary prevention population[12] (see supplementary text for search strategy). We looked at guidelines that dealt with total cardiovascular risk rather than specific to a single condition such as hypertension or hypercholesterolemia alone.

We performed a systematic literature search to identify appropriate guidelines[12]. We searched for published guidelines using MEDLINE and CINAHL between May 3, 2009 and June 30, 2016. We supplemented this by using guidelines specific databases; 1) The National Guideline Clearinghouse (US), 2) National Library for Health on Guidelines Finder (UK), 3) Canadian Medical Association InfoBase (Canada), and 4) G-I-N International Guideline

Library (http;/www.g-i-n.net). A search of a number of websites of guidelines development organizations was also carried out and updated on February 8, 2017 (see supplementary Table A1 for list). Searches were limited to national guidelines from the United States, Canada, the United Kingdom, Australia and New Zealand and other international guidelines written in English.

1.2.2 Study Selection:

References meeting the Institute of Medicine definition of guidelines were included. Guidelines were excluded if they did not contain recommendations for the apparently healthy adult population, were entirely focused on a single condition (e.g. hypertension), were not produced on behalf of a professional organization or were not relevant to Western countries. Only guidelines produced from May 2009 with an Appraisal for Guidelines and Research Evaluation (AGREE) II rigor of development score over 40% were included to ensure appropriateness and relevance of the selected guidelines.

1.2.3 Data Extraction and Quality Assessment

Titles and abstracts were assessed by 2 independent reviewers (MK and VB). Articles were excluded if both reviewers agreed they were not eligible. Discrepancies between reviewers were resolved by consensus. Both reviewers performed the final selection for full data extraction.

We utilized the 23-item AGREE II instrument to determine the rigor of development for each of the guidelines[15]. Two reviewers (MK and CVW) independently rated the 8 items on a 7-point Likert scale in accordance with the instructions of the AGREE II committee with particular emphasis on the rigor of development domain. Average rigor scores were obtained

by expressing the sum of the individual scores as a percentage of the maximum possible score. Reproducibility of the 2 reviewers scores was very good, with an interclass correlation coefficient of 0.80 (comparing the agreement of the total rigor of development score obtained by the two reviewers, see supplementary Table A2). Guidelines were ranked according to their scores. Editorial independence from the funding body, external funding and disclosure of relationships with industry were also assessed.

1.2.4 Data Synthesis and Analysis

One reviewer (MK) extracted all the relevant recommendations from the guidelines that had an AGREE II score of greater than 40%. General lifestyle advice was the main emphasis of the data extraction. A recommendation matrix was produced. The matrix was divided into (1) a methods section, (2) target group and (3) recommended lifestyle advice.

1.3 Results

Our search retrieved 3560, of which 187 were potentially eligible (Figure 1). On the basis of the abstract we excluded 133 articles. After we reviewed the full report 47 more were excluded. We included 7 guidelines on total lifestyle advice or intervention for total cardiovascular risk reduction. Table 1 summarizes the selected guidelines with rigor scores and conflicts of interest.

Six of the 7 guidelines had a rigor score of 40% or greater. The guidelines originated from the USA (2 guidelines), UK (2), Australia (1) and Europe (1). Table 2 to 7 summarise the guideline recommendations in a matrix along with levels of evidence stated in the guidelines where this was available. Table 2 provides a summary of the 6 guidelines with a rigor score of over 40%. We then provide a summary of the specific recommendations on smoking (Table 3), diet (Table 4), weight (Table 5), physical activity (Table 6) and psychological factors and

sleep (Table 7). Supplementary table A3 provides an abbreviated version of the recommendations included in the main tables.

1.3.1 Areas of agreement

Most of the guidelines identified high-risk categories of people that should receive intensive lifestyle counselling. This commonly included presence of

1. Diabetes - although no consensus exists as to which group of diabetics (examples include Type 1 diabetes or diabetes with an additional risk factor such as age>60, or microalbuminuria)
2. Chronic kidney disease (CKD) – the most common estimated glomerular filtration rate cut-off was < 60mls/min/1.73m2 with one guideline using <45 mls/min/1.73m2 (NVDP).
3. An elevated calculated CVD risk score – although there was no consensus on the risk threshold, primarily due to differences in risk scores used and the end points that the risk scores use in their prediction.

1.3.1.1 Smoking

There was a consensus regarding the importance of smoking cessation advice. Only the ACC/AHA did not have recommendations on smoking as it was not in the remit of the guidelines specific clinical questions. Offering additional assistance, including referral to counselling services and pharmacotherapy, were also recommended. Most of the guidelines also specifically mention avoidance of second hand smoke (also termed as environmental/ passive smoking).

1.3.1.2 Physical activity

All guidelines agree on the importance of physical activity in CVD risk reduction. All agree on a minimum of 150 minutes per week of at least moderate activity. There is also general consensus that if vigorous activity is undertaken then the amount required is less (NVDP only mentions suggestions for moderate activity). They recommend 75 minutes of vigorous physical activity (half of the moderate requirement). Many of the guidelines also recommend that the physical activity takes place in bouts of 10 minutes or more. (ESC, ACC/AHA, CDC/AHA and JBS3). The general recommendation is to spread the activity over the course of the week. The 2 UK based guidelines (NICE and JBS3) and the CDC/AHA also mention that twice per week the activity should be of the form that also provides muscle strengthening. The 2 UK based guidelines also recommend referral to programs where support or supervision is provided for those that may need support to change their lifestyle; this is particularly stated for people who are considered to be at high risk of developing CVD. The JBS3 also recommends community-based exercise initiatives for high-risk patients.

1.3.1.3 Weight

There is a general consensus that people who are overweight (most commonly defined as BMI > 25 kg/m2) or obese (most commonly defined as BMI > 30 kg/m2) should be offered advice and support to work towards achieving and maintaining a healthy weight. Only the JBS3 has reservations on weight reduction recommendations and mentions that there is limited evidence that weight loss in itself directly reduces CVD risk. It mentions that the effects of weight loss such as blood pressure (BP) reduction may have CVD reducing impact. It does, however, recommend weight loss in people with obstructive sleep apnoea/hypopnea syndrome who are overweight as a means to CVD risk reduction.

1.3.1.4 Stress and psychological factors

This is only discussed in 2 out of the 6 guidelines (ESC and NVDP). They both recommend the assessment for depression and psychological factors. The NVDP states that risk assessment using the Framingham Risk score may be underestimated in those with depression. Only the ESC makes recommendation on the use of stress management and counselling on psychological risk factors as part of a multimodal intervention in those at very high CVD.

1.3.1.5 Dietary factors

There was a consensus between the guidelines on the importance of dietary advice being a cornerstone of CVD prevention. Lifestyle factors mentioned in guidelines specifically for lowering of BP other than weight control, increased physical activity include moderation of alcohol, sodium restriction, increased consumption of fruit and vegetables and low fat dairy products (ESC, ACC/AHA, CDC/AHA and JBS3). The ACC/AHA guideline also mentions dietary patterns such as the DASH diet, the USDA food pattern or the AHA diet.

1.3.1.5.1 *Saturated fats*

There was a common recommendation on the lowering of intake of saturated fats and trans-saturated fats. Three out of the six guidelines specify a recommended percentage for intake with recommended levels below 7% (NICE) or 10% (ESC, JBS3). The other three guidelines suggest limiting intake but without specifying cut-offs.

1.3.1.5.2 *Fruit and vegetables*

All recommendations state that diets should be rich in fruit and vegetables. Only the ESC makes a distinction in the proportion of intake of fruit vs. vegetables. The UK guidelines

recommend five portions of fruits or vegetables (JBS3) or more (NICE) per day. The ESC recommendations refer to 'servings' rather than portions, with between 2-3 servings of both fruit and vegetables per day (equivalent to about 200g of each). The remaining guidelines make general recommendations on a diet rich in fruit and vegetables without specifying cut-offs.

1.3.1.5.3 Fish

All guidelines emphasize the recommendation for intake of fish in the diet. Four of the guidelines recommend at least two portions per week with at least one of them being of the oily variety. The remaining guidelines (ACC/AHA and NVDP) generally recommend a diet emphasizing the intake of fish without stating any cut-offs.

1.3.1.5.4 Meat

The recommendations regarding the consumption of meat products is less prescriptive. There is a general recommendation for predominantly consuming white meat, such as poultry. Two of the guidelines specifically emphasize poultry consumption (NVDP and ACC/AHA) and lean meat (NVDP). The JBS3 specifically mentions the avoidance of processed meats that tend to be high in trans-fatty acids.

1.3.1.5.5 Grains and nuts

There was a consensus on the recommendation for the consumption of wholegrain in the diet and other sources of fibre. There are general recommendations made encouraging regular intake of wholegrain, beans, seeds and nuts. Only the NICE guideline recommends a specific quantity and suggests at least 4-5 portions of unsalted nuts, seeds and legumes per week. The ESC does not make specific mention of nuts or grains in its recommendations.

1.3.1.5.6 Salt consumption

There is a consensus regarding the importance of limiting salt intake in the diet. The most commonly recommended intake of salt was <6g/day (approximately 2,300mg of sodium). The lowest recommendation being from the CDC/AHA guideline for women of less than 1,500mg of sodium. This cut-off is also mentioned in the ACC/AHA guideline as offering additional BP lowering compared to the 2,400mg of sodium considered the upper limit.

1.3.1.5.7 Plant stenols and sterols

Although the ESC mentions that the use of plant stenols and sterols can lower LDL cholesterol they do not make a recommendation on its use. The NICE guideline very clearly recommends against plant stenols or sterols for primary or secondary prevention of CVD. The recommendations for the lowering of cholesterol through lifestyle factors is mentioned in most of the guidelines although most are not explicit as to which specific factors should be addressed beyond general advice.

1.3.1.5.8 Oils

Most of the guidelines do not make specific recommendations for the types of oils used for cooking. The ACC/AHA recommends the use of non-tropical vegetable oils and NICE recommend the use of olive oil, rapeseed oil or spreads from those oils and as potential replacement for non-saturated fats.

1.3.1.5.9 Sugar

There is a general consensus in the recommendations to reduce the amount of sugar in the diet. Particular mention is made on the avoidance, or at least limiting, the intake of sugar

sweetened beverages. The NICE guidelines also mention avoiding other food products that contain refined sugars, including fructose.

1.3.2 Areas of disagreement

1.3.2.1 Dietary patterns

The 2 dietary patterns that have most often been mentioned in the guidelines include the Mediterranean (ESC, NVDP, JBS3) and the DASH (ESC, ACC/AHA, CDC/AHA and JBS3) diets. The NICE guidance opted to avoid using the term Mediterranean diet in its recommendations as they felt the description was non-specific and they instead opted to recommend some of the components of what would be considered beneficial from a 'Mediterranean diet' instead.

1.3.2.2 Alcohol intake

There is a general consensus on limiting the intake of alcohol. However, the limits that are set are variable compared to other recommendations. Only the ACC/AHA guideline does not mention any recommendation on alcohol intake as they stipulate it is outside the remit of the specific clinical questions addressed in the guideline. The CDC/AHA guideline for women only, recommends < 7 servings (1 serving is 4 oz. of wine). The ESC also recommends a similar amount for women and 14 units for men per week. The UK guidelines have a higher upper limit. The JBS3 recommends <21 units for men and < 14 units per week for women. The NICE guideline makes a more generalized recommendation of not regularly drinking more than 3-4 units per day for men (i.e. no more than 21-28 units /week) and not regularly drinking more than 2-3 units per day for women (i.e. not more than 14 to 21 units per week).

1.4.1 Discussion

We identified 7 guidelines, of which 6 were rigorously developed, on lifestyle advice and interventions for total cardiovascular risk reduction in a primary prevention setting. There is a general consensus between the 6 guidelines about the importance of lifestyle in CVD risk reduction and it forms the cornerstone of almost all of the guidelines considered regardless of whether pharmacotherapy is indicated or already being taken. The recommendation on the need for adequate physical activity levels, smoking cessation, limiting intake of saturated fat and particularly avoiding trans fats, having a diet that is rich in fruit and vegetables, that includes fish and wholegrain and limiting salt intake are very similar between the guidelines. There is also a consensus on the recommendations to reduce intake of sugars with specific mention of sugar sweetened beverages. This is particularly topical with the UK government's introduction of the 'sugar tax' and this being preceded in other countries such as Brazil with the goal of tackling obesity and diabetes. NICE recommends against use of plant stenols and sterols and the ESC does not make a recommendation for their use citing the absence of studies with clinical endpoints[16]. The advice on intake of meat products is less clearly defined. There is a general trend to recommending poultry over red meat although this is not present in all guidelines. These areas may require further research for clarification.

There are differences noted in the recommendations for what is considered acceptable alcohol intake. Of note, none of the guidelines assigned a level of evidence grade to these recommendations. Cut-offs for limited alcohol intake were generally based on an interpretation of observational studies. Observational studies are useful when the association between alcohol intake in units with cardiovascular disease, is representative for the effect of an intervention leading to reduced alcohol intake. It is however uncertain whether reducing alcohol intake in those who are regularly drinking would translate into a reduction in event

rates similar to what can be expected based on the observational studies. One recently published meta-analysis demonstrated that in people who drank at least three drinks per day, a reduction of alcohol consumption to near abstinence was associated with a significant reduction in blood pressure: -1.09 (95%CI -1.61 to -0.57), and a differential effect by gender was uncertain. It was estimated that more than 7000 inpatient hospitalisations and 678 cardiovascular deaths would be prevented per year in the UK if people who drank more than two drinks per day reduced their alcohol consumption based on the blood pressure reductions that would be seen in this group[17]. These findings seem to conflict with the recommendations including higher upper intake limits. Similar meta-analyses on the effect of alcohol reduction on cardiovascular risk factors may help resolving the inconsistencies in recommendations. Stress and psychological factors were only mentioned in 2 guidelines with only one recommending its inclusion as part of a multimodal strategy, even though this was graded as a level of evidence 1A. There was no agreement on recommendation of specific dietary patterns, but the two most commonly mentioned include the Mediterranean and the DASH diets, which advocate specific macronutrients or whole foods rather than concentrating on micronutrients. The effectiveness of these diets has been demonstrated within multiple randomized trials, leading to a 1A classification in one guideline. It is however interesting that the NICE guideline avoids using the term Mediterranean diet in their recommendations based on quality of the evidence and potential ambiguity with the term. The Mediterranean diet is comprised of abundant fruit, vegetables, cereals, beans, nuts and seeds, with olive oil, a low consumption of red meat and low to moderate consumption of dairy products and wine. The PREDIMED randomized trial tested the potential for such a diet to reduce CVD events in patients at elevated CVD risk. The multivariable adjusted HRs were 0.70 (95% CI 0.54 to 0.92) and 0.72 (95% CI 0.54 to 0.96) for groups assigned to a Mediterranean diet with extra-virgin olive oil and a group assigned to a Mediterranean diet with nuts, respectively, versus a

control group consisting of a low fat diet[18]. The Dietary Approaches to Stop Hypertension (DASH) study demonstrated that a diet rich in fruit, vegetables, and low fat dairy products reduced levels of total and saturated fat and lowered BP [19]. Although there is growing interest in the area of sleep quality and duration there was no mention regarding this area in any of the guidelines. Impact of areas such as psychological factors (including mindfulness) and sleep on cardiovascular health and prevention should be considered more widely by future guideline writing committees and recommendations based on current evidence.

Adherence to lifestyle interventions remain suboptimal despite general consensus between the guideline. This appears to be a problem in primary prevention (including those with diabetes[20], hypertension[21] and obesity[22], and secondary prevention [23,24] and is not limited to specific countries. Causes for lack of compliance or adherence are multifactorial and may include lack of understanding/education of the condition, motivation and which healthcare provider delivers the advice[20,22]. However more research is needed to improve our knowledge of factors related to adherence and this may help to improve prevention program effectiveness in the long term[22]. Future studies need to focus on optimising patient adherence to prevention strategies, their cost-effectiveness and whether interventions work best when performed simultaneously or individually[25]. In the meantime, we should actively remind patients and assess adherence of lifestyle factors opportunistically during visits with healthcare professionals.

It should be borne in mind that individuals might have difficulties changing their lifestyle and behaviour, which is often based on long-standing behavioural patterns[26]. These factors may impede the ability to adopt a healthier lifestyle. In addition changing advice from medical professionals over time also causes confusion and sometimes mistrust from the public, for

example in the case of plant sterols[27]. Awareness of these factors may facilitate empathy and by providing simple and practical advice this may support behavioural change.

1.4.2 Relative risk

It is recognized that in younger patients there may be an underestimation of future risk if only a 10-year period is considered rather than over a longer period[5,6,16]. Therefore, lifetime or relative risk scores have been advocated in order to identify individuals who may be at high risk in the longer-term to encourage earlier recognition and implementation of lifestyle intervention, even if pharmacotherapy is not deemed necessary at that stage.

Relatively young people are at low absolute risk of a CVD event in the ensuing 10 years despite having many risk factors. For example, a male aged 45 years who smokes, has a systolic BP of 180 mmHg, and a blood cholesterol of 8 mmol/L has a risk of fatal CVD of only 4% over 10 years (SCORE charts), suggesting no need for drug treatment. However, the relative risk chart indicates that his risk is already 12-fold higher than that of a male with no risk factors [16].In these groups it is increasingly recognized that lifestyle intervention should be emphasized earlier[5,16].

1.4.3 Limitations

Some limitations could bias our findings and limit its generalizability. Only guidelines developed by Western national and international medical organizations dealing with total cardiovascular risk reduction were included. Although we did not take into account prevention guidelines from societies such as from Latin America or Eastern Countries, it should be acknowledged that even western guidelines have included evidence provided studies from other ethnic groups (i.e. African, Chinese, Japanese, Latin American

populations) in order to support their recommendations on different prevention strategies. Including other countries may have helped to make the findings more generalisable but may also have introduced more heterogeneity in areas such as diet due to cultural and geographical variations. We tried to control for selection bias by having a comprehensive search strategy as previously published and articles were appraised by 2 independent researchers. Researchers were not blinded to the guidelines countries of origin or the developing organizations name. Although we assessed the guideline development process we did not assess the clinical validity of the recommendations as this is not currently included in the AGREE II instrument and as it was beyond the scope of this review. Finally, we only emphasized lifestyle interventions and advice and not pharmacotherapy to avoid overlap with previous publications in this area.

1.5 Conclusions

Current guidelines are agreed on the importance of lifestyle in the prevention of CVD with consensus on most factors including physical activity, smoking cessation and diet, which should be actively integrated in cardiovascular risk reduction programs aiming to improve clinical outcomes. Recommendations covering psychological factors and sleep are currently limited and should be considered for future prevention guidelines.

Author contributions

MK, SP and MH contributed to the conception or design of the work. MK, CVW, VB contributed to the acquisition, analysis, or interpretation of data for the work. MK drafted the manuscript. MK, CVW, VB, BF, SP and MH critically revised the manuscript. All gave final approval and agree to be accountable for all aspects of work ensuring integrity and accuracy.

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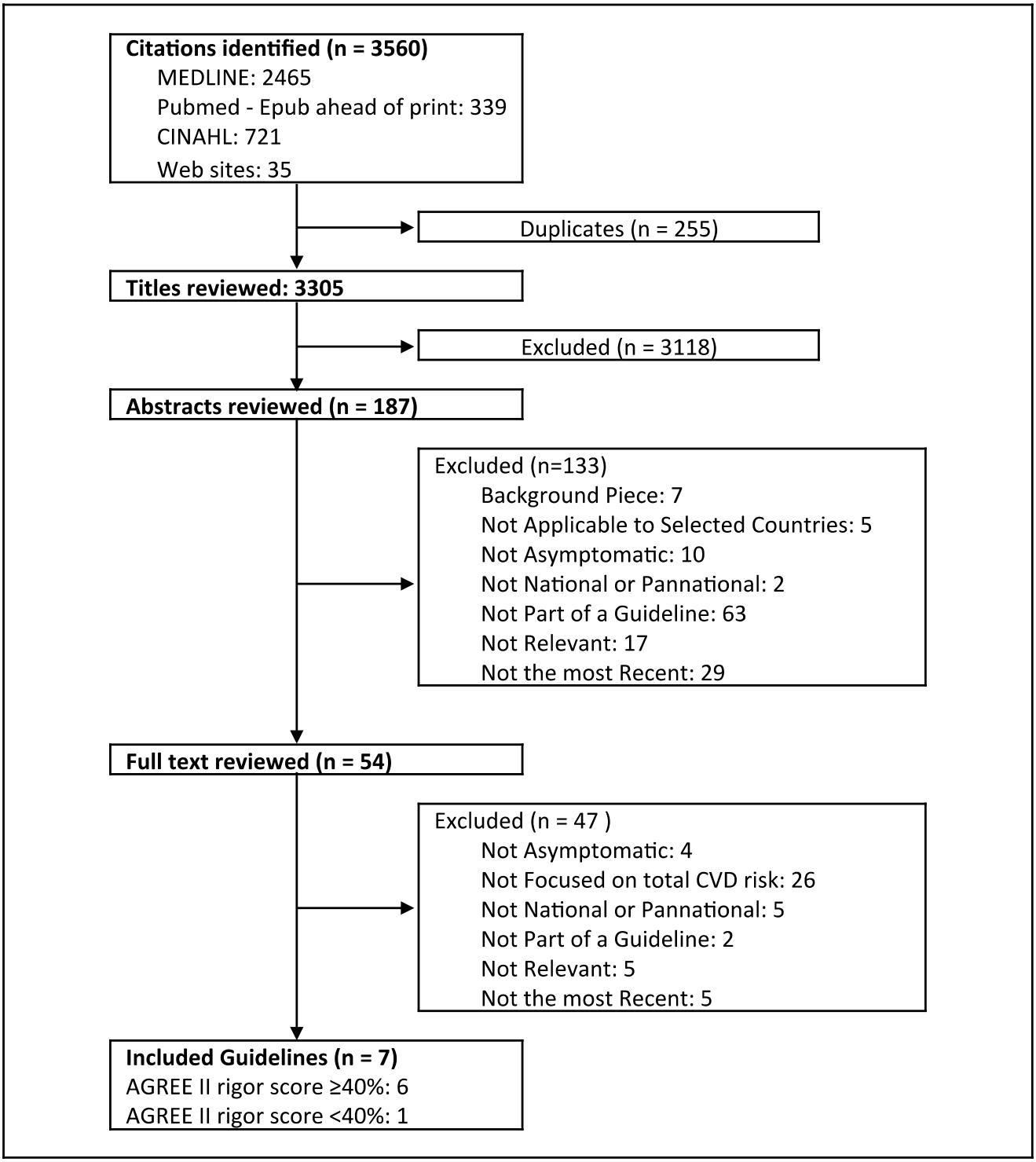

Figure 1. Summary of the guideline search and review process

Table 1. Characteristics of 7 Guidelines for Total Cardiovascular risk

Guideline	Organization Responsible for Guideline Development	Country Applied	AGREEII Rigor score, %	Conflicts of Interest
ESC[16], 2016	European Society of Cardiology	Europe	86	SCI[a]
NICE[7], 2014	National Institute for Health and Clinical Excellence	United Kingdom	86	EI,SCI[a,b]
NHMRC[8], 2012	National Health and Medical Research Council	Australia	85	EI,SCI [b]
ACC/AHA[6, 13,28], 2013	American College of Cardiology/ American Heart Association	United States	83	SCI[a, b]
CDC[29], 2011	Centres for Disease Control and Prevention	United States	65	EI,SCI[a ,b]
JBS3 Board[5], 2014	British Cardiovascular Society	United Kingdom	45	SCI [a]
NZGP [30], 2012	New Zealand Guideline Group	New Zealand	20	EI,SCI [c]

Abbreviations: AGREEII, 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

[a] Relationship with industry is reported by any group member;

[b] A group member is reported recused when a relevant area is under discussion;

[c] Conflicts of interest only available on request;

Table 2. Lifestyle recommendations for total CVD risk reduction in 6 Guidelines – Summary of the guidelines

Organization responsible for guideline development	NICE	ESC	(NVDP	ACC/AHA	CDC/ AHA	BCS
Country applied	UK	EUR	Australia	USA	USA	UK
Year	2014	2016	2012	2013	2011	2014
AGREE II rigor Score %	86%	86%	85%	83%	65%	45%
Methods used to evaluate evidence	Systematic review	Systematic review	Systematic review	Systematic review	Systematic review	Review
Methods used to formulate recommend-ations	Formal consensus	Formal consensus	Formal consensus	Formal consensus	Formal consensus and voting	NR
Consideration of Costs	Systematic review of published literature/ Performed CEA	Review of CEA studies	Review of CEA studies	Not considered	Review of CEA studies	Review of CEA studies
Target Group	Persons aged 40-74 (NHS Health Check)	Men > 40-y, Women >50-y or post-menopausal	All adults aged >45 y or Aboriginal and Torres Strait Islanders aged >35 y	Persons aged ≥ 21	Women ≥ 20 y	Children and adults
High Risk Group	Type 1 DM, eGFR <60 ml/min/1.73m2, aged ≥ 85 y, QRISK2 >10% at 10 years	DM, > moderate CKD (eGFR < 60mL/min/1.73m2) very high levels of individual risk factors, high SCORE risk (≥5%) and are high priority for intensive advice	DM and aged >60 y; DM with microalbuminuria (Males: >20 mcg/min or UACR >2.5 mg/mmol. Females: >3.5 mg/mmol f); Moderate or severe CKD (persistent	NR	NR	DM, aged >40 y, CKD stages 3–5, Familial Hypercholesterolemia or high short-term risk as per NICE 2014 (i.e. QRISK2 ≥10%)

		about all risk factors	proteinuria or eGFR <45mL/min/1.73m 2); Previous diagnosis of familial hypercholesterolem ia; SBP ≥ 180 mmHg or DBP ≥ 110 mmHg; Serum TC >7.5 mmol/L			
Screening Strategy	Opportunistic screening/ case finding/ record based to identify high-risk	Opportunistic screening/ case finding	Opportunistic screening/ case finding	Opportunistic screening/ case finding	NR	Linked to NHS Health Checks
Behavioral change strategy		Target Group: Establish CBT (e.g. motivational interviewing), if needed from specialized health care professionals High Risk group: Use multimodal interventions, i.e. education on healthy lifestyle and medical resources, exercise training, stress management plus counseling on psychological risk	Both target and high-risk group: Counseling for smoking cessation. Dietary counseling if needed			Both target and high-risk group: Counseling or group therapy for smoking cessation. Communicating heart age or lifetime risk measure to motivate change

		factors				
Intensive Lifestyle Counseling	If 10-y CHD/ stroke/ TIA risk ≥10%	If 10-y CVD mortality >1% or LDL-C >100mg/dL.	If 5-y CHD/stroke risk ≤10%. If 5-y CHD/stroke risk ≥10%; more frequent and sustained lifestyle advice, support and follow-up to achieve behavioral change.	If 10-y CHD/ stroke risk ≥7.5% and LDL-C 70-189 mg/dL; DM1 or DM2; LDL-C level ≥190 mg/dL.	NR	If Diabetes, age >40 years, CKD stages 3–5, Familial Hypercholesterolemia or high short-term risk as per NICE 2014 (i.e. QRISK2 ≥10%)
High-risk Monitoring	NR	NR	If 5-y CHD/stroke risk ≥ 15%; according to clinical context. If 5-y CHD/stroke risk 10%-15%; every 6-12 months	NR	NR	NR
Screening intervals	If 10-y CHD/ stroke/ TIA risk ≥10%; on an ongoing basis i.e.5 yearly as per NSF	NR	If 5-y CHD/stroke risk <10%; every 2 y If 5-y CHD/stroke risk 10-15%; Every 6-12 months. If 5-y CHD/stroke risk >15%; according to clinical context	If 10-y CHD/ stroke risk <7.5%; every 4-6 y.	NR	NR

* Advise people who would benefit from LDL lowering; ^ Advise those who would benefit from BP lowering; €, in line with the Four commonly used methods to increase physical activity (NICE public health guidance 2); *, in line with the national guidance for the general population (see physical activity guidelines for adults at NHS choices);

Abbreviation: CBT, cognitive behavioral therapy, CEA , cost-effectiveness analysis, CHD , coronary heart disease, CKD , chronic kidney disease, CVD , cardiovascular disease, DM , diabetes mellitus, NR , not reported, NSF , National Service Framework, SCORE , Systematic Coronary Risk Evaluation, TG , triglyceride, TIA , transient ischemic attack, y , years

Level of evidence: A, Data derived from multiple randomized clinical trials or meta-analysis. B, Data derived from a single randomized trial or nonrandomized studies. C, Only consensus opinion of experts, case studies or standard of care.

Recommendation class: Class I, Benefit >>> risk. Class IIa, Benefit >> risk. IIb benefit ≥ risk.

Table 3. Lifestyle recommendations for total CVD risk reduction in 6 Guidelines - Smoking

Organization	NICE	ESC	(NVDP	ACC/AHA	CDC/ AHA	BCS
Smoking	All smokers: advise to stop. Smokers who want to stop: offer support and advice and referral to intensive support services Smokers who are unable or unwilling to accept referral to intensive support service; offer pharmacotherapy and Varenicline for smoking cessation	Avoid all smoking (IB); Avoid passive smoking (IB); Young should be encouraged not to take up smoking (IC); Give all smokers advice to quit and offer assistance (IA)	All smokers: advise to stop (A); Offer advice about methods to aid smoking cessation including counseling services, and if assessed as nicotine dependent, nicotine replacement therapy or other appropriate pharmacotherapy should be used	NR	Women: advise not to smoke and avoid environmental tobacco smoke. Provide counseling at each encounter, nicotine replacement, and other pharmacotherapy in conjunction with a behavioral program or formal smoking cessation program (Class I; Level of Evidence B).	All smoking children and adults: professional support on stopping smoking at every available opportunity byself-help material and referral to more intensive support e.g. stop smoking services; Smokers who want to stop: offer behavioral counseling, group therapy, pharmacotherapy (NRT, Varenicline or bupropion) or a combination. All (non-) smoking children and adults: raise awareness of risks of active and passive smoking.

Abbreviation: CVD, cardiovascular disease, NR, not reported, NRT, nicotine replacement therapy, y , years
Level of evidence: A, Data derived from multiple randomized clinical trials or meta-analysis. B, Data derived from a single randomized trial or nonrandomized studies. C, Only consensus opinion of experts, case studies or standard of care.
Recommendation class: Class I, Benefit >>> risk. Class IIa, Benefit >> risk. IIb benefit ≥ risk.

Table 4. Lifestyle recommendations for total CVD risk reduction in 6 Guidelines - Diet

Organization responsible for guideline development	NICE	ESC	(NVDP	ACC/AHA	CDC/ AHA	BCS
Dietary patterns	NR	Mediterranean diet or DASH diet	Mediterranean diet	DASH diet, the United States Department for Agriculture Food Pattern, or the AHA Diet (1:A) *^	DASH dietary pattern	Mediterranean diet or DASH diet
Diet	If at high risk for CVD; advise and support to achieve a healthy diet in line with the Behavior change following principles for effective interventions from NICE public health guidance 6.	Advise to follow a healthy diet	Follow current dietary guidelines for Australian Adults	NR	Advise to consume a diet rich in fruits and vegetables; choose whole-grain, high-fibre foods; consume fish, especially oily fish, at least twice a week; limit intake of saturated fat, cholesterol, alcohol, sodium, and sugar; and avoid trans-fatty acids. (I:B).	Give professional support to consume a diet associated with the lowest cardiovascular risk
Saturated fat	Total fat intake ≤ 30% of total intake, saturated fats ≤7%, dietary cholesterol <300mg/day, replace saturated fats with mono-unsaturated and polyunsaturated fats where possible	Should account for <10% of total energy intake though replacement by polyunsaturated fatty acids. Trans-unsaturated fatty acids as little as possible, preferably no processed foods and <1% of total	Diet low in saturated and trans-saturated fats. Low fat dairy products	Reduce percentage of calories from saturated fat; Reduce percentage of calories from trans fat (1:A)*	Limit intake of saturated fats to <7% of total energy intake limit and cholesterol to <150mg/day (as found in animal meats, organ meats, eggs etc.). Avoid trans-fatty acids	Intake of saturated fat to <10% of total fat intake (preferably in lean meat and low fat dairy products)/ Replace saturated fat with polyunsaturated fat where possible

		energy from natural origin				
Fruit and vegetables	At least 5 portions of fruit and vegetables /day	200g of fruit /day (2-3 servings); 200g of vegetables /day (2-3 servings)	Diet rich in fruit and vegetables	Dietary pattern emphasizing intake of fruit and vegetables (1:A)*^	Diet rich in fruit and vegetables of ≥4.5 cups/day servings	Consume five portions/ day of fruit and vegetables
Fish	At least 2 portions /week, including a portion of oily fish	At least 2 portions/ week, including a portion of oily fish	Varied diet rich in fish	Dietary pattern emphasizing intake of fish (1:A)*^	At least 2 portions /week, especially oily fish	At least 2 portions /week, preferably oily fish
Grains and nuts	Choose wholegrain variety of starches. Eat at least 4-5 portions of unsalted nuts, seeds and legumes / week	NR	Varied diet rich in wholegrain cereals, legumes, beans, seeds and nuts	Dietary pattern emphasizing intake of legumes and nuts (1:A)*^	≥4/week servings per week of nuts legumes and seeds. (E.g. 1/2 cup or 1/2 oz. nuts is one serving) Choose wholegrain high fiber foods	Consider regular consumption of whole grains and nuts
Salt	Reduce salt intake	< 5g of salt/ day	<6g of salt/day (= approximately 2300 mg of sodium/day)	Lower sodium intake (1:A)^; Consume < 2,400 mg of sodium/day; Further reduction to 1,500 mg of sodium/day can lower BP more; At least reduce sodium intake by at least 1,000 mg/day to lower BP (2a:B)^	< 1,500 mg of sodium/day	<6 g of salt/day
Alcohol intake	Avoid binge drinking Men: Limit to 3-4 units /day Women: Limit to 2-3 units/day.	Men: limit to 2 glasses / day (20g/day of alcohol) Women: limit to 1	Limit alcohol intake. Advised to follow the current Australian guidelines to reduce health risks	NR	≤1/day (e.g. 4 oz. of wine or 12 oz. of beer)	Men: <21 units/ week Women: <14 units/ week

		glass /day (10g/day of alcohol) for women	from drinking alcohol (2009)			
Oils	Use olive oil, rapeseed oil or spreads based on those oils in food preparation, also as replacement for mono-unsaturated fats.	NR	NR	Emphasize pattern including non-tropical vegetable oils	Consumption of omega-3 fatty acids in the form of fish or in capsule form (e.g., EPA 1800 mg/d) may be considered in women with hypercholesterolemia and/or hypertriglyceridemia for primary and secondary prevention (Class IIb;B).	NR
Sugar	Reduce intake of sugar and food products containing refined sugars including fructose	Avoid sugar sweetened soft drinks	NR	Limit intake of sugars and sugar sweetened soft drinks	≤5 servings/week (≤ 450 kcal/week) from sugar sweetened beverages (1 serving is 1 tablespoon of sugar, 1 cup of lemonade)	Avoid sugar sweetened beverages and calorie rich, but nutritionally poor, snacks such as sweets, cakes
Meats	NR	NR	Varied diet rich in lean meat and poultry	Dietary pattern emphasizing intake poultry	Limit saturated fat intake to <7% as found in fried foods, fat on meat or chicken skin, packaged deserts, cheese etc.	Avoid processed meats or commercially produced foods which tend to be high in salt and TFA

*** Advise people who would benefit from LDL lowering; ^ Advise those who would benefit from BP lowering; €, in line with the Four commonly used methods to increase physical activity (NICE public health guidance 2).**

Abbreviation: CVD, cardiovascular disease, DASH, Dietary Approaches to Stop Hypertension, DM, diabetes mellitus, NR, not reported, y, years

Level of evidence: A, Data derived from multiple randomized clinical trials or meta-analysis. B, Data derived from a single randomized trial or nonrandomized studies. C, Only consensus opinion of experts, case studies or standard of care.
Recommendation class: Class I, Benefit >>> risk. Class IIa, Benefit >> risk. IIb benefit ≥ risk.

Table 5. Lifestyle recommendations for total CVD risk reduction in 6 Guidelines - Weight

Organization responsible for guideline development	NICE	ESC	(NVDP	ACC/AHA	CDC/ AHA	BCS
Weight	Offer overweight and obese people appropriate advice and support to work towards achieving and maintaining a healthy weight (in line with the Obesity (NICE guideline 43)	Weight reduction in overweight and obese people is associated with favorable effects on BP and dyslipidemia, which may lead to less CVD (I:A)	Weight loss should be recommended for those who are overweight or obese (B). Limit energy intake to maintain a healthy weight. Ideal weight should be BMI <25 kg/m2 and waist circumference <94 cm in men (<90 cm in Asian men) or <80 cm in women (including Asian women)	Achieve and maintain a healthy weight (As per 2013 Obesity Expert Panel Report)	Women should maintain or lose weight through an appropriate balance of physical activity, caloric intake, and formal behavioral programs when indicated to maintain or achieve an appropriate body weight (e.g., BMI ??25 kg/m2 in U.S. women), waist size (e.g., >35 in), or other target metric of obesity. (Class I:B).	NR

* Advise people who would benefit from LDL lowering; ^ Advise those who would benefit from BP lowering; €, in line with the Four commonly used methods to increase physical activity (NICE public health guidance 2); *, in line with the national guidance for the general population (see physical activity guidelines for adults at NHS choices);

Abbreviation: BMI, body mass index, BP, blood pressure, CVD, cardiovascular disease, NR, not reported, y , years
Level of evidence: A, Data derived from multiple randomized clinical trials or meta-analysis. B, Data derived from a single randomized trial or nonrandomized studies. C, Only consensus opinion of experts, case studies or standard of care.
Recommendation class: Class I, Benefit >>> risk. Class IIa, Benefit >> risk. IIb benefit ≥ risk.

Table 6. Lifestyle recommendations for total CVD risk reduction in 6 Guidelines – Physical activity

Organization responsible for guideline development	NICE	ESC	(NVDP	ACC/AHA	CDC/ AHA	BCS
Physical activity	At least 150 minutes of moderate intensity aerobic activity or 75 minutes of vigorous intensity aerobic activity/ week. Or a mix of moderate and vigorous intensity physical activity. * Or exercise at their maximum safe capacity based on co-morbidities or personal circumstances. Agree goals and provide written information about benefits and local opportunities to be active	Do 2.5 - 5 hours a week of physical activity or aerobic exercise training of at least moderate intensity or 1-2.5 a week of vigorous intensity exercise. Sedentary subjects should be strongly encouraged to start light intensity exercise programs (IA). / Perform in multiple bouts of >10 mins and evenly spread thought-out the week (i.e. 4-5 days / week) (IIa:A)	All adults to participate in at least 30 minutes of moderate intensity physical activity on most days of the week, preferably every day (>2.5 hours/week)(B)	Engage in 2 h and 30 min/ week of moderate-intensity physical activity, or 1 h and 15 min (75 min)/ week of vigorous-intensity aerobic physical activity, or an equivalent combination of moderate- and vigorous-intensity aerobic physical activity. Aerobic activity should be performed in episodes of at least 10 min, preferably spread throughout the week; 3-4 sessions / week of aerobic physical activity, lasting on average 40 mins / session with moderate to vigorous intensity for those needing to reduce LDL-C and	Women should be advised to accumulate at least 150 min/week of moderate exercise, 75 min/week of vigorous exercise, or an equivalent combination of moderate- and vigorous-intensity aerobic physical activity. Aerobic activity should be performed in episodes of at least 10 min, preferably spread throughout the week (Class I:B). Women should also be advised that additional cardiovascular benefits are provided by increasing moderate-intensity aerobic physical activity to 5 h (300 min)/week, 2 1/2 h/week of	An increase in overall levels of sustained physical activity and avoidance of prolonged sedentary behavior are important for reduction of CVD risk. / Emphasize walking, cycling, and other aerobic physical daily activities, at moderate intensity, as part of an active lifestyle, for at least 150 min/ week in bouts of ≥10 min, or 75 min/ week of vigorous physical activity, or a combination of the two. / Muscle strengthening activities performed on at least two occasions/ week.

				non-HDL cholesterol or BP (2aA)*^	vigorous-intensity physical activity, or an equivalent combination of both (Class I:B)	
Exercise training	Perform muscle strengthening activities on 2 or more days of the week that work all major muscles groups.*	NR	NR	NR	Women should be advised to engage in muscle-strengthening activities that involve all major muscle groups performed on >2 d/week (Class I; B). / Women who need to lose weight or sustain weight loss should be advised to accumulate a minimum of 60 to 90 min of at least moderate-intensity physical activity (e.g., brisk walking) on most, and preferably all, days of the week (Class I:B).	Incorporating a warm up and cool down period, should be performed at moderate to high intensity, 2-3 times per week for 30–40 min each time. / The mode of exercise should be aerobic and, where possible, continuous allowing for a steady progression in effort for example, walking programs, cycling, jogging, swimming. / The time spent exercise training contributes to meeting the 150min/ week physical activity recommendation.

Supervised exercise	Refer to programs such as exercise referral schemes for people who may need support to change their lifestyle	NR	NR	NR	NR	If at higher risk of CVD: offer a more structured approach in managing patients All children and adults: Assess and set specific goals with risk stratification, delivered by professionals skilled in health-related exercise. Increase in exercise with community-based exercise initiatives are recommended for patients at risk of CVD

***** Advise people who would benefit from LDL lowering; ^ Advise those who would benefit from BP lowering; €, in line with the Four commonly used methods to increase physical activity (NICE public health guidance 2).
Abbreviation: CVD, cardiovascular disease, NR, not reported, y , years
Level of evidence: A, Data derived from multiple randomized clinical trials or meta-analysis. B, Data derived from a single randomized trial or nonrandomized studies. C, Only consensus opinion of experts, case studies or standard of care.
Recommendation class: Class I, Benefit >>> risk. Class IIa, Benefit >> risk. IIb benefit ≥ risk.

Table 7. Lifestyle recommendations for total CVD risk reduction in 6 Guidelines – Psychological factors and sleep

Organization responsible for guideline development	NICE	ESC	(NVDP	ACC/AHA	CDC/ AHA	BCS
Stress or psychological factors	NR	If at high risk for CVD: Assess for multimodal interventions, including stress management and counseling on psychosocial risk factors (1:A). Provide tailored clinical management considered to enhance QOL and CHD prognosis (IIa:B).	Assess for depression and other psychosocial factors. Risk may be FRS may underestimate risk in adults with depression.	NR	NR	NR
Sleep quality or length	NR	NR	NR	NR	NR	NR

Abbreviation: CHD , coronary heart disease, CVD , cardiovascular disease, FRS, Framingham Risk Score, NR , not reported,
Level of evidence: A, Data derived from multiple randomized clinical trials or meta-analysis. B, Data derived from a single randomized trial or nonrandomized studies. C, Only consensus opinion of experts, case studies or standard of care.
Recommendation class: Class I, Benefit >>> risk. Class IIa, Benefit >> risk. IIb benefit ≥ risk.

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On behalf of all Co-Authors, the corresponding Author shall bear full responsibility for the submission. Any changes to the list of authors, including changes in order, additions or removals will require the submission of a new author agreement form approved and signed by all the original and added submitting authors.

All authors are requested to disclose any actual or potential conflict of interest including any financial, personal or other relationships with other people or organizations within three years of beginning the submitted work that could inappropriately influence, or be perceived to influence, their work. If there are no conflicts of interest, the COI should read: “The authors report no relationships that could be construed as a conflict of interest”.

Supplementary Material for Online Only publication

Table A1: Website searches of guideline development organizations, including websites affiliated with all the guidelines included in our previous publication

Organization Responsible for Guideline Development	Country	Website Searched
Australian Diabetes Society (ADS)	Australia	https://www.diabetessociety.com.au
Australian Medical Association (AMA)	Australia	http://www.ama.com.au/web.nsf
Cardiac Society of Australia and New Zealand (CSANZ)	Australia	http://www.csanz.edu.au
National Health and Medical Research Council (NHMRC)	Australia	http://www.nhmrc.gov.au/index.htm
National Heart Foundation	Australia	http://www.heartfoundation.org.au/index.htm
Canadian Diabetes Association	Canada	http://guidelines.diabetes.ca
Canadian Hypertension Society (CHS)	Canada	http://www.hypertension.ca
Canadian Task Force on Preventive Health Care (CTFPHC)	Canada	http://canadiantaskforce.ca
European Society of Cardiology	Europe	http://www.escardio.org
International Diabetes Federation European Region	International	http://diabetespreventionforum.org/index.php/projects/6-image-project
International Diabetes Federation (IDF)	International	http://www.idf.org
International Society of Hypertension	International	http://www.ish-world.com
World Heart Federation	International	http://www.world-heart-federation.org
World Health Organisation (WHO)	International	http://www.who.int/en
World Hypertension League	International	http://www.worldhypertensionleague.org/Pages/Home.aspx
British Cardiac Society (BCS)	United Kingdom	http://www.bcs.com/pages/default.asp
British Hypertension Society (BHS)	United Kingdom	http://www.bhsoc.org/default.stm
Department of Health (DOH)	United Kingdom	http://www.dh.gov.uk/en/index.htm
National Institute for Health and Clinical Excellence (NICE)	United Kingdom	http://www.nice.org.uk/
American Academy of Family Physicians (AAFP)	United States	http://www.aafp.org/online/en/home.html
American Association of Clinical Endocrinologists	United States	www.aace.com

American College of Cardiology	United States	http://www.acc.org
American College of Physicians	United States	http://www.acponline.org
American College for Preventive Medicine	United States	http://www.acpm.org
American Diabetes Association (ADA)	United States	http://www.diabetes.org
American Geriatrics Society (AGS)	United States	http://www.americangeriatrics.org
American Heart Association (AHA)	United States	http://www.americanheart.org
American Medical Association (AMA)	United States	http://www.ama-assn.org
American Stroke Association	United States	http://www.strokeassociation.org
Centers for Disease Control and Prevention (CDC)/ AHA	United States	http://www.cdc.gov
National Heart Lung and Blood Institute	United States	http://www.nhlbi.nih.gov/guidelines/index.htm
New Zealand Guidelines Group	New Zealand	http://www.nzgg.org.nz
Royal College of General Practitioners (RCGP)	United Kingdom	http://www.rcgp.org.uk/default.aspx
Scottish Intercollegiate Guidelines Network (SIGN)	United Kingdom	http://www.sign.ac.uk
U.S. Preventive Services Task Force (USPSTF)	United States	http://www.ahrq.gov/clinic/uspstfix.htm

Supplementary Table A2- AGREE II instrument: Rigor of development domain results

Guideline	**ESC**		**NICE**		**ACC/AHA**		**NHMRC/ NVDPA**		**CDC/AHA**		**BCS/JBS3**	
Reviewer	A	B	A	B	A	B	A	B	A	B	A	B
Method to search for evidence	6	7	7	5	7	6	7	6	6	6	3	4
Criteria to select evidence	5	7	7	5	6	6	7	6	5	6	2	4
strengths and limitations of evidence	6	7	7	5	6	4	6	5	5	6	3	3
Methods for formulating recommendations	7	7	7	5	7	6	7	5	6	4	3	4
health benefits, side effects, and risks	6	6	7	5	5	6	6	6	5	5	5	4
Link between recommendations and evidence	7	6	7	5	6	5	6	5	4	5	4	4
Procedures for external expert review	5	5	7	6	7	6	6	6	5	7	6	6
Updating process	6	5	7	6	6	6	6	7	1	2	2	1
Domain score, %	**86%**		**86%**		**83%**		**85%**		**65%**		**45%**	

Table A3. Lifestyle recommendations for total CVD risk reduction in 6 Guidelines

Organization responsible for guideline development	National Institute for Health and Care Excellence (NICE)	European Society of Cardiology (ESC)	National Vascular Disease Prevention alliance (NVDP)	American College of Cardiology/ American Heart Association (ACC/AHA)	Centers for Disease Control and Prevention/ American Heart Association (CDC/ AHA)	British Cardiovascular Society (BCS)
Country applied	UK	EUR	Australia	USA	USA	UK
Year	2014	2016	2012	2013	2011	2014
AGREE II rigor Score %	86%	86%	85%	83%	65%	45%
Methods used to evaluate evidence	Systematic review	Systematic review	Systematic review	Systematic review	Systematic review	Review
Methods used to formulate recommend-ations	Formal consensus	Formal consensus	Formal consensus	Formal consensus	Formal consensus and voting	NR
Target Group	Persons aged 40-74 (NHS Health Check)	Men > 40-y, Women >50-y or post-menopausal	All adults aged >45 y or Aboriginal and Torres Strait Islanders aged >35 y	Persons aged ≥ 21	Women ≥ 20 y	Children and adults
Intensive Lifestyle Counselling	If 10-y CHD/ stroke/ TIA risk ≥10%	If 10-y CVD mortality >1% or LDL-C >100mg/dL.	If 5-y CHD/stroke risk ≤10%. If 5-y CHD/stroke risk ≥10%; more frequent and sustained lifestyle interventions.	If 10-y CHD/ stroke risk ≥7.5% and LDL-C 70-189 mg/dL; DM1 or DM2; LDL-C level ≥190 mg/dL.	NR	If Diabetes, age >40 years, CKD stages 3–5, Familial Hypercholesterolaemia or high short term risk as per NICE 2014 (i.e. QRISK2 ≥10%)
Smoking	All smokers: advise to stop with support.	Avoid all smoking; Avoid passive smoking; Young should be encouraged not to	All smokers: advice to stop with support.	NR	Advise not to smoke and avoid environmental tobacco smoke. Provide support	All smoking children and adults: professional support on stopping smoking

		take up smoking; Give all smokers advice to quit and offer support				at every available opportunity
Dietary patterns	NR	Mediterranean diet or DASH diet	Mediterranean diet	DASH diet, the United States Department for Agriculture Food Pattern, or the AHA Diet *^	DASH dietary pattern	Mediterranean diet or DASH diet
Saturated fat	≤7%, Replace saturated fats with mono and polyunsaturated fats where possible	<10% of total energy intake. Trans-unsaturated fatty acids as little as possible, preferably no processed foods.	Diet low in saturated and trans-saturated fats. Low fat dairy products	Reduce percentage of calories from saturated fat; Reduce percentage of calories from trans fats*	<7% of total energy intake limit and cholesterol to <150mg/day (as found in animal meats, organ meats, eggs etc.). Avoid trans-fatty acids	<10% (preferably in lean meat and low fat dairy products)/ Replace saturated fat with polyunsaturated fat where possible
Fruit and vegetables	At least 5 portions of fruit and vegetables /day	200g of fruit /day (2-3 servings); 200g of vegetables /day (2-3 servings)	Diet rich in fruit and vegetables	Dietary pattern emphasizing intake of fruit and vegetables (1A)*^	Diet rich in fruit and vegetables of ≥4.5 cups/day servings	Consume five portions/ day of fruit and vegetables
Fish	At least 2 portions /week, including a portion of oily fish	At least 2 portions/ week, including a portion of oily fish	Varied diet rich in fish	Dietary pattern emphasizing intake of fish (1A)*^	At least 2 portions /week, especially oily fish	At least 2 portions /week, preferably oily fish
Grains and nuts	Choose wholegrain variety of starches. Eat at least 4-5 portions of unsalted nuts, seeds and legumes / week	NR	Varied diet rich in wholegrain cereals, legumes, beans, seeds and nuts	Dietary pattern emphasizing intake of legumes and nuts (1A)*^	≥4/week servings per week of nuts legumes and seeds. Choose wholegrain high fibre foods	Consider regular consumption of whole grains and nuts
Salt	Reduce salt intake	< 5g of salt/ day	<6g of salt/day (= approximately 2300 mg of sodium/day)	Lower sodium intake (1A)^; Consume < 2,400 mg of sodium/day^	< 1,500 mg of sodium/day	<6 g of salt/day

Alcohol intake	Avoid binge drinking Men: Limit to 3-4 units /day Women: Limit to 2-3 units/day	Men: limit to 2 glasses / day (20g/day of alcohol) Women: limit to 1 glass /day	Limit alcohol intake (follow current Australian guidelines on drinking alcohol, 2009)	NR	≤1 unit/day (e.g. 4 oz. of wine or 12 oz. of beer)	Men: <21 units/ week Women: <14 units/ week
Sugar	Reduce intake of sugar and food products containing refined sugars including fructose	Avoid sugar sweetened soft drinks	NR	Limit intake of sugars and sugar sweetened soft drinks	≤5 servings/week (≤ 450 kcal/week) from sugar sweetened beverages (1 serving is 1 tablespoon of sugar)	Avoid sugar sweetened beverages and calorie rich, but nutritionally poor, snacks such as sweets, cakes
Meats	NR	NR	Varied diet rich in lean meat and poultry	Dietary pattern emphasizing intake poultry	Limit saturated fat intake to <7% as found fat on meat or chicken skin	Avoid processed meats or commercially produced foods which tend to be high in salt and trans fat
Weight	Offer overweight and obese people appropriate advice and support	Weight reduction in overweight and obese people is associated with favourable effects on BP and dyslipidaemia, and may reduce CVD	Weight reduction recommended for overweight or obese. Ideal weight should be BMI <25 kg/m2 and waist circumference <94 cm in men (<90 cm in Asian men) or <80 cm in women (including Asian women)	Achieve and maintain a healthy weight	Women should maintain or lose weight through an appropriate balance of physical activity, caloric intake +/- formal behavioural programs (eg aim BMI ??25 kg/m2 in U.S. women)	NR
Physical activity	At least 150 mins of moderate intensity aerobic activity or 75 minutes of vigorous	Do 150 – 300 mins/week of physical activity or aerobic exercise training of at least moderate intensity	At least 30 mins of moderate intensity physical activity on most days of the week, preferably	Engage in 150 mins/ week of moderate-intensity physical activity, or 75 minutes/ week of vigorous-	At least 150 min/week of moderate exercise, 75 min/week of vigorous exercise. Performed in	Increase overall levels of sustained physical activity and avoid prolonged sedentary behaviour. Emphasize walking, cycling, and

	intensity aerobic activity/ week*	or 60 -150 mins/ week of vigorous intensity exercise. Sedentary subjects should start light intensity exercise programs. Perform in multiple bouts of >10 mins and evenly spread thought-out the week	every day (>150 mins/week)(B)	intensity aerobic physical activity. Performed in burst of at least 10 mins, preferably spread throughout the week*^	episodes of at least 10 min, preferably spread throughout the week. Additional cardiovascular benefits by increasing moderate-intensity to 300 minutes/week or 150 mins/week of vigorous-intensity	other aerobic physical daily activities, at moderate intensity for at least 150 min/ week in bouts of ≥10 min, or 75 min/ week of vigorous physical activity. Muscle strengthening activities performed on at least two occasions/ week.
Stress or psychological factors	NR	If at high risk for CVD: Assess for multimodal interventions, including stress management and counselling on psychosocial risk factors. (1A) Provide tailored support considered to enhance QOL and CHD prognosis	Assess for depression and other psychosocial factors. FRS may underestimate risk in adults with depression.	NR	NR	NR

* Advise people who would benefit from LDL lowering; ^ Advise those who would benefit from BP lowering; €, in line with the Four commonly used methods to increase physical activity (NICE public health guidance 2); *, in line with the national guidance for the general population (see physical activity guidelines for adults at NHS choices);

Abbreviation: ABI , ankle brachial index, CBT , cognitive behavioural therapy, CEA , cost-effectiveness analysis, CAC , coronary artery calcium, CHD , coronary heart disease, CKD , chronic kidney disease, CVD , cardiovascular disease, DASH , Dietary Approaches to Stop Hypertension, 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, US , ultrasound, y , years

Search Example

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 (aort* 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 exam*)) 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 l

Supplementary Table A4 - Reporting Checklist for Systematic Review

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	1
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	4
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	5
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	As previously published (5)
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	5-6
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	5-6
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	Supplementary material
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	6-7

Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	6-7
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	5-6

Section/topic	**#**	**Checklist item**	**Reported on page #**
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	Not applicable
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	Not applicable
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	7
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	Not applicable
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	Not applicable
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	7-8
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	7
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	Not applicable
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	Table 1-2 Pages 25-29

Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	7-13
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	Not applicable
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	Not applicable
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	14
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	16
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	16
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	18