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CANADIAN CARDIOVASCULAR SOCIETY 1998 CONSENSUS CONFERENCE ON THE PREVENTION OF CARDIOVASCULAR DISEASE: THE ROLE OF THE CARDIOVASCULAR SPECIALIST

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Section 1: The role of the cardiovascular specialist in the prevention of cardiovascular diseases - Executive summary

Ruth L Collins-Nakai, Gilles R Dagenais

Cardiovascular diseases (CVD) cause the greatest mortality in Canada, accounting for more than one out of three deaths. Furthermore, CVD have a high morbidity and impose a major socioeconomic burden on individuals and society. CVD are largely preventable through control of major risk factors. Risk factors are independent predictors of disease that have shown dose-dependent responses, consistent associations with disease in many studies in various settings and biological plausibility. The demonstration of causality by a risk factor requires a randomized trial that lowers the trend or the occurrence of the risk factor and subsequently leads to a lower rate of events. Ischemic CVD are related to biological risk factors such as dyslipidemia, hypertension, diabetes, obesity, to lifestyles or behaviours such as smoking, unhealthy diet and physical inactivity, and to some psychological risks and socioeconomic factors. Some risk factors have been identified recently and are the subjects of increased research efforts that should clarify their contribution to CVD in the near future.

The prevalence of these biological risk factors and lifestyles is high among Canadians. The Canadian Heart Health Survey, conducted between 1986 and 1992 among 23,139 persons aged 18 to 74 years, indicated that two-thirds of Canadians had at least one risk factor (1). Unfortunately, recent increases in the prevalence of risk factors in Canadian adolescents and women strongly suggest that CVD may increase in the future if the trends are maintained.

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Canadians with CVD are at high risk for recurrent events and mortality. Patients aged 55 years and more with a previous CVD have an annual risk of about 4% of having another major ischemic event such as myocardial infarction (MI), stroke or CVD death (personal communication, Heart Outcomes Prevention Evaluation [HOPE] study). These recurrent events can be reduced by therapeutic approaches according to evidence-based interventions, and the management of biological risk factors and unhealthy lifestyles.

THE ROLE OF CARDIOVASCULAR SPECIALISTS

Cardiovascular specialists contribute to the reduction of the burden of these diseases by managing acute CVD. However, they can make significant additional contributions by ensuring optimal treatment and risk factor management in patients with CVD by implementing evidence-based recommendations derived from large randomized trials in their daily practice.

Cardiovascular specialists can make further contributions by encouraging preventive measures for their patients' families. Finally, they can provide leadership in hospitals and communities for primary and secondary CVD prevention, and lobby governments to create public policies that enhance resources for CVD prevention and cardiovascular health.

THE ROLE OF THE CANADIAN CARDIOVASCULAR SOCIETY, OTHER HEALTH PROVIDERS AND GOVERNMENTS IN PREVENTING CVD

CVD prevention is one of the major objectives of the Canadian Cardiovascular Society (CCS). After participating in the preparation and conduct of the successful Fourth International Conference on Preventive Cardiology in 1997, the CCS decided to build on the scientific and policy momentum created, by focusing its 1998 consensus conference on CVD prevention and the role of cardiovascular specialists.

The burden of CVD can only be reduced by teamwork involving cardiovascular specialists, other physicians, nurses, dietitians, behavioural scientists, physical educators, other health professionals, health organizations and the private sector. Prevention of disease and promotion of cardiovascular health also require supportive policies. Governments at the federal, provincial and local levels need to be involved in this challenge.

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TABLE 1
Levels of evidence and grading of recommendations

Criteria	
Level of evidence	
I.	Based on randomized trials with low false positive (.) and low false negative (.) errors (high power)
II.	Based on randomized trials with high false positive (.) and/or high false negative (.) errors (low power)
III.	Based on nonrandomized concurrent cohort comparisons between contemporaneous controls
IV.	Based on nonrandomized historical cohort comparisons
V.	Based on case series without control
Grade of the recommendation	
A.	Supported by at least one or more Level I randomized trials
B.	Supported by at least one Level II randomized trial
C.	Supported by Level III

OBJECTIVE OF THE 1998 CCS CONSENSUS CONFERENCE

The objective of the conference was to analyze and report the scientific evidence base for recommendations on the prevention of CVD, and to identify research issues and gaps that must be addressed to increase the level or quality of evidence. Scientific evidence provides the basis for recommendations and policy development for the prevention of CVD. It is hoped that by providing an up-to-date assessment of current scientific information, consistent and

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nationally supported recommendations can be implemented by cardiovascular physicians and can provide a basis for CVD prevention policies in Canada.

THE CONSENSUS DOCUMENT

The process: The Co-Chairs of the CCS consensus conference were appointed by the Council of the CCS. They identified a primary panel comprising colleagues from national professional societies as well as Canadian experts in different fields of CVD prevention or cardiovascular health. Each member of the panel was asked to prepare short reviews on the topic of their expertise highlighting the 1998 state of the art according to a review of the literature and indicating the scientific evidence for recommendations on CVD prevention. They were also asked to identify gaps in our knowledge or in the evidence base that must be addressed. The initial reviews were circulated to all members of the primary panel for feedback. Revised versions were circulated to all members of the primary panel and to a secondary panel constituted of colleagues of the CCS and other Canadians in specific domains of CVD prevention. A third version of each review was prepared following the second round of feedback, and was circulated to all CCS members and presented at the 51st Annual Meeting of the CCS in October, 1998. Feedback from this third round was received for a final review by primary panel members.

The levels of evidence and grading of the recommendations: Except for the section on hypertension, the recommendations in this consensus conference are based on the levels of evidence and grading scores as reported by Sackett (2) and used in several previous CCS consensus conferences (Table 1). Although there has been no large, randomized trial on smoking cessation, the evidence is so strong that we believe it constitutes a grade A recommendation.

Focus of the document - the whole person and not the individual risk factor: The main thrust of our message is that the focus of health professional interventions should be the whole person rather than piecemeal risk factors. After identifying all risk factors, the physician evaluating a patient should intervene according to the cumulative nature of these factors, which can be used to predict the likelihood of CVD. Persons with ischemic heart disease, stroke or peripheral

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arterial disease are at very high risk for adverse cardiovascular events, necessitating optimal treatment of their disease and concurrent management of all risk factors to prevent recurrent events. The Framingham risk factor charts for both ischemic heart disease and stroke are recommended for the prediction of these events in persons without CVD (Appendix, Table 1, pages 11G-12G). Although these charts do not take into account some important risk factors such as familial hypercholesterolemia, their value outweighs their limitations because of their proven clinical usefulness.

The Task Force of the European Society of Cardiology, European Atherosclerosis Society and European Society of Hypertension have previously published and recently updated their guidelines (3). The American College of Cardiology and the American Heart Association have published a position paper on coronary disease prevention (4) and have recently formulated a document on women and CVD (5). These documents are pertinent and serve as useful references for the Canadian context.

Main topics of the consensus document: The consensus conference document has 10 sections with a total of 23 topics. Section 1(pages 7G-10G) is the executive summary explaining the justification and objective of the consensus conference and the methodology used for the preparation of this document. This section also summarizes the main clinical and research recommendations (Appendix, Table 2, pages 13G-16G).

Section 2 (pages 17G-24G) documents the issues of the burden of CVD worldwide and in Canada. If current trends in increased risk factor prevalence are maintained, CVD will rise in the future, particularly in developing countries and, by 2020, will account for close to 40% of deaths in the world. A similar increase in mortality may also be expected in Canada, particularly in women and aboriginal peoples.

Section 3 (pages 25G-50G) focuses on the special populations of children and youth, women, the elderly, aboriginal peoples and ethnic groups. The increasing rates of smoking in children, adolescents and women, and the higher incidence of sedentariness and obesity in the population at large, especially in aboriginal peoples, are highlighted. The key message of this section is the need to apply the same intensive approaches for the reduction of CVD risk to both sexes, to youth and the elderly, and to all cultures and races.

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Section 4 (pages 51G-76G) summarizes the evidence for biological risk factors such as dyslipidemia, hypertension, diabetes, obesity and several emerging risk factors that may become more important as our knowledge base improves. New dyslipidemia guidelines are provided, including a proposal for measuring apolipoprotein B that may simplify the management of high risk persons with dyslipidemia. The target levels for reducing elevated low density lipoprotein or hyperapolipoprotein B for high risk persons are less than 2.5 mmol/L or less than 90 mg/dL, respectively. New recommendations for the management of hypertension from the Canadian Hypertension Society are also highlighted. Persons with hypertension would benefit from nonpharmacological interventions such as weight reduction for overweight individuals, smoking cessation, regular exercise, proper diet and limited alcohol intake. Blood pressure should be reduced to 140/90 mmHg or less, and for persons with diabetes to at least 130/80 mmHg. Persons with diabetes should strive for a fasting glucose level of 4 to 7 mmol/L and should be screened for microalbuminuria, which increases CVD risk. Persons with diabetes should have all other risk factors managed and take acetylsalicylic acid (ASA) if they have at least one other risk factor. Obesity, a frequent risk factor among Canadians, is often associated with dyslipidemia, hypertension and insulin resistance. Different approaches in weight reduction such as behavioural therapy, diet, and exercise, with family participation, are recommended. The section on emerging risk factors discusses homocysteinemia, lipoprotein(a), *Chlamydia pneumoniae* and coagulation factors such as fibrinogen and factor VII.

Section 5 (pages 77G-101G) deals with behavioural and social risk factors such as smoking, diet, physical inactivity, psychological risks, socioeconomic factors and social support. All smokers should be encouraged to quit, and everyone should avoid exposure to environmental tobacco smoke. Physicians should be proactive in promoting restricted access to tobacco products for children and adolescents, and support bans on promotion of tobacco in Canada and throughout the world. Patients who are at high risk for CVD should have a diet low in total and saturated fat, with a moderate polyunsaturated fat intake and avoidance of both animal and hydrogenated fats. Physical inactivity is recognized as a major modifiable risk factor and is highly prevalent among Canadians. People of all ages are advised to engage in physical activity of moderate intensity for 30 mins on most days, preferably all days. Psychological risks

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include depression, anxiety and low social support. The impact of low socioeconomic status on the prevalence of biological and psychological or behavioural risk factors and on CVD events is discussed, and specialists are urged to consider these factors in treating patients with CVD.

Sections 6 (pages 102G-105G), 7 (pages 106G-109G) and 8 (pages 110G-113G) cover the risk factors for stroke, peripheral arterial disease and cardiac rehabilitation. For stroke, recommendations address the association of oral contraceptives with smoking and hypertension. The use of anti-coagulation in the elderly with atrial fibrillation and the management of carotid occlusive disease are reviewed. Patients with peripheral arterial disease are at high risk of new CVD events and benefit from risk factor reduction. The chapter on rehabilitation programs focuses on the restoration of optimal physiological, psychological and vocational status of patients.

Section 9 (pages 114G-116G) describes cost effectiveness analyses for various cardiovascular preventive programs. In general, secondary and tertiary preventive interventions at the individual level are found to be highly cost effective.

Section 10 (pages 117G-119G) focuses on policies and partnerships, and the need for governments, the private sector, national health organizations and health professionals to adopt consistent and specific principles and recommendations. Only such collaboration will bring about the political determination to introduce supportive policies and facilitate implementation of policies for the prevention of CVD. The main target levels, evaluations, recommendations and re-search needs for each risk factor are shown in Table 2 in the Appendix.

It is our hope that various medical organizations, other health and education professional groups, health charities and governments will create a partnership to foster and implement a national strategy for preventing CVD and improving cardiovascular health. We offer this consensus document as a potential contribution to this proposed national strategy.

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ADDENDUM

Results of the international HOPE study, organized by the Canadian Cardiovascular Collaboration, were first presented on August 31, 1999. HOPE findings will modify the approach recommended in managing patients aged 55 years and more who are at high risk for a major cardiovascular event, due to their previous ischemic heart disease, stroke or peripheral artery disease, or due to diabetes with another risk factor. Indeed, because of its large population, length of follow-up, high number of events and highly significant response of the angiotensin-converting enzyme inhibitor (ACE-I), the HOPE Study should have an impact similar to those obtained with trials on ASA, lipid-lowering agents or antihypertensive medications in stable patients.

According to a 2×2 factorial design, the HOPE Study randomized 9297 men and women aged 55 years and more with stable vascular diseases or diabetes mellitus with an additional risk factor, without congestive heart failure or known left ventricular ejection fraction less than 0.40, to receive either an ACE-I (ramipril) 10 mg or its placebo, and vitamin E 400 U or its placebo. The primary outcome was the first occurrence of cardiovascular death, MI or stroke. The study had to be stopped at 4.5 years because of convincing evidence of benefit of ramipril and lack of effect of vitamin E. During the 4.5-year follow-up, there were 657 CVD deaths, 624 fatal and nonfatal MIs, 322 fatal and nonfatal strokes, 1050 total deaths, 971 heart failure events, 1606 coronary and noncoronary revascularization procedures, and 633 diabetic complications. Ramipril reduced CVD mortality by 25% (P=0.0002), all MIs by 20% (P=0.0005), all strokes by 31% (P=0.0003), total mortality by 16% (P=0.0005). A highly significant reduction with ramipril was documented for all heart failure events (23%), revascularization procedures (16%) and diabetic complications (17%). Ramipril had few side effects, an excess of 5% coughing, but no significant hypotension despite a mean level of blood pressure at entry of 139/79 mmHg. Ramipril induced a mean drop of 3 mmHg for systolic and 2 mmHg for diastolic blood pressure. Vitamin E did not reduce any of these CVD outcomes and had no significant side effects. Thus, in this large trial done in high risk participants aged 55 years or more, ramipril highly significantly reduced CVD mortality, nonfatal MI, strokes and several other end points, but vitamin E had no significant benefit on these outcomes (6).

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REFERENCES

1. Canadian Heart Health Surveys: A profile of cardiovascular risk. Can Med Assoc J 1992;146:1969-2029.
2. Sackett DL. Rules of evidence and clinical recommendations for the use of antithrombotic agents. Chest 1986;89:25-36.
3. Pyorala K, De Bacher G, Graham I, et al. Prevention of coronary heart disease in clinical practice. Recommendation of the Task Force of the European Society of Cardiology, European Atherosclerosis Society and European Society of Hypertension. Eur J Cardiol 1994;15:1300-31.
4. Fuster V, Pearson TA, Abrams J, et al. The 27th Bethesda Conference: Matching the intensity of risk factor management with the hazard for coronary disease events. J Am Coll Cardiol 1996;27:957-1047.
5. Mosca L, Judelson MD, King K, et al. AHA/ACC Medical/Scientific Statement Consensus Panel Statement: A guide to preventive cardiology for women. J Am Coll Cardiol 1999;99:1751-3.
6. HOPE investigators. Effects of an angiotensin converting enzyme inhibitor, ramipril, on death from cardiovascular causes, myocardial infarction and stroke in high risk patients. N Engl J Med. (In press)

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Section 1: APPENDIX TABLE 1 - Risk factor Prediction Charts Coronary Artery Disease

1. Find points for each risk factor

Age (if female)		Age (if male)		HDL cholesterol		Total cholesterol		SBP		Other	Points
Age	Points	Age	Points	HDL-C	Points	Total-C	Points	SBP	Points		
30	-12	30	-2	0.64-0.68	7	3.60-3.92	-3	98-104	-2	Cigarettes	4
31	-11	31	-1	0.69-0.75	6	3.93-4.31	-2	105-112	-1	Diabetic-male	3
32	-9	32-33	0	0.76-0.83	5	4.32-4.73	-1	113-120	0	Diabetic-female	6
33	-8	34	1	0.84-0.91	4	4.74-5.17	0	121-129	1	ECG-LVH	9
34	-6	35-36	2	0.92-0.99	3	5.18-5.68	1	130-139	2	For each NO	
35	-5	37-38	3	1.00-1.09	2	5.69-6.21	2	140-149	3		0
36	-4	39	4	1.10-1.20	1	6.22-6.80	3	150-160	4		
37	-3	40-41	5	1.21-1.30	0	6.81-7.48	4	161-172	5		
38	-2	42-43	6	1.31-1.43	-1	7.49-8.18	5	173-185	6		
39	-1	44-45	7	1.44-1.56	-2	8.19-8.58	6				
40	0	46-	8	1.57-	-3						

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		47		1.72				
41	1	48-49	9	1.73-1.90	-4			
42-43	2	50-51	10	1.91-2.08	-5			
44	3	52-54	11	2.09-2.26	-6			
45-46	4	55-56	12	2.27-2.50	-7			
47-48	5	57-59	13					
49-50	6	60-61	14					
51-52	7	62-64	15					
53-55	8	65-67	16					
56-60	9	68-70	17					
61-67	10	71-73	18					
68-74	11	74	19					

C Cholesterol; ECG-LVH Left ventricular hypertrophy on electrocardiogram; HDL High density lipoprotein; SBP Systolic blood pressure

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2. Sum points for all risk factors

	+		+		+		+		+		+		=	
Age		HDL C		Total		SBP		Smoker		Diabetes		ECG		Point total

Note: Minus points subtract from total

3. Look up risk corresponding to point total

Probability								
Points	5-year	10-year	Points	5-year	10-year	Points	5-year	10-year
1	<1%	<2%	13	3%	8%	25	14%	27%
2	1%	2%	14	4%	9%	26	16%	29%
3	1%	2%	15	5%	10%	27	17%	31%
4	1%	2%	16	5%	12%	28	19%	33%
5	1%	3%	17	6%	13%	29	20%	36%
6	1%	3%	18	7%	14%	30	22%	38%
7	1%	4%	19	8%	16%	31	24%	40%
8	2%	4%	20	8%	18%	32	25%	42%
9	2%	5%	21	9%	19%			
10	2%	6%	22	11%	21%			
11	3%	6%	23	12%	23%			
12	3%	7%	24	13%	25%			

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4. Compare with average 10-year risk

Probability					
Age	Women	Men	Age	Women	Men
30-34	<1%	3%	55-59	12%	16%
35-39	<1%	5%	60-64	13%	21%
40-44	2%	6%	65-69	9%	30%
45-49	5%	10%	70-74	12%	24%
50-54	8%	14%			

These charts were prepared with the help of William B Kannel MD, Professor of Medicine and Public Health, and Ralph D'Agostino PhD, Head, Department of Mathematics, both at Boston University; Keaven Anderson PhD, Statistician, National Heart, Lung, and Blood Institute, Framingham Study; Daniel McGee PhD, Associate Professor, University of Arizona. Framingham Heart Study – National Heart, Lung, and Blood Institute. Reproduced with permission from the Risk Factor Prediction Kit, 1990, copyright American Heart Association

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STROKE RISK FACTOR PREDICTION CHART

1. Find points for each risk factor

Age	SBP	Men					
		HYP RX	Diabetes	Cigs	CVD	AF	LVH
54-56 = 0	95-105 = 0	No = 0	No = 0	No = 0	No = 0	No = 0	No = 0
57-59 = 1	106-116 = 1	Yes = 2	Yes = 2	Yes = 3	Yes = 3	Yes = 4	Yes = 6
60-62 = 2	117-126 = 2						
63-65 = 3	127-137 = 3						
66-68 = 4	138-148 = 4						
69-71 = 5	149-159 = 5						
72-74 = 6	160-170 = 6						
75-77 = 7	171-181 = 7						
78-80 = 8	182-191 = 8						
81-83 = 9	192-202 = 9						
84-86 = 10	203-213 = 10						

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Women							
Age	SBP	HYP RX	Diabetes	Cigs	CVD	AF	LVH
54-56 = 0	95-104 = 0	No = 0	No = 0	No = 0	No = 0	No = 0	No = 0
57-59 = 1	105-114 = 1	If yes see	Yes = 3	Yes = 3	Yes = 2	Yes = 6	Yes = 4
60-62 = 2	115-124 = 2	below					
63-65 = 3	125-134 = 3						
66-68 = 4	135-144 = 4	If currently under antihypertensive therapy, add the following points depending on SBP level					
69-71 = 5	145-154 = 5	SBP	95-104	105-114	115-124	125-134	135-144
72-74 = 6	155-164 = 6	Points	6	5	5	4	3
75-77 = 7	165-174 = 7	SBP	155-164	165-174	175-184	185-194	195-204
78-80 = 8	175-184 = 8						
81-83 = 9	185-194 = 9	Points	2	1	1	0	0
84-86 = 10	195-204 = 10						

AF History of atrial fibrillation?; Cigs Smokes cigarettes?; CVD History of myocardial infarction, angina pectoris, coronary insufficiency, intermittent claudication or congestive heart failure?; Diabetes History of diabetes?; HYP RX Under antihypertensive therapy?; LVH left ventricular hypertrophy on electrocardiogram?; SBP Systolic blood pressure.

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2. Sum points for all risk factors

Age	SBP	HYP RX	Diabetes	Cigs	CVD	AF	LVH	Point total
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3. Look up risk corresponding to point total

Men 10-year						Women 10-year					
Points	Probability	Points	Probability	Points	Probability	Points	Probability	Points	Probability	Points	Probability
1	2.6%	11	11.2%	21	41.7%	1	1.1%	11	7.6%	21	43.4%
2	3.0%	12	12.9%	22	46.6%	2	1.3%	12	9.2%	22	50.0%
3	3.5%	13	14.8%	23	51.8%	3	1.6%	13	11.1%	23	57.0%
4	4.0%	14	17.0%	24	57.3%	4	2.0%	14	13.3%	24	64.2%
5	4.7%	15	19.5%	25	62.8%	5	2.4%	15	16.0%	25	71.4%
6	5.4%	16	22.4%	26	68.4%	6	2.9%	16	19.1%	26	78.2%
7	6.3%	17	25.5%	27	73.8%	7	3.5%	17	22.8%	27	84.4%
8	7.3%	18	29.0%	28	79.0%	8	4.3%	18	27.0%		
9	8.4%	19	32.9%	29	83.7%	9	5.2%	19	31.9%		
10	9.7%	20	37.1%	30	87.9%	10	6.3%	20	37.3%		

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4. Compare with average 10-year risk

Average 1-year probability by age

Men		Men		Women		Women	
55-59	5.9%	70-74	13.7%	55-59	3.0%	70-74	10.9%
60-64	7.8%	75-79	18.0%	60-64	4.7%	75-79	15.5%
65-69	11.0%	80-84	22.3%	65-69	7.2%	80-84	23.9%

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Section 1: APPENDIX TABLE 2 - Cardiovascular Diseases Risk Factors

TABLE 2
Summary of risk factors for cardiovascular diseases

Risk factor	Target level	Evaluations	Recommendations	Research needs
Smoking	<ul style="list-style-type: none"> Complete cessation Avoidance of exposure to environmental tobacco smoke Limitation of international sales of tobacco products 	<ul style="list-style-type: none"> Quantify and document smoking and tobacco usage status Assess exposure to environmental tobacco smoke Prohibit use of tobacco products in presence of children 	<ul style="list-style-type: none"> Encourage individual and family to stop smoking Offer counselling and smoking cessation support Provide nicotine replacement or other therapeutic alternatives 	Determine <ul style="list-style-type: none"> predictors of smoking initiation in youth efficient prevention and cessation programs
Diabetes	<ul style="list-style-type: none"> Fasting glucose level between 4 and 7 mmol/L 	<ul style="list-style-type: none"> Screen all for microalbuminuria Screen for all other risk factors 	<ul style="list-style-type: none"> Diet and reduce weight Control blood glucose Add ASA 80 to 325 mg/day if there is another risk factor Treat dyslipidemia, hypertension and all other risk factors 	Determine <ul style="list-style-type: none"> risk of CVD with hyperglycemia cardioprotective role of tight glucose control effect of lipid-lowering medication in diabetes optimal antihypertensive medication in diabetes
Diet	<ul style="list-style-type: none"> Total fibre intake 20 to 35 g/day Limit total fat intake to 30% of total caloric intake 	<ul style="list-style-type: none"> Determine sodium consumption of hypertensive patients by interview 	<ul style="list-style-type: none"> Reduce or eliminate intake of trans fatty acids Reduce dietary sodium intake among hypertensive patients, particularly those 	<ul style="list-style-type: none"> Define effect of specific dietary nutrients on lipid profiles and development of CVD

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	<ul style="list-style-type: none"> • Reduce saturated fat to <8% of caloric intake • Consume up to 15% of fat as monounsaturated fatty acids • Consume <300 mg/day of cholesterol • Patients with known CVD should consume 150 g fish two to three times/week 		<p>over the age of 44 years, to a target range of 90 to 130 mmol/day (corresponds to 3 to 7 g of salt/day)</p> <ul style="list-style-type: none"> • Replace refined carbohydrates with complex (whole grain) carbohydrates • Restrict alcohol consumption to 2 drinks/day 	<p>in different populations</p> <ul style="list-style-type: none"> • Define effective dietary interventions for populations • Define effective dietary interventions for high risk populations or those with known CVD
Dyslipidemia	<ul style="list-style-type: none"> • Low density lipoprotein cholesterol <2.5 mmol/L or apolipoprotein B <90 mg/dL • In selected patients consider measuring the following in addition: - total cholesterol to high density lipoprotein cholesterol ratio and - triglyceride level and - level of high density lipoprotein cholesterol 	<ul style="list-style-type: none"> • Assess for all other risk factors • For high risk patients with CVD, determine annual fasting lipid profile • For patients with xanthomata or family history of early IHD <ul style="list-style-type: none"> - determine lipid profile once during youth - repeat at age 30 years - repeat every five years from age 40 years (men) or 50 years (women) • For adults with diabetes <ul style="list-style-type: none"> - determine lipid profile every one to three years • For men aged 40 to 70 years and women 50 to 70 years <ul style="list-style-type: none"> - determine lipid profile every five years 	<ul style="list-style-type: none"> • Implement strategies for <ul style="list-style-type: none"> – diet – weight reduction – physical activity • Treat high risk patients with statins to reduce low density lipoprotein to <2.5 mmol/L and/or apolipoprotein B to <90 mg 	<ul style="list-style-type: none"> • Define strategies to identify and treat children with dyslipidemia • Define effective population strategies for screening and therapy

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TABLE 2 - continued
Summary of risk factors for cardiovascular disease

Risk factor	Target level	Evaluations	Recommendations	Research needs
Hypertension	<ul style="list-style-type: none"> • BP <140/90 mmHg in adults • BP <95 percentile for age in children • BP <130/80 mmHg in persons with diabetes 	<ul style="list-style-type: none"> • Measure BP as part of routine visits • Routinely obtain four-limb BPs at least once during childhood 	<ul style="list-style-type: none"> • Attain desirable body weight • Reduce alcohol intake • Perform physical activity daily • Limit salt intake • Prescribe antihypertensive drug therapy for all patients with systolic BP 160 or diastolic BP 100 mmHg • Use thiazide, beta-blocker or angiotensin-converting enzyme inhibitor as first-line drug therapy 	<ul style="list-style-type: none"> • Identify prediction of essential hypertension in children • Identify safe and cost effective strategies to manage hypertension in children
Obesity	<ul style="list-style-type: none"> • Desirable weight BMI=18.5 to 24.9 kg/m² • Desirable WHR <0.9 for men and <0.8 for women 	<ul style="list-style-type: none"> • Measure weight and waist at periodic examination • Calculate BMI for all patients • Screen for other risk factors, especially hypertension, dyslipidemia, diabetes, tobacco usage and physical inactivity 	<p>Obese persons should</p> <ul style="list-style-type: none"> • have behavioural therapy (preferably with family support) • increase daily physical activities • consult nutritionist or dietician • Overweight children should have counselling involving the entire family 	<ul style="list-style-type: none"> • Determine Canada-specific percentiles for WHR and skinfold thicknesses for children • Implement innovative prevention programs for school-aged children
Physical inactivity	<ul style="list-style-type: none"> • Physical activity of moderate intensity for at least 30 mins, preferably each day for people of all ages • All persons with known CVD should have access to and benefit from cardiac rehabilitation 	<ul style="list-style-type: none"> • Quantify and document physical activities for all patients • Stratify patients according to low risk (good left ventricular function and no induced ischemia) and to high risk (poor left ventricular function and/or ischemia) and/or symptomatic dysrhythmia at low work load 	<ul style="list-style-type: none"> • Encourage a total of at least 30 mins of daily physical activity of moderate intensity • Whenever possible, increase the intensity of physical activity because it produces higher benefit • Target multiple risk factor interventions in cardiac rehabilitation programs • Make daily physical activity mandatory in 	<ul style="list-style-type: none"> • Develop interactions between physical activity and other lifestyle behaviours (diet, smoking, etc) • Define optimal intensity and volume of activity for CVD prevention (in different populations) • Define appropriate levels of fitness and assessment for return to work • Establish cost effective

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	programs		schools, and encourage it in postsecondary and workplace environments	accessibility to all persons, for all ethnicities and sexes • Identify determinants of physical activity across socioeconomic groups
Psychological risk factors	• Early amelioration or elimination of poor or absent social support as a risk factor	• Routinely assess for depression, anxiety and social support in high risk patients or those known to have CVD	• Apply a psychological assessment and, if necessary, treatment for all high risk patients or those known to have CVD	• Identify the pathophysiological mechanisms by which psychosocial factors promote CVD • Conduct cohort studies to determine whether the risks associated with depression, anxiety and lack of social support are independent of one another • Assess the impact of modification of psychological risk factors on CVD

ABI Ankle brachial index;
ASA Acetylsalicylic acid;
BMI Body mass index;
BP Blood pressure;
CVD Cardiovascular disease;
IHD Ischemic heart disease;
PAD Peripheral arterial disease;
WHR Weight to height ratio

TABLE 2 – continued
Summary of risk factors for cardiovascular disease

Risk factor	Target level	Evaluations	Recommendations	Research needs
Socioeconomic and social risk factors	• Cardiac specialists and other health care providers should be aware of the contribution of socioeconomic status and social risk factors to CVD and should participate in attempts to decrease social and	• Routinely assess socioeconomic status and social support in patients being assessed or treated for CVD	• Consider literacy and language/culture in producing patient and population materials • Support policies that promote healthy child development, especially among low income families • Apply risk factor reduction to all people	• Include ethnic-specific data in data collection • Determine the effect of policies that decrease income inequality and social division on CVD • Clarify why biological.

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	socioeconomic status risk factors		(males and females equally, the elderly, ethnic groups)	behavioural, psychological and social risk factors are differently distributed by socioeconomic status <ul style="list-style-type: none"> Regularly collect data and conduct surveillance of CVD risk factors and outcomes across Canada and for all levels of socioeconomic status, age and ethnic groups
Other risk factors				<ul style="list-style-type: none"> Conduct a national survey of CVD risk factors in children and adolescents across Canada
Atrial fibrillation	<ul style="list-style-type: none"> Prevention of stroke and other emboli 	<ul style="list-style-type: none"> Regularly assess cardiac rhythm in all patients, particularly the elderly 	<ul style="list-style-type: none"> Prescribe anticoagulation if it is not contraindicated; in patients <65 years of age with no other risk factors or if patients are not suitable for anticoagulation, use ASA (if no contraindication) 	
Oral contraceptive pills in young women who smoke or are hypertensive	<ul style="list-style-type: none"> Prevention of stroke 	<ul style="list-style-type: none"> Inquire about oral contraceptive use in all women <35 years of age who smoke or are hypertensive 	Stop smoking and have hypertension controlled; otherwise, oral contraceptives should be discontinued	
Hormone replacement		<ul style="list-style-type: none"> Assess hormonal 	<ul style="list-style-type: none"> Give estrogens if they are not contraindicated. 	<ul style="list-style-type: none"> Further studies are needed

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therapy in patients with IHD		replacement therapy in all menopausal women	Until new evidence is available, progesterone should not be used in patients with IHD	
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TABLE 2 – continued
Summary of risk factors for cardiovascular disease

Risk factor	Target level	Evaluations	Recommendations	Research needs
Peripheral arterial disease	<ul style="list-style-type: none"> To improve functional capacity and reduce other risk factors in patients with PAD <ul style="list-style-type: none"> walk continuously for 1 h three Times/week ABI 0.95 to 1.00 	<ul style="list-style-type: none"> Measure ABI routinely in screening programs for prevention of atherosclerosis 	<ul style="list-style-type: none"> In patients with symptoms of PAD and asymptomatic individuals with abnormal ABI, assess for the presence of other risk factors for atherosclerosis In patients with PAD, vigorously modify other risk factors In patients with symptomatic or asymptomatic PAD, give antiplatelet agents and encourage participation in an ongoing walking exercise program Manage skin lesions early and practise Intense foot care 	<ul style="list-style-type: none"> Include patients with symptomatic and asymptomatic PAD in cardiovascular studies of prevention of atherosclerosis Determine overlap of coexistence of PAD, IHD and cerebrovascular disease Determine cost effectiveness of various interventions for PAD
Coagulation factors	<ul style="list-style-type: none"> To reduce recurrent event in all patients with CVD and prevent CVD events in persons with diabetes 		<ul style="list-style-type: none"> In all patients with CVD or diabetes give ASA if not contraindicated 	<ul style="list-style-type: none"> Conduct further research on fibrinogen and other coagulation risk factors
Elevated homocysteine levels in high risk persons	<ul style="list-style-type: none"> Assess homocysteine in young patients with CVD 		<ul style="list-style-type: none"> Give folic acid 0.8 to 2 mg/day 	<ul style="list-style-type: none"> Screen families of patients <55 years of age with known CVD for risk factors Randomized trials are in progress

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Elevated lipoprotein(a) levels in high risk persons			<ul style="list-style-type: none"> • Use antithrombotic therapy and lipid-lowering agents empirically 	<ul style="list-style-type: none"> • Conduct further studies on lipoprotein(a) as a risk factor and on its reduction
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BP Blood pressure;
CVD Cardiovascular disease;
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Section 2: The global burden of cardiovascular diseases

David R MacLean MD, Arun Chockalingam PhD

Over the last quarter of this century, the world has witnessed the development of a global pandemic of cardiovascular diseases (CVD) (1). These diseases, particularly acute ischemic heart disease (IHD) and stroke, account for over 15 million deaths per year, which accounts for about 30% of all deaths worldwide (2). Several million more per year are disabled by these conditions, or are struck down prematurely before the age of 65 years. It has been estimated that by the year 2020 up to 40% of all deaths worldwide will result from CVD (3).

CVD are an important cause of mortality, morbidity and potential years of life lost in most areas of the world. They are the leading cause of disability, loss of productivity and deterioration in the quality of life in many countries. Care of patients with CVD, where available, uses up a large share of health budgets devoted to health care. While the information required to quantify these costs for most areas of the globe is lacking, for many countries of the world, CVD place a heavy burden in social and economic terms.

The epidemic is at different stages of development in different regions of the world, closely linked to a country's economic development. This situation results from an epidemiological transition that has occurred, to one degree or another, in many regions of the world over the past two to three decades. (In this document, epidemiological transition is defined as the shift

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indisease burden in a population from that primarily related to infectious disease to that related to noncommunicable diseases, and that usually accompanies industrialization and urbanization.) This transition is characterized by declines in fertility, infant mortality, and mortality from infectious and nutritional deficiency diseases, coupled with increasing life expectancy and aging of the population.

These demographic changes have been accompanied by increases in urban migration and exposure to a host of un-healthy environmental and psychosocial factors, especially the uptake of physical inactivity, smoking and high caloric, high fat foods on a mass scale in many societies. These lifestyles have led to an increase in the prevalence of high blood pressure, elevated blood cholesterol, smoking, obesity and diabetes.

Clearly, as the 20th century comes to a close, CVD present a major global public health problem. Research over the past 30 years has demonstrated that a substantial proportion of CVD can be prevented or effectively controlled (4,5). The application of this knowledge throughout the world poses a significant public health challenge for the 21st century.

OVERVIEW OF THE GLOBAL DISEASE BURDEN FROM CVD

Overall, although the availability of basic and reliable data on CVD in many of the regions of the world is limited, it appears that developing countries now contribute a greater proportion of the global burden of CVD than developed countries. It has been estimated that 5.3 million deaths resulted from CVD in developed countries in 1990, compared with more than 8 million deaths in developing countries. IHD was the leading cause of death in the world in 1990, accounting for 6.3 million deaths. Of these deaths, 2.7 million occurred in developed countries and 3.6 million in developing countries. Cerebrovascular disease was the second most common cause of death worldwide, with 4.4 million deaths, of which almost 3 million occurred in developing regions of the world (3).

When viewed from the perspective of the probability of death, adults under the age of 70 years are at a greater risk of dying from CVD in the poorer regions of the world, such as sub-Saharan Africa and India, than in countries with established market economies. Likewise, premature

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mortality rates from diseases such as CVD are higher in populations with high general mortality and low income than in the industrialized countries (3).

REGIONAL BURDEN OF CVD

Because of changing lifestyles and the aging of the population, IHD is of increasing concern in Africa. In sub-Saharan Africa, IHD causes 26% of all CVD death. Although the occurrence of fatal IHD is low by global standards, hypertension rates are approaching those in developed countries, and stroke is the leading cause of CVD death in sub-Saharan Africa. Most affected individuals with high blood pressure are either not treated or ineffectively treated (6).

Rheumatic heart disease is a major cause of premature mortality and accounts for 1% to 6% of all CVD death in the region. Cardiomyopathies are also a common problem.

In the Americas, the bulk of mortality and morbidity results from CVD. The majority of countries of Central and South America are undergoing epidemiological transition. The highest CVD mortality rates are found in the English-speaking Caribbean, North America and the Southern Cone, with the lowest rates in the Latin Caribbean and Central America (7). In general, CVD rates have dropped over the past 20 years in the Americas, with the exception of El Salvador, Guatemala and the Dominican Republic, where they rose. While both IHD and stroke are important illnesses in these regions, the relative position of the two has changed over the past two decades. There has been a proportional rise in the importance of IHD as a cause of death. In countries where death rates from IHD have been declining, the reductions have been in all age and sex groups. In general, the reductions have been proportionally greater in the younger ages and in women.

The Eastern Mediterranean region constitutes a classical example of countries in the midst of epidemiological transition. Over the past two decades, the population of the region almost doubled, reaching approximately 400 million in 1990. Life expectancy increased from 56 years to 62 years from 1985 to 1990 (8). Throughout this period, there was a steady shift from the traditional and rural lifestyles to more urbanized and industrialized patterns, which was accompanied by increasing rates of smoking, obesity and a growing prevalence of hypertension and diabetes. Although CVD rates vary within the region, the proportion of deaths

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attributable to these diseases ranges from 25% to 45%. Although data sources are limited, IHD appears to be the major CVD found in the population, particularly in Jordan and Kuwait. Although rheumatic heart disease continues to be a major problem in some of the countries of the region, its prevalence is in decline. In Kuwait for example, the mortality from rheumatic heart disease fell by 70% between 1979 and 1984 (8).

The ongoing social and economic changes in Central and Eastern Europe and in the newly independent states of the former Soviet Union have occurred concurrently with alarming rises in CVD death rates. Although CVD death rates are falling in some Western European countries, in about half of the 49 European countries, CVD mortality rates (before age 65) increased between 1985 and 1992. Previously, high rates of hypertension, hypercholesterolemia, smoking and obesity increased further during this same period (9).

In the Southeast Asian region that includes some of the poorest countries in the world, CVD are becoming a leading cause of mortality, and IHD accounts for half of these deaths in India, while stroke is the leading cause of CVD death in China (10). Hypertension has been found to affect up to 15% of the population in India, Indonesia and Thailand. Although diabetes is rare in rural areas, its prevalence in urban populations is similar to rates observed in industrialized countries.

Increasing prevalence of hypertension, diabetes, smoking and obesity are also observed in the Western Pacific region. There have been some stark differences within the region: in recent years, Australia, Japan, New Zealand and Singapore have shown a decrease in morbidity and mortality from CVD, while in other countries of the region, including Malaysia, Republic of Korea, Philippines and Fiji, disease rates are on the rise.

Significant health care resources have been invested to organize specialized services using sophisticated diagnostic and treatment technologies that are often not universally affordable due to high cost in developed countries (11). As a control strategy, this approach has its limitations given that most CVD have a long preclinical period, with symptomatic manifestations occurring at an advanced stage of the disease (12). This approach is not

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feasible or sustainable as a means to serve the needs of the total population for most countries of the world.

It is clear that cardiovascular health is declining for a substantial proportion of the world's population. Many developing countries now suffer a double burden of high rates of both communicable diseases and noncommunicable diseases, principally CVD. Unfortunately, projections suggest that the global disease burden from CVD will continue to increase in the next century unless significant preventive intervention occurs.

RESEARCH NEEDS AND RECOMMENDATIONS

Enough is known about CVD to take action now (13). A multidisciplinary research agenda needs to be supported to address a wide spectrum of prevention issues in developing countries. For example, operational and behavioural re-search is needed to facilitate implementation of sustainable community interventions and their evaluation; policy re-search is needed regarding health systems and their financing, particularly with respect to the determinants of consumer behaviour and that of health care providers; re-search is also needed on cost effective technology transfer with respect to the prevention and management of CVD in countries and regions of the world with few resources.

Timely, current and accurate information at an affordable cost on a global scale is essential to the success of activities for CVD prevention and control. It is required for effective planning, implementation, and evaluation of programs and services, as well as to assist with policy development and marketing. An important feature of information systems in this regard is their ability to provide decision makers with information concerning trends. Central to this function is the concept of tracking.

For the development and monitoring of public health policy for CVD prevention and control, tracking information over time with respect to trends for such things as mortality, morbidity, disease rates, and the prevalence of risk factors and their sociocultural determinants is necessary. In addition, monitoring systems need to incorporate indicators to evaluate the process of health system adjustment and reorientation. Finally, the capacity of monitoring

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systems will need to be increased to track policy-related indicators in order to contribute to the overall assessment of health promotion and policy-based outcomes.

Overall, there is a paucity of information with respect to effective strategies for the prevention of CVD, which poses a significant barrier to effective policy and program development, including marketing, at the community, national and international levels.

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REFERENCES

1. Lopez AD. Assessing the burden of mortality from cardiovascular disease. World Health Stat Q 1993;46:91-6.
2. Conquering Suffering, Enriching Humanity: The World Health Report 1997. Geneva: World Health Organization, 1997.
3. Murray CJ, Lopez AD. The Global Burden of Disease: A Comprehensive Assessment of Mortality and Disability from Diseases, Injuries, and Risk Factors in 1990 and Projected to 2020. Cambridge: Harvard University Press, 1996:17,176,178.
4. Reddy KS, Yusuf S. Emerging epidemic of cardiovascular disease in developing countries. Circulation 1998;97:596-601.
5. Leaf A, Ryan TJ. Prevention of coronary artery disease: a medical imperative. N Engl J Med 1990;323:1416-9.
6. Muna WFT. Cardiovascular disorders in Africa. World Health Stat Q 1993;46:126-32.
7. Health Conditions in the Americas. Pan Am Health Org 1994;549:217-25.
8. Alwan AAS. Cardiovascular diseases in the Eastern Mediterranean Region. World Health Stat Q 1993;46:97-100.
9. Health in Europe [WHO Regional Publications, European Series, No 56]. Copenhagen: WHO Regional Office for Europe, 1994.
10. AdHoc Committee on Health Research Relating to Future Intervention Options. Summary of Investing in Health Research and Development [Document TDR/GEN/96.2]. Geneva: World Health Organization, 1996:43-5.
11. Economic Burden of Illness in Canada, 1993. Ottawa: Health Protection Branch, LCDC, Health Canada, 1997.

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12. Rose G. Sick populations and sick individuals. Int J Epidemiol 1985;14:32-8.
13. The Victoria Declaration on Heart Health. Advisory Board of the International Heart Health Conference, British Columbia, 1992. Ottawa: Health and Welfare Canada, Heart and Stroke Foundation of Canada, 1993.

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Section 2: The burden of cardiovascular diseases in Canada

Bruce Reeder MD FRCPC, Gregory Taylor MD FRCPC

The burden that cardiovascular diseases (CVD) place on Canadians is great and expected to increase further in the coming decades. CVD are the leading cause of death in Canada. In 1995, CVD accounted for 79,117 deaths or 37% of all deaths. Of these deaths, 40,085 occurred in men, while 39,023 occurred in women, accounting for 36% and 39% of deaths in men and women, respectively (1). Men experience approximately twice the mortality rates of women for ischemic heart disease (IHD) and myocardial infarction (MI) until after age 75 years, when the difference in rates diminishes (Table 1). The difference in mortality rates between men and women is considerably less with respect to stroke. Mortality rates for the major categories of CVD rise steeply with age, reflecting both increased incidence and decreased survival in the older age groups. Canadians from lower socioeconomic groups and aboriginal Canadians suffer from higher CVD mortality rates than the remainder of the population, while those in the Atlantic provinces experience higher rates than those in the West (Tables 2,3) (2,3). CVD are responsible for the loss of nearly 300,000 potential years of life, making it the third leading cause of premature death after injuries and cancer (1).

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TABLE 1

Age-specific mortality rate per 100,000 – All cardiovascular diseases, males and females, Canada, 1995

		Age group (years)					
	Sex	35 to 44	45 to 54	55 to 64	65 to 74	75 to 84	Over 85
IHD	M	19	78	267	702	1825	4020
	F	4	19	85	296	1029	3163
AMI	M	11	45	161	385	924	1662
	F	2	11	51	173	542	1251
Stroke*	M	4	11	37	159	568	1639
	F	3	10	28	103	450	1688
Other CVD	M	8	19	71	231	714	2122
	F	4	10	36	129	477	2099
All CVD	M	31	109	376	1092	3107	7781
	F	11	39	149	528	1956	6950

***International Classification of Diseases, 9th edn [ICD-9] 430-438. AMI Acute myocardial infarction (heart attack; AMI is a subcategory of ischemic heart disease [IHD]); CVD Cardiovascular disease (ICD-9 390-459); F Female; M Male. Data from reference 18 and Statistics Canada*

TABLE 2

Age-standardized, sex-specific mortality rates* per 100,000 – All cardiovascular diseases, males, provincial comparisons, Canada, 1995

Province	IHD **			Stroke ***	Other CVD	All CVD
	AMI	Other IHD	Total IHD			
Newfoundland	103	97	201	52	69	317
Prince Edward Island	99	82	181	57	74	312
Nova Scotia	84	83	167	35	74	278
New Brunswick	86	65	151	45	83	280
Quebec	95	68	163	39	59	260

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Ontario	76	84	160	42	51	252
Manitoba	85	80	165	49	68	283
Saskatchewan	82	66	148	39	72	258
Alberta	61	77	139	38	63	240
British Columbia	74	55	128	42	55	226
Canada	81	74	155	41	58	254

**Standardized to 1991 Canadian male population; †International Classification of Diseases, 9th edn [ICD-9] 410-414; ‡ICD-9 430-438. AMI Acute myocardial infarction (heart attack; AMI is a subcategory of ischemic heart disease [IHD]); CVD Cardiovascular disease (ICD-9 390-459). Data from reference 18 and Statistics Canada*

TABLE 3

Age-standardized, sex-specific mortality rates* per 100,000 – All cardiovascular diseases, females, provincial comparisons, Canada, 1995

Province	IHD **			Stroke ***	Other CVD	All CVD
	AMI	Other IHD	Total IHD			
Newfoundland	77	97	147	65	80	294
Prince Edward Island	76	65	141	45	69	255
Nova Scotia	62	56	118	57	78	253
New Brunswick	51	59	110	53	82	245
Quebec	69	57	125	49	59	235
Ontario	57	71	128	57	56	243
Manitoba	65	66	131	60	69	259
Saskatchewan	50	50	99	52	68	222
Alberta	48	62	109	56	76	243
British Columbia	53	42	94	57	64	219
Canada	59	61	120	55	62	239

**Standardized to 1991 Canadian female population; †International Classification of Diseases, 9th edn [ICD-9] 410-414; ‡ICD-9 430-438. AMI Acute myocardial infarction (heart attack; AMI is a subcategory of ischemic heart disease [IHD]); CVD Cardiovascular disease (ICD-9 390-459). Data from reference 18 and Statistics Canada*

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Incidence rates of CVD, that is, the number of new cases arising in a given population during a specific time interval, can be best derived from cohort studies. In certain circumstances, measures of health service use may approximate disease incidence rates (4,5). The Quebec Cardiovascular Study, a 16-year follow-up of a cohort of men aged 35 to 64 years in 1972, reported incidence rates for first nonfatal MI of 4.9/1000/year, fatal MI of 0.8/1000/year and sudden death of 1.3/1000/year (6). The Nova Scotia-Saskatchewan Study, using validated hospital separation diagnoses, reported slightly lower incidence rates for 25- to 74-year-old men in those two provinces, while, for women, the incidence rate for first nonfatal MI was estimated at 1.1/1000/year and first fatal MI (including sudden death) at 0.55/1000/year in Nova Scotia (0.9 and 0.4, respectively, in Saskatchewan) (4). The Canadian Collaborative Study Group of Stroke Hospitalizations found that annual incidence rates of first and recurrent cerebral infarction (*International Classification of Diseases*, 9th edn [ICD-9] 434 and 436) in 1992 ranged from 2.3 (55 to 64 years of age) to 24.2/1000 (85 years of age or older) in men and from 1.2 to 19.8/1000 in women, respectively. The comparable rates for intracerebral hemorrhage (ICD-9 431) were 0.3 to 1.1/1000 in men and 0.2 to 0.9/1000 in women (5).

Since a peak in the mid-1960s, the incidence rates of IHD and MI have declined in the American and European populations that have been studied prospectively (7-9). This trend has been observed as well in Canada (4). Between 1982 and 1991, the incidence rates of cerebral infarction in Canada declined by 11% in men and 7% in women, while those of intracerebral hemorrhage rose by 44% and 34%, respectively (5). The overall downward trend for cerebral infarction, however, masks a levelling off in the latter half of that period, an observation that is consistent with similar American and European reports (10-12).

Up to 42% of men experiencing their first MI die suddenly as a result of it before reaching hospital (4,6). In those admitted, the 28-day case fatality rates declined from 20% in the early 1980s to approximately 10% by the mid-1990s (6,13,14). Case fatality rates for stroke, too, have decreased during the past decade. For individuals aged 75 to 84 years, for example, the 30-day case fatality rate from cerebral infarction declined from 20% in 1982 to 16% in 1992, while that for intracerebral hemorrhage declined from 66% to 45% (5).

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With substantial improvements in survival following MI and stroke, and rather slowly declining incidence rates, one may expect to observe during the coming years an increasing prevalence in the general population of individuals who have suffered these events. The 1990 Heart Health Surveys in Quebec and Saskatchewan have demonstrated that at least 5% of men and 7% of women aged 55 to 74 years have symptoms of angina, 10% and 1%, respectively, have a history of MI, and 5% and 4%, respectively, have a history of previous stroke (15,16).

The etiology of IHD is multifactorial and a field of active research. Four major modifiable risk factors are recognized: smoking, high blood pressure, dyslipidemia and physical inactivity. The Canadian Heart Health Surveys demonstrate an increasing prevalence in smoking and high blood pressure from west to east across Canada (3) that may account for part of the gradient in IHD mortality (Table 4). The exceptions to this pattern are rates of high blood pressure in Quebec and smoking in Ontario, which are among the lowest. The prevalence of dyslipidemia is relatively uniform across the country.

TABLE 4											
Percentage of population aged 18 to 74 years with selected cardiovascular disease risk factors by province and in Canada overall, 1986 to 1992											
Risk factors	BC	AB	SK	MB	ON	PQ	NB	NS	PE	NF	Canada*
At least one major factor**	70	69	70	77	74	79	79	79	78	82	75
Major risk factors											
Regular smoking***	25	27	23	25	23	32	31	33	29	36	27
High blood pressure ⁺	20	17	21	22	23	19	26	25	24	27	21
Elevated blood cholesterol ⁺⁺	46	36	44	40	42	49	47	45	44	42	44
Sedentary lifestyle ⁺⁺⁺	29	37	30	45	39	37	45	42	44	48	38
Other risk factors											
Obesity [#]	28	33	35	36	33	28	36	36	37	41	31
Diabetes ^{##}	4	5	5	5	4	5	5	-	4	5	5

*Excluding Yukon Territory and the Northwest Territories; †Major risk factors are regular smoking, high blood pressure, elevated blood cholesterol and sedentary lifestyle; ‡One or more cigarettes per day, every day; §Diastolic blood pressure more than 90 mmHg or systolic blood

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pressure more than 140 mmHg and/or pharmacological or nonpharmacological treatment; ¶¶Total plasma cholesterol more than 5.2 mmol/L; **Respondents not physically active during leisure time at least once a week during the month preceding the survey; ††Body mass index more than 27 (Body mass index = weight [kg]/height squared [m²]); ‡‡Self-reported diabetes; information not collected in Nova Scotia. AB Alberta; BC British Columbia; MB Manitoba; NB New Brunswick; NF Newfoundland; NS Nova Scotia; ON Ontario; PE Prince EdwardIsland; PQ Quebec; SK Saskatchewan. Data from reference 3

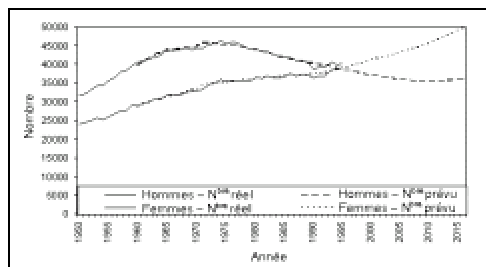


Figure 1) Number of cardiovascular disease deaths (International Classification of Diseases, 9th edn [ICD-9] 390 to 459) – Actual and projected, men and women, Canada, 1950 to 2015. Reproduced from reference 19

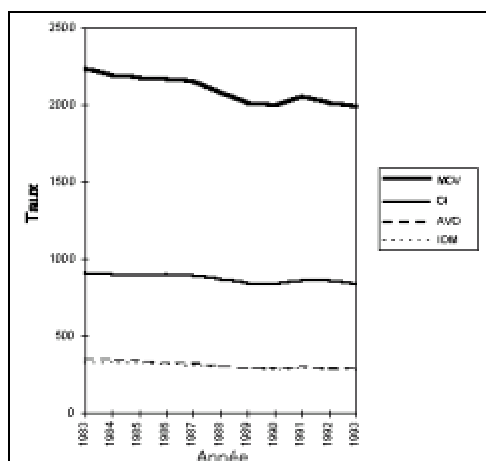


Figure 2) Age-standardized hospital separation rate per 100,000 for men living in Canada from 1983 to 1993. AMI Acute myocardial infarction; CVD Cardiovascular disease; IHD Ischemic heart disease. Data from reference 18 and Statistics Canada

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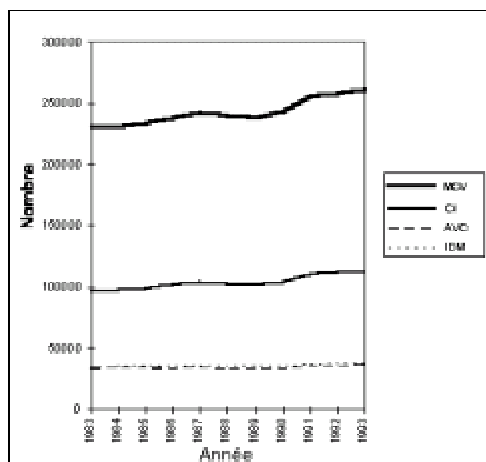


Figure 3) Nombre de congés de l'hôpital pour les hommes vivant au Canada de 1983 à 1993. CI : cardiopathie ischémique; AVC : accident vasculaire cérébral; IDM : infarctus du myocarde; MCV : maladies car-dio-vasculaires. Source : référence 18 et Statistique Canada

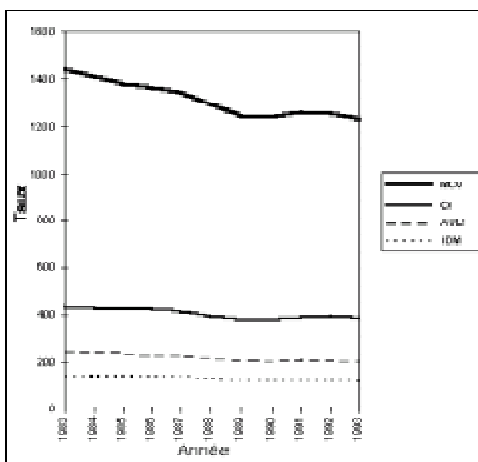


Figure 4) Taux de congé de l'hôpital, normalisés selon l'âge, par 100 000 femmes vivant au Canada de 1983 à 1993. CI : cardiopathie ischémique; AVC : accident vasculaire cérébral; IDM : infarctus du myocarde; MCV : maladies cardio-vasculaires. Source : référence 18 et Statistique Canada

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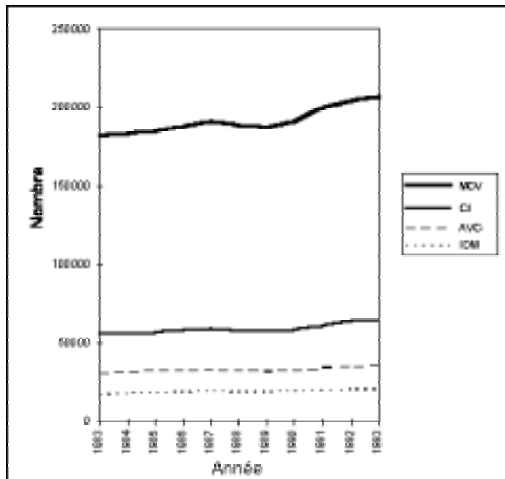


Figure 5) Nombre de congés de l'hôpital pour les femmes vivant au Canada de 1983 à 1993. CI : cardiopathie ischémique; AVC : accident vasculaire cérébral; IDM : infarctus du myocarde; MCV : maladies car-dio- vasculaires. Source : référence 18 et Statistique Canada

A basic cardiovascular surveillance system exists in Canada through a partnership between the LCDC at Health Canada and Statistics Canada. It is limited in scope, with data primarily extracted from the national mortality and hospital discharge databases. This core information is augmented from other occasional sources, such as the Canadian Heart Health Database. The purpose of a surveillance system is to provide timely and ongoing information to allow evidence-based decisions around CVD prevention and control activities. However, the current system is inadequate because it lacks basic information on disease incidence, prevalence, trends in risk factors, intervention outcomes and economic burden. Canada needs an enhanced CVD surveillance system. To this end, LCDC is spearheading the development of a CVD surveillance network in an attempt to achieve national consensus on the content, scope, frequency, output and evaluation of a comprehensive surveillance system. This effort involves collaboration with various

governmental organizations such as the Canadian Institutes of Health Information, Statistics Canada, provincial health departments and various cardiovascular organizations, such as the Heart and Stroke Foundation of Canada and the Canadian Cardiovascular Society. The intent of the surveillance system is to use modern electronic technology to access and analyze information from multiple databases across the country rather than create a single large database.

CVD are a large and changing burden on the health of Canadians. Over 40% of the mortality of acute MI occurs before hospitalization and, hence, before the provision of several effective modes of therapy. Although incidence rates are falling because patients are surviving longer, the prevalence of individuals with CVD in our communities is likely to rise. The absolute number of men and women presenting to health facilities for care and dying from CVD is

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projected to rise. Furthermore, if the prevalence of risk factors among women and youth rises, as prevalence of smoking has, incidence rates of CVD may also rise in the years ahead. To lessen the impact of these changes, Canadians need to focus on disease prevention. The country's health and social systems should plan for an increased load and, possibly, a changing face of CVD.

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REFERENCES

1. Heart Disease and Stroke in Canada. Ottawa: Heart and Stroke Foundation of Canada, 1997.
2. Mao Y, Moloughney BW, Semenciew R, Morrison H. Indian reserve and registered indian mortality in Canada. Can J Public Health 1992;83:350-3.
3. Canadians and Heart Health: Reducing the Risk. Ottawa: Health Canada, 1995.
4. Nova Scotia-Saskatchewan Cardiovascular Disease Epidemiology Group. Trends in incidence and mortality from acute myocardial infarction in Nova Scotia and Saskatchewan, 1974 to 1985. Can J Cardiol 1992;8:253-8.
5. Mayo NE, Neville D, Kirkland S, et al. Hospitalization and case-fatality rates for stroke in Canada from 1982 through 1991. The Canadian Collaborative Study Group of Stroke Hospitalizations. Stroke 1996;27:1215-20.
6. Dagenais GR, Cantin B, Dagenais F, Lupien PJ, Robitaille NM, Bogaty P. Importance of outside hospital mortality as a first acute ischemic heart event: The Quebec Cardiovascular Study. Can J Cardiol 1996;12:914-8.
7. Sytkowski PA, D'Agostino R, Belanger A, Kannel WB. Sex and time trends in cardiovascular disease incidence and mortality: The Framingham Heart Study, 1950-1989. Am J Epidemiol 1996;143:338-50.
8. Immonen-Raiha P, Arstila M, Tuomilehto J, et al. 21 year trends in incidence of myocardial infarction and mortality from coronary disease in middle-age. Eur Heart J 1996;17:1495-502.
9. Hunink MGM, Goldman L, Tosteson ANA, et al. The recent decline in mortality from coronary heart disease, 1980-1990. The effect of secular trends in risk factors and treatment. JAMA 1997;277:535-42.

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10. Broderick JP, Phillips SJ, Whisnant JP, O'Fallon WM, Bergstralh EJ. Incidence rates of stroke in the eighties: the end of the decline in stroke? *Stroke* 1989;20:577-82.
11. Wolf PA, D'Agostino RB, O'Neal MA, et al. Secular trends in stroke incidence and mortality. The Framingham Study. *Stroke* 1992;23:1551-5.
12. Thorvaldsen P, Kuulasmaa K, Rajakangas AM, Rastenyte D, Sarti C, Wilhelmsen L. Stroke trends in the WHO MONICA project. *Stroke* 1997;28:500-6.
13. Naylor CD, Chen E. Population-wide mortality trends among patients hospitalized for acute myocardial infarction: The Ontario experience, 1981 to 1991. *J Am Coll Cardiol* 1994;24:1431-8.
14. Rouleau JL, Talajic M, Sussex B, et al. Myocardial infarction patients in the 1990s - their risk factors, stratification and survival in Canada: The Canadian Assessment of Myocardial Infarction (CAMI) Study. *J Am Coll Cardiol* 1996;27:1119-27.
15. Reeder BA, Liu L, Horlick L. Sociodemographic variation in the prevalence of cardiovascular disease in Saskatchewan: Results from the Saskatchewan Heart Health Survey. *Can J Cardiol* 1996;12:271-7.
16. Daveluy C, Chenard L, Levasseur M, Emond A. Et votre coeur, ça va? Rapport de l'Enquête québécoise sur la santé cardiovasculaire 1990. Montréal: Ministère de la Santé et des Services sociaux, Gouvernement du Québec, 1994.
17. Moore R, Mao Y, Zhang J, Clarke K. Economic Burden of Illness in Canada, 1993 [Catalogue No H21-136/1993E]. Ottawa: Environmental Risk Assessment and Case Surveillance Division, Laboratory Centre for Disease Control, 1997.
18. Health Protection Branch, Laboratory Centre for Disease Control, Health Canada. Disease Surveillance Online. <http://www.hc-sc.gc.ca/hpb/lcdc/webmap/>.
19. The Changing Face of Heart Disease in Canada. Ottawa: Heart and Stroke Foundation of Canada, 1999.

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Section 3: Prevention and control of risk factors among children and youth

Gilles Paradis MD, Brian McCrindle MD

Cardiovascular risk factors begin at an early age. The major modifiable cardiovascular risk factors in children and youth are related to lifestyles such as smoking, obesity and physical inactivity, and to biological factors such as hyperlipidemia and hypertension.

TOBACCO PRODUCTS

Surveys of school-aged youth indicate that between 14% and 25% of children smoke their first cigarette by age 12 years. Daily cigarette use usually begins by age 16 years (1). Younger age at onset of smoking is problematic for many reasons. Any cigarette use places the individual at higher risk for subsequent use, and the severity of nicotine addiction is worst among those who start smoking at an earlier age. Early smokers are less likely to quit and are at higher risk of smoking-attributable death (2,3). In addition, cigarette smoking is often a gateway drug for youth, leading to experimentation with illicit drugs (4).

Tobacco use among Canadian youth aged 15 to 19 years decreased from 43% in 1981 to 20% in 1990 (5), but increased to 24% in 1994 and to 29% in 1996-97 (6). This is an increase of almost 40% since 1990. In particular, smoking prevalence among high school students aged 14 years and over is now 33% and, among girls, 40% (6). The age at which children smoke their first cigarette is decreasing. A recent study in Montreal showed that the average age of the first puff was 8.1 years for boys and 8.8 years for girls (7).

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Environmental tobacco smoke poses a threat to an even greater number of children. It has been estimated that 2.8 million children (50% of all children) in Canada are exposed to environmental tobacco smoke, increasing their risk of sudden infant death syndrome, otitis media, other respiratory tract infections and asthma.

Because children who do not smoke before their 21st birthday are unlikely ever to smoke, and because it is very difficult to stop smoking once addiction to nicotine is established, efforts must be directed toward preventing smoking experimentation among children and youth (1).

Smoking progresses through five fairly well described stages: preparation, initiation, experimentation, regular smoking and addiction. Studies have also identified risk factors for these stages (1). For example, parental and sibling smoking seems to shape the values and beliefs of children regarding smoking (preparation stage) and to a lesser degree predicts initiation and experimentation of smoking. Peer influences strongly predict these latter two stages, as do individual personality traits such as self-esteem.

Significant reductions in smoking prevalence have been achieved by school-based prevention programs that teach adolescents skills to resist social influences to smoke (1). The effectiveness of school-based programs seems to be enhanced by comprehensive school health education, by environmental and policy changes such as the availability of nonsmoking areas and policies, and by community-wide programs that involve parents. Increases in the real price of cigarettes also reduce smoking by children and adolescents. However, cessation programs for adolescents have low success rates. Recently, increased use of other tobacco products, particularly chewing tobacco, has been noted among some youth groups.

RECOMMENDATIONS

Offer cessation counselling to parents who smoke (see general smoking recommendations) (Level I, Grade A).

Strongly recommend to parents who smoke to avoid smoking in the presence of their children (Level III, Grade A).

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Recommend to all parents to discuss smoking prevention with their children and to establish a nosmoking rule in their house (**Level III, Grade A**). Recommend to their pediatric patients not to experiment with smoking and offer brief behavioural counselling on refusal skills (**Level III, Grade A**).

Enforce a strict no-smoking policy in their offices (**Level III, Grade A**).

Promote and support smoking prevention education and no-smoking policies at local schools (**Level III, Grade A**).

Support national policies to prohibit the sale of tobacco products to children and youth, including increases on tobacco taxes (**Level II, Grade A**).

RESEARCH RECOMMENDATIONS

Identify the predictors of smoking initiation, experimentation and use among Canadian youth.

Characterize the influence of family, socioeconomic status and ethnic origin on the process of smoking initiation and experimentation.

Identify more effective prevention programs and, in particular, programs for elementary school children to prevent the earliest stages in the process of smoking or tobacco use.

OBESITY

Obesity is defined as the presence of excess adipose tissue. Clinical standards for defining obesity in children are not well established. The American Heart Association recommends that any child with weight-for-height above the 75th percentile for age and sex or who has significantly increased his weight-for-height percentile and who suffers from a morbidity that would be worsened by obesity (dyslipidemia, diabetes or hypertension) should be considered obese (8). For adults and adolescents, the American Heart Association defines obesity as a body mass index (BMI) ($[\text{weight in kg}]/[\text{height in m}]^2$) of 30 or greater, or a body weight-for-height of 130% or more of ideal. However, there are no Canadian standards for defining obesity in adolescents.

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Among children, changes in body composition as a result of growth preclude the use of a single measure for assessment of body fat. At present, a combination of weight-for-height for age and sex, and a measure of skinfold thickness (sub-scapular or triceps) is the most accepted method for evaluation of body fat in children. Elevated body weight-for-height and obesity are major public health problems among children and youth because of their high prevalence, and because of the immediate and long term consequences on the health of children (9,10). Among children, elevated body weight has been associated with increases in low density lipoprotein (LDL) and very low density lipoprotein cholesterol, decreases in high density lipoprotein cholesterol, increases in blood pressure and clustering of ischemic heart disease risk factors (11-15). Excessive weight during late childhood and adolescence has been associated with higher morbidity and mortality in adulthood, as well as with poverty and a lower likelihood of being married (16-19). Although the majority of overweight adults were not overweight as children, 26% to 41% of obese preschool children, and 42% to 63% of obese schoolchildren become obese adults (20). Obesity in adults is a strong risk factor for many chronic diseases, including cardiovascular diseases (CVD), type II diabetes, hypertension, dyslipidemia and certain cancers (9,10,21).

Although few Canadian data exist, particularly among youth, population-based surveys have documented dramatic rises in weight-for-height indexes among children and adolescents over the past 30 years (22-25). In a recent study of over 2000 children aged nine to 12 years in 24 low socioeconomic status schools in Montreal, the prevalence of over-weight (BMI and triceps skinfold thickness greater than or equal to the 85th National Health and Nutrition Examination Survey [NHANES] II percentile) was 35% for boys and 33% for girls (26). The prevalence of obesity was 15% and 13%, respectively (BMI *and* triceps skinfold thickness greater than or equal to the 95th NHANES II percentile).

Given the tracking of body weight into adulthood and the low success in treating either adult or youth obesity, efforts must be devoted to the prevention of excess body fat in childhood.

Greater success has been achieved in the treatment of obesity among children aged six to 12 years. Frequent contacts with a health care provider, inclusion of parents and family in the dietary treatment program, strong social support and regular physical activities are associated

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with higher success rates (8). Public health efforts such as school health promotion programs have shown significant improvements in physical activity among elementary and high school children (27).

RECOMMENDATIONS

- Physicians should measure and record on standard growth charts the height and weight of their pediatric patients (**Level III, Grade A**).
- Physicians should be attentive to excesses in weight-for-height gains. Values of weight-for-height greater than the 75th percentile for age and sex should indicate the need for measurements of skinfold thickness (subscapular or triceps) (**Level III, Grade A**).
- Skinfold thickness equal to or above the 95th percentile for age and sex warrants further assessment of family history of obesity, diabetes, dyslipidemia and hypertension, as well as evaluation of the child's lipoprotein levels, blood pressure, fasting glucose level, history of hypoventilation and physical examination (**Level III, Grade B**).
- An obese child without a family history of obesity-related disease and who is otherwise healthy may not respond to intensive dietary therapy alone. All such children should be encouraged to be physically active. Treatment of children with obesity-related complications may warrant a consultation with a nutritionist and specialized team (**Level III, Grade A**).

RESEARCH RECOMMENDATIONS

- Determine Canadian-specific percentiles for weight-for-height indexes and for skinfold thickness.
- Identify the social, familial, personal and environmental determinants of obesity among Canadian youth.
- Develop and evaluate innovative prevention programs for obesity targeting school-aged children.

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PHYSICAL ACTIVITY

The health benefits of regular physical activity are well documented and include the prevention of CVD, type II diabetes, osteoporosis and several cancers. Among children and youth, the practice of regular physical activity has been associated with a more favourable CVD risk factor profile, including lower triglyceride and higher high density lipoprotein cholesterol (28-30) levels, lower blood pressure (30) and lower body fat in some but not all studies (31-34). Indeed, it has been difficult to show a clear relationship between physical activity and overweight or obesity, possibly because of a problem in the measurement of physical activity and study design problems (35).

In Canada, 72% of boys and 49% of girls aged 10 to 14 years were physically active in 1988 compared with 15% of boys and 23% of girls who were inactive. Among adolescents aged 15 to 19 years, 69% of boys and 39% of girls were active compared with 15% of boys and 30% of girls who were inactive (36). In a more recent survey in Quebec, 63% of boys and 39% of girls aged 15 to 19 years practised moderate or vigorous physical activity three times per week for at least 20 mins (37). Sedentariness is striking for girls, 47% of whom are inactive when they reach adolescence, compared with 25% of boys. There is good evidence that childhood physical activity levels track into adolescence and adulthood, so that inactivity in youth may contribute to a lifelong habit of inactivity (32,38,39).

Recent trials have shown that elementary school-based programs can significantly increase regular physical activity among children (27). There is general agreement that such programs should begin before the onset of puberty because health behaviours begin to consolidate as lifelong behaviour patterns at about the age at which children begin to exercise more volitional control over their activity choices (34).

HYPERLIPIDEMIA

Identification and management of hyperlipidemia in children remain controversial (40,41). Chief concerns relate to a lack of evidence as to whether identification and management of

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hyperlipidemia in children reduce atherosclerotic events in adult years, and whether this strategy is cost effective and safe. Screening algorithms are imperfect for identifying children at risk (42), and there are concerns over the health anxiety and the psychosocial effects of labelling (43,44). There is also considerable reluctance to alter diet in this population, who are experiencing a period of growth and development, with concerns about the potential for nutritional deficiencies and predisposition to malignancy. The use of lipid-lowering medication is fraught with concerns over long term safety and effectiveness. Nonetheless, a considerable potential opportunity for primary prevention exists in this vulnerable population.

Concomitant with considerations regarding hyperlipidemia in children are disturbing trends toward increasing adiposity in North American children, with adverse effects on lipid risk factors (45). Careful attention must be paid to this trend and strategies devised to intervene, focusing on improved nutrition and physical activity **Hyperlipidemia and atherosclerosis:** Hyperlipidemia in childhood and clinical atherosclerotic events in later adult years are difficult to link, but a growing body of indirect evidence supports this link. Data from the Bogalusa Heart Study clearly identified an association between elevated total cholesterol and LDL from a population-based study, and degree of atherosclerotic involvement of the aorta and coronary arteries in an autopsy study of children, adolescents and young adults who died from other causes (46,47). These findings were supported by the Pathobiological Determinants of Atherosclerosis in Youth (PDAY) study (48). Recent noninvasive assessments of the atherosclerotic process in children and adolescents have shown links between hyperlipidemia and coronary artery calcification on ultrafast computed tomography (49), endothelial dysfunction as assessed by brachial artery reactivity (50-52) and increased intima-media thickness of the common carotid artery on ultrasound (53,54).

Identification of hyperlipidemia: Hyperlipidemia has its roots in the pediatric age range, and both multifactorial causes and genetic disorders of lipid metabolism can be identified reliably in early childhood. The most commonly identified genetic lipid abnormality in children is familial hypercholesterolemia, with xanthomata and atherosclerotic events present in the first two decades of life in the rare child homozygous for this condition. Both the Bogalusa Heart Study

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and the Muscatine Study have documented that hyperlipidemia in childhood tracks into adulthood (55,56). There is also evidence in children that hyperlipidemia inter-acts with other risk factors, primarily obesity (55,57). The majority of children with hyperlipidemia in Canada are identified from screening secondary to a positive family history of premature atherosclerotic events in first-degree relatives or as an incidental finding as part of a work-up for another medical condition, usually obesity. Widespread population screening for hyperlipidemia in children has not been advocated or adopted in Canada.

At present, the most widely cited guidelines for screening in children come from the National Cholesterol Education Program (NCEP) in the United States (58), which has advocated an individualized approach to screening, primarily aimed at identifying children at highest risk. An initial risk assessment would identify children who, any time after the age of two years, should have screening with either a total blood cholesterol (if a parent is documented to have a total cholesterol level of 6.2 mmol/L or more) or a fasting lipoprotein analysis (if there is a positive family history of atherosclerotic CVD before age 55 years in a parent or grandparent). Children with a screening total cholesterol level of 4.4 mmol/L or more (confirmed by repeat measurement) qualify for fasting lipoprotein analysis. The fasting lipoprotein profile is repeated, and the average LDL level used to stratify risk and management. Children with average LDL levels between 2.8 and 3.4 mmol/L require risk factor advice, intervention and periodic re-evaluation. Children with average LDL levels of more than 3.4 mmol/L require clinical evaluation of secondary causes, more intensive dietary intervention and screening of other family members. Children who, after dietary intervention, fail to meet target LDL levels may be candidates for lipid-lowering medication.

The screening algorithm is imperfect (41,42). Studies have shown the inadequacy of family history assessment as an entry point for screening, and a significant proportion of children with high LDL may be missed. The algorithm does not take into account the reduced atherosclerotic risk of premenopausal women, and the lipid profile cut-points are fixed and are not sufficiently age- or sex-specific throughout the pediatric age range. There are concerns that too many children would meet criteria for drug therapy, and that, despite intervention with dietary therapy

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and drugs, target LDL levels cannot be achieved in a significant proportion.

Dietary intervention: The Dietary Intervention Study in Children (DISC), a large multicentre, randomized, controlled clinical trial, has provided convincing evidence of safety and efficacy of dietary intervention in hypercholesterolemic children (59). Dietary goals were achieved in the intervention group without adverse effects on growth, or nutritional or psychological parameters. The mean adjusted attributable reduction in LDL was -0.08 mmol/L (95% CI -0.15 to -0.01 mmol/L). While statistically significant, this reduction is modest at best. A further study has likewise confirmed normal growth in children on low fat diets (60).

As part of its recommendations, the NCEP recommended as a population strategy, in children aged two years or more, a diet adequate in nutritional content and calories with restriction of total fat calories to 30% or less of total calories, saturated fat calories to less than 10% and dietary cholesterol intake to less than 300 mg/day (58). No dietary restrictions were recommended before the age of two years. These recommendations are similar to those made by the Canadian Paediatric Society, with the exception that a low fat diet in Canada was recommended to be implemented gradually (61).

Pharmacological therapy: A proportion of children will meet NCEP criteria for lipid-lowering medication after a period of dietary intervention (58). This area is the most controversial because there is no evidence to suggest that intensive intervention in childhood will or will not alter cardiovascular morbidity and/or mortality, and the implications of therapy are lifelong. The NCEP guidelines recommend drug therapy only in children aged 10 years and older whose LDL remains more than 4.9 mmol/L, or whose LDL remains more than 4.1 mmol/L with a positive family history of premature CVD, or a personal history of two or more other persistent cardiovascular risk factors (58). The report, however, urges discretion. There are no Canadian recommendations regarding drug therapy. Ose and Tonstad (62) and Tonstad (63) have proposed an algorithm for introduction of medication based on age, sex, lipid levels and family history.

The only approved medications for use in children are the bile acid-binding resins. Although their safety has been well documented, palatability and compliance are a problem in children,

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with both the tablet and the powder formulations (64,65). In addition, only LDL reductions of -10% to -15% are achieved, which are often inadequate to reach target LDL levels in children with primary hyperlipidemias. There is an increasing body of evidence to support efficacy and short term safety associated with use of the hepatic hydroxy-methylglutaryl coenzyme A reductase inhibitors in adolescents (66-69). However, the results of future studies regarding long term safety and cost effectiveness must be awaited before general use in children and adolescents can be recommended. Nonetheless, physicians are using these agents to treat children, as shown in a recent national survey (70). The use of antioxidant vitamins may offer some additional benefit (52); however, the use of alternative medicines remains to be studied further, although the use of garlic extract supplements appears to have no benefit (71).

RECOMMENDATIONS

- Physicians should routinely incorporate family history assessment of hyperlipidemia and atherosclerotic events into well child care visits, with selected screening of fasting total cholesterol or lipoprotein profiles as recommended by the United States NCEP's Expert Panel Report (**Level III, Grade B**).
- Physicians should provide counselling to families regarding institution of a low fat and low cholesterol diet while maintaining adequate calories and nutrition to ensure optimal growth and development for all children older than two years (**Level III, Grade B**).
- Children with primary hyperlipidemia who are being considered for pharmacological therapy should be referred to a specialist clinic or centre (**Level III, Grade A**).
- Physicians should advocate reducing fat and cholesterol in food choices and preparation in schools and the food service industry (**Level III, Grade A**).
- Physicians who diagnose premature ischemic CVD in patients should institute screening of the patient's siblings and progeny (**Level III, Grade A**).

RESEARCH RECOMMENDATIONS

- Develop efficient and cost effective population-based strategies to identify children with significant lipoprotein abnormalities.

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- Identify educational and behavioural strategies to enhance dissemination and compliance with the recommended low fat prudent diet.
- Develop and supply noninvasive assessments to quantify and characterize early pathophysiological processes and anatomical abnormalities related to the development of atherosclerotic lesions.
- Identify safe and cost effective interventions aimed at improving lipoprotein abnormalities in children, and assess the effect of such interventions on the atherosclerotic process.

HYPERTENSION

Hypertension mediates its adverse effects in terms not only of accelerated atherosclerosis, but also of direct end-organ damage. Many of these changes are evident in hypertensive children. Autopsy evidence from the Bogalusa Heart Study showed significant correlations between blood pressure parameters and degree of atherosclerotic involvement of the aorta and coronary arteries of children, adolescents and young adults (46,72). Echocardiographic evidence of increased left ventricular mass and diastolic dysfunction has been documented in hypertensive adolescents (73,74). Data from the Bogalusa Heart Study and the Muscatine Study suggest that blood pressure measurements in childhood may be predictive of adult hypertension, with systolic pressure tracking somewhat better than diastolic pressure (75,76).

Recommendations for blood pressure measurement have been made by the Second Task Force on Blood Pressure Control in Children (77,78). Blood pressure should be screened routinely in all children by three years of age using an appropriate-sized cuff and technique. Hypertension is defined as a blood pressure above the 95th percentile for age and sex as measured on at least three separate occasions.

Secondary causes predominate in younger children and children with more extreme elevations of blood pressure. In addition to a careful history and physical examination, hypertensive children may be screened with urinalysis, serum urea nitrogen and creatinine to exclude renovascular causes. Coarctation of the aorta must be excluded with assessment of pulses and blood pressure in all extremities. Endocrine causes must be considered, as well as the

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effect of pharmacological agents. Essential hypertension is suggested by a negative work-up, often with a positive family history of hypertension.

Management of hypertension is first directed at any secondary or exacerbating factors. The initial mainstay of therapy consists of reduced dietary sodium intake with a program of weight normalization and physical activity (77,78). Pharmacological therapy is recommended for the minority of children with hypertension, and the initial agent is usually an angiotensin-converting enzyme inhibitor (77,78). Outcomes data regarding therapy in children are limited.

RECOMMENDATIONS

Blood pressure should routinely be measured and charted on percentiles graphs for children, with appropriate investigation and management of those with significantly abnormal values (Level II, Grade A).

RESEARCH RECOMMENDATIONS

- Characterize the development of essential hypertension in children, and identify predictors that may be amenable to intervention.
- Identify safe and cost effective strategies to manage children with significant hypertension.
- Identify relationships between hypertension, and early pathophysiological processes and atherosclerotic lesions in children.

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REFERENCES

1. Preventing Tobacco Use Among Young People. A Report of the Surgeon General. Atlanta: Centers for Disease Control and Prevention, 1994.
2. Pierce JP, Gilpin E. How long will today's new adolescent smoker be addicted to cigarettes? Am J Public Health 1996;86:253-6.
3. Breslau N, Perterson EL. Smoking cessation in young adults: age at initiation of cigarette smoking and other suspected influences. Am J Public Health 1996;86:214-20.
4. Torabi MR, Bailey WJ, Majd-Jabbari M. Cigarette smoking as a predictor of alcohol and other drug use by children and adolescents: evidence of the "gateway drug effect". J Sch Health 1993;63:302-6.
5. 1994 Youth Smoking Survey [Cat no H49-98/1994E]. Ottawa: Minister of Supply and Services Canada, 1996.
6. Direction générale de la protection de la santé, Laboratoire de lutte contre la maladie. Enquete nationale sur la santé de la population, Cycle 2, 1996-97. Ottawa: Santé Canada, 1999.
7. O'Loughlin J, Renaud L, Paradis G, Meshefedjian G, Zhou X. Prevalence and correlates of early smoking among elementary schoolchildren in multiethnic, low-income inner-city neighborhoods. Ann Epidemiol 1998;8:308-18.
8. Gidding SS, Leibel RL, Daniels S, Rosenbaum M, Van Horn L, Marx GR. Understanding obesity in youth. A statement for healthcare professionals from the Committee on Atherosclerosis and Hypertension in the Young of the Council on Cardiovascular Disease in the Young and the Nutrition Committee, American Heart Association. Writing Group. Circulation 1996;94:3383-7.
9. National Research Council. Committee on Diet and Health. Diet and Health: Implications for Reducing Chronic Disease Risk. Committee on Diet and Health, Food

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and Nutrition Board, Commission on Life Sciences. National Research Council. Washington: National Academy Press, 1989.

10. Department of Health and Human Services. The Surgeon General's Report on Nutrition and Health [DHHS (PHS) Publication no. 88-50210]. Washington: US Department of Health and Human Services. Public Health Service, 1988.
11. Asayama K, Hayashibe H, Dobashi K, Uchida N, Kawada Y, Nakazawa S. Relationships between biochemical abnormalities and anthropometric indices of overweight, adiposity and body fat distribution in Japanese elementary schoolchildren. *Int J Obesity* 1995;19:253-9.
12. Ersnt ND, Obarzanek E. Child health and nutrition: obesity and high blood cholesterol. *Prev Med* 1994;23:427-36.
13. Resnicow K, Morabia A. The relation between body mass index and plasma total cholesterol in a multi-racial sample of US schoolchildren. *Am J Epidemiol* 1990;132:1083-90.
14. Srinivasan SR, Bao W, Wattigney WA, Berenson GS. Adolescent overweight is associated with adult overweight and related multiple cardiovascular risk factors: The Bogalusa heart study. *Metabolism* 1996;45:235-40.
15. Clarke WR, Lauer RM. Does childhood obesity track into adulthood? *Crit Rev Food Sci Nutr* 1993;33:423-30.
16. Gortmaker SL, Must A, Perrin JM, Sobol AM, Dietz WH. Social and economic consequences of overweight in adolescence and young adulthood. *N Engl J Med* 1993;34:1008-12.
17. Mossberg HO. 40-year follow-up of overweight children. *Lancet* 1989;ii:491-3.
18. Must A, Jacques PF, Dallal GE, Bajema CJ, Dietz WH. Long term morbidity and mortality of overweight adolescents. *N Engl J Med* 1992;327:1350-5.

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19. Nieto FJ, Szklo M, Comstock GW. Childhood weight and growth rate as predictors of adult mortality. *Am J Epidemiol* 1992;136:201-13.
20. Serdula MK, Ivery D, Coates RJ, Freedman DS, Williamson DF, Byers T. Do obese children become obese adults? A review of the literature. *Prev Med* 1993;22:167-77.
21. Manson JE, Willett WC, Stampfer MJ, et al. Body weight and mortality among women. *N Engl J Med* 1995;333:677-85.
22. Gortmaker SL, Dietz WH, Sobol AM, Wehler CA. Increasing pediatric obesity in the United States. *Am J Dis Child* 1987;41:535-40.
23. Shear CL, Freedman SD, Burke GL, Harsha DW, Webber LS, Berenson GS. Secular trends of obesity in early life: The Bogalusa Heart Study. *Am J Public Health* 1988;78:75-7.
24. Troiano RP, Flegal KM, Kuczmarski RJ, Campbell SM, Johnson CL. Overweight prevalence and trends for children and adolescents. The National Health and Nutrition Examinations Surveys, 1963 to 1991. *Arch Pediatr Adolesc Med* 1995;149:1085-91.
25. Chinn S, Rona RJ. Secular trends in weight, weight-for-height and triceps skinfold thickness in primary schoolchildren in England and Scotland from 1972 to 1980. *Ann Hum Biol* 1987;14:311-9.
26. O'Loughlin J, Paradis G, Renaud L, Meshefedjian G, Gray-Donald K. Prevalence and correlates of overweight among elementary school children in multiethnic, low-income, inner-city neighbourhoods in Montreal, Canada. *Ann Epidemiol* 1998;8:422-32.
27. Luepker RV, Perry CL, McKinlay SM, et al. Outcomes of a field trial to improve children's dietary patterns and physical activity. The Child and Adolescent Trial for Cardiovascular Health. *JAMA* 1996;275:768-76.
28. DuRant RH, Baranowski T, Rhodes T, et al. Association among serum lipid and lipoprotein concentrations and physical activity, physical fitness, and body composition in young children. *J Pediatr* 1993;123:185-92.

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29. Suter E, Hawes MR. Relationship of physical activity, body fat, diet, and blood lipid profile in youth 10-15 yr. *Med Sci Sports Exerc* 1993;25:748-54.
30. Craig SB, Bandini LG, Lichtenstein AH, Schaefer EJ, Dietz WH. The impact of physical activity on lipids, lipoproteins, and blood pressure in preadolescent girls. *Pediatrics* 1996;98:389-95.
31. Reynolds KD, Killen JD, Bryson SW, et al. Psychosocial predictors of physical activity in adolescents. *Prev Med* 1990;19:541-51.
32. Raitakari OT, Porkk KVK, Taimela S, Telama R, Rasanen L, Viikari JSA. Effects of persistent physical activity on coronary risk factors in children and young adults. The Cardiovascular Risk in Young Finns Study. *Am J Public Health* 1994;140:1995-205.
33. Moore LL, Nguyen UDT, Rothman KJ, Cupples LA, Ellison RC. Preschool physical activity level and change in body fatness in young children. The Framingham Children's Study. *Am J Epidemiol* 1995;142:982-8.
34. US Department of Health and Human Services. Physical Activity and Health: A Report of the Surgeon General. Atlanta: US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, 1996.
35. Klesges RC, Klesges LM, Eck LH, Shelton ML. A longitudinal analysis of accelerated weight gain in preschool children. *Pediatrics* 1995;95:126-30.
36. Stephen P, Craig CL. The wellbeing of Canadians. Highlights from the 1988 Campbell Survey. Ottawa: Canadian Fitness and Lifestyle Research Institute, 1990.
37. Nolin B, Prud'homme D, Godbout M. L'activité physique de loisirs au Québec: une analyse en fonction des bénéfices pour la santé [Monographie #5]. Montréal: Santé-Québec, MSSS et Kino-Quebec, MAM, Gouvernement du Quebec, 1996.
38. Kelder SH, Perry CL, Klepp KI, Lytle LL. Longitudinal tracking of adolescent smoking, physical activity, and food choice behaviors. *Am J Public Health* 1994;84:1121-6.

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· knowledge translation, including dissemination of research and encouragement of best practices· professional development, and leadership in health policy.

39. Pate RR, Baranowski T, Dowda M, Trost SG. Tracking of physical activity in young children. *Med Sci Sports Exerc* 1996;28:92-6.
40. Newman TB, Hulley SB. Reducing dietary intake of fat and cholesterol in children. *JAMA* 1995;274:1424-5.
41. Newman TB, Garber AM, Holtzman NA, Hulley SB. Problems with the report of the Expert Panel on blood cholesterol levels in children and adolescents. *Arch Pediatr Adolesc Med* 1995;149:241-7.
42. Dennison BA, Jenkins PL, Pearson TA. Challenges to implementing the current pediatric cholesterol screening guidelines into practice. *Pediatrics* 1994;94:296-302.
43. Rosenthal SL, Knauer-Black S, Stahl MP, Catalanotto TJ, Sprecher DL. The psychological functioning of children with hypercholesterolemia and their families. A preliminary investigation. *Clin Pediatr* 1993;32:135-41.
44. Rosenberg E, Lamping DL, Joseph L, Pless IB, Franco ED. Cholesterol screening of children at high risk: behavioural and psychological effects. *Can Med Assoc J* 1997;156:489-96.
45. Gidding SS, Bao W, Srinivasan SR, Berenson GS. Effects of secular trends in obesity on coronary risk factors in children: The Bogalusa Heart Study. *J Pediatr* 1996;127:868-74.
46. Newman WP III, Freedman DS, Voors AW, et al. Relation of serum lipoprotein levels and systolic blood pressure to early atherosclerosis. The Bogalusa Heart Study. *N Engl J Med* 1986;314:138-44.
47. Freedman DS, Wattigney WA, Srinivasan SR, et al. The relation of atherosclerotic lesions to antemortum and postmortem lipid levels: The Bogalusa Heart Study. *Atherosclerosis* 1993;104:37-46.

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48. Natural history of aortic and coronary atherosclerotic lesions in youth. Findings from the PDAY Study. Pathobiological Determinants of Atherosclerosis in Youth (PDAY) Research Group. *Arterioscler Thromb* 1993;13:1291-8.
49. Mahoney LT, Burns TL, Stanford W. Coronary risk factors measured in childhood and young adult life are associated with coronary artery calcification in young adults: The Muscatine Study. *J Am Coll Cardiol* 1996;27:277-84.
50. Celermajer DS, Gooch VM, Spiegelhalter DJ, et al. Non-invasive detection of endothelial dysfunction in children and adults at risk of atherosclerosis. *Lancet* 1992;340:1111-5.
51. Sorensen GK, Celermajer DS, Georgakopoulos D, Hatcher G, Betteridge DJ, Deanfield JE. Impairment of endothelium-dependent dilation is an early event in children with familial hypercholesterolemia and is related to the lipoprotein (a) level. *J Am Coll Cardiol* 1994;93:50-5.
52. Mietus-Snyder M, Malloy MJ. Endothelial dysfunction occurs in children with two genetic hyperlipidemias: improvement with antioxidant vitamin therapy. *J Pediatr* 1998;133:35-40.
53. Pauciullo P, Iannuzzi A, Sartorio R, et al. Increased intima-media thickness of the common carotid artery in hypercholesterolemic children. *Arterioscler Thromb* 1994;14:1075-9.
54. Virkola K, Pesonen E, Akerblom HK, Siimes MA. Cholesterol and carotid artery wall in children and adolescents with familial hypercholesterolaemia: a controlled study by ultrasound. *Acta Paediatr* 1997;86:1203-7.
55. Bao W, Srinivasan SR, Wattigney WA, Berenson GS. Usefulness of childhood low-density lipoprotein cholesterol level in predicting adult dyslipidemia and other cardiovascular risks. The Bogalusa Heart Study. *Arch Intern Med* 1996;156:1315-20.

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56. Lauer RM, Clarke WR. Use of cholesterol measurements in childhood for the prediction of adult hypercholesterolemia. JAMA 1990;264:3034-8.
57. Ernst ND, Obarzanek E. Child health and nutrition: obesity and high blood cholesterol. Prev Med 1994;23:427-36.
58. National Cholesterol Education Program: Report of the Expert Panel on Blood Cholesterol Levels in Children and Adolescents. Pediatrics 1992;89:525-84.
59. The Writing Group for the DISC Collaborative Research Group. Efficacy and safety of lowering dietary intake of fat and cholesterol in children with elevated low-density lipoprotein cholesterol. The Dietary Intervention Study in Children (DISC). JAMA 1995;273:1429-35.
60. Tershakovec AM, Jawad AF, Stallings VA, et al. Growth of hypercholesterolemic children completing physician-initiated low-fat dietary intervention. J Pediatr 1998;133:28-34.
61. Nutrition Recommendations Update. Dietary Fat and Children. Report of the Joint Working Group of the Canadian Paediatric Society and Health Canada. Ottawa: Health Canada, 1993.
62. Ose L, Tonstad S. The detection and management of dyslipidaemia in children and adolescents. Acta Paediatr 1995;84:1213-5.
63. Tonstad S. A rational approach to treating hypercholesterolaemia in children. Weighing the risks and benefits. Drug Saf 1997;16:330-41.
64. McCrindle BW, O'Neill MB, Cullen-Dean G, Helden E. Acceptability and compliance with two forms of cholestyramine in the treatment of hypercholesterolemia in children: a randomized, crossover trial. J Pediatr 1997;130:266-73.
65. Tonstad S, Knudtzon J, Sivertson M, Refsum H, Ose L. Efficacy and safety of cholestyramine therapy in peripubertal and prepubertal children with familial hypercholesterolemia. J Pediatr 1996;129:42-9.

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66. Lambert M, Lupien PJ, Gagné C, et al. Treatment of familial hypercholesterolemia in children and adolescents: effect of lovastatin. Canadian Lovastatin in Children Study Group. *Pediatrics* 1996;97:619-28.
67. Knipscheer HC, Boelen CC, Kastelein JJ, et al. Short-term efficacy and safety of pravastatin in 72 children with familial hypercholesterolemia. *Pediatr Res* 1996;39:867-71.
68. Ducobu J, Brasseur D, Chaudron JM, et al. Simvastatin use in children. *Lancet* 1992;339:1488.
69. Stein EA, Illingworth DR, Kwiterovich PO, et al. Efficacy and safety of lovastatin in adolescent males with heterozygous familial hypercholesterolemia: a randomized controlled trial. *JAMA* 1999;281:137-44.
70. Kimm SY, Payne GH, Stylianou MP, Wacławski MA, Lichtenstein C. National trends in the management of cardiovascular disease risk factors in children: second NHLBI survey of primary care physicians. *Pediatrics* 1998;102:E61.
71. McCrindle BW, Helden E, Conner WT. Garlic extract therapy in children with hypercholesterolemia. *Arch Pediatr Adolesc Med* 1998;152:1089-94.
72. Berenson GS, Wattigney WA, Tracy RE, et al. Atherosclerosis of the aorta and coronary arteries and cardiovascular risk factors in persons aged 6 to 30 years and studied at necropsy. (The Bogalusa Heart Study). *Am J Cardiol* 1992;70:851-8.
73. Snider AR, Gidding SS, Rocchini AP, et al. Doppler evaluation of left ventricular diastolic filling in children with systemic hypertension. *Am J Cardiol* 1985;56:921-6.
74. Daniels SR, Meyer RA, Loggie JMH. Determinants of cardiac involvement in children and adolescents with essential hypertension. *Circulation* 1990;82:1243-8.
75. Mahoney LT, Lauer RM, Lee J, Clarke WR. Factors affecting tracking of coronary heart disease risk factors in children: the Muscatine Study. *Ann NY Acad Sci* 1991;623:120-32.

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· knowledge translation, including dissemination of research and encouragement of best practices· professional development, and leadership in health policy.

76. Bao W, Srinivasan SR, Wattigney WA, Berenson GS. Persistence of multiple cardiovascular risk clustering related to syndrome X from childhood to young adulthood: The Bogalusa Heart Study. Arch Intern Med 1994;154:1842-7.
77. Task Force on Blood Pressure Control in Children. Report of the Second Task Force on Blood Pressure Control in Children - 1987. Pediatrics 1987;79:1-25.
78. Update on the Task Force Report (1987) on High Blood Pressure in Children and Adolescents: A Working Group Report from the National High Blood Pressure Education Program National Institutes of Health [NIH Publication No 96-3790]. Washington: National Heart, Lung, and Blood Institute, 1996.

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Section 3: Women and cardiovascular diseases

Lorretta B Daniel MD

Cardiovascular diseases (CVD) are the leading cause of death among Canadian women, accounting for 39% of all female deaths (1). Women appear to be protected from the complications of atherosclerosis until menopause, at which time the incidence of cardiovascular events increases (2). Despite a decline in the rate of CVD due to management of cardiac risk factors and better interventions for CVD, morbidity and mortality due to CVD among Canadian women will increase with the aging population and, particularly, with the higher prevalence of risk factors.

Canadian women do not perceive CVD as a major health concern, believing that cancer, specifically breast cancer, is more of a threat. Men with ischemic heart disease are more likely to present with a myocardial infarction (MI) or sudden death, while women are more likely to present with chest pain or atypical symptoms (3). First cardiovascular events are often fatal in women. Women with an MI take longer to get to the hospital, thereby decreasing their chances of getting timely thrombolysis, and have higher in-hospital recurrent MI and death rates (4). Women are less likely to be referred for cardiac catheterization; however, when they are, they are appropriately referred for revascularization procedures (5). Morbidity and mortality rates after angioplasty and bypass surgery are higher in women than in men, and fewer women are referred to cardiac rehabilitation programs (4). Even when women are referred to cardiac

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rehabilitation programs, more women drop out than men because the programs do not address the specific needs of women (6). The incidence and prevalence of stroke are higher in men than in women; however, after age adjustment, the differences disappear (4). More women than men die after a stroke due to their advanced age. The mortality rates for both men and women, however, are similar for all ages (1).

Increased morbidity and mortality in women with CVD is likely due to a variety of factors including older age at the time of an event, a greater number of concomitant diseases, delayed diagnosis, more unstable presentation, more diffuse coronary disease and presence of smaller vessels. Major health initiatives for the prevention of CVD in women need to include the education of women to increase their awareness of CVD as a major health issue, and of cardiac risk factors and how to modify them. Physicians must be better educated about the incidence, diagnosis and appropriate management of CVD in women.

The majority of Canadian women have at least one risk factor for CVD, while multiple risk factors are seen especially in aboriginal women and in women of lower socioeconomic status (1). Most of the randomized clinical trials for risk factor management of CVD have been conducted almost exclusively in men. The exclusion of women in trials does not diminish the importance of aggressive risk factor modification for primary and secondary prevention of CVD in women.

SMOKING

Smoking among Canadian women will account for their increased death rates. The risk of CVD in women is proportional to the number of cigarettes smoked, and statistics demonstrate that fewer women are quitting and more are starting to smoke compared with men (7). In particular, the prevalence of smoking among adolescents aged 15 to 19 years is now higher in girls than in boys. Women of lower socioeconomic status and younger women who may use smoking for weight control are at particularly high risk.

Smoking is the leading preventable risk factor for CVD. Smoking cessation should be a priority in CVD prevention in women. To achieve this goal, knowledge about the dangers of smoking

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and tobacco use, smoking prevention strategies in schools, and smoking cessation programs should be improved (1).

HYPERTENSION

Management of hypertension significantly reduces cardiovascular event rates in women. More than 50% of the subjects enrolled in three large, randomized, controlled hypertension studies using beta-blockers and/or diuretics (Systolic Hypertension in the Elderly Program [SHEP] [8], Swedish Trial in Old Patients with Hypertension [STOP Hypertension] [9], and Medical Research Council [MRC] [10]) were elderly women. The trials demonstrated a 13 % to 44 % reduction in cardiac event rate and a 31 % to 47 % reduction in stroke rate. A recent meta-analysis demonstrated that women have a significant reduction in stroke rate and major cardiovascular events with antihypertensive therapy (11). The Canadian guidelines for the management of hypertension are recommended to be followed.

Oral contraceptives, including low dose birth control pills, have been shown to increase the risk of hemorrhagic stroke and MI in women with increased age, smoking and/or hypertension (12,13). Women who smoke or who are hypertensive and are considering the use of oral contraceptives should be advised to quit smoking and to have their hypertension under control before starting oral contraceptives. Women who develop hypertension while taking oral contraceptives should be advised to discontinue them.

DYSLIPIDEMIA

Until menopause, women have higher high density lipo-protein (HDL) and lower low density lipoprotein (LDL) levels than men. After menopause, HDL decreases and LDL increases, and these alterations in plasma lipids account, in part, for the progression of atherosclerosis in postmenopausal women. Important predictors of CVD in women include low HDL and, possibly, high triglycerides (14,15). The effects of cholesterol-lowering agents in the primary prevention of CVD in women have been studied in asymptomatic patients with a mean LDL-cholesterol of 3.9 mmol/L. Hepatic hydroxymethylglutaryl coenzyme A (HMG CoA) reductase

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inhibitors have been demonstrated to decrease the progression of atherosclerosis in the carotid arteries and to reduce the risk of stroke and first acute major cardiac events including MI, unstable angina and sudden cardiac death (16,17). Secondary prevention studies, such as the Scandinavian Simvastatin Survival Study (4S) (18), the Long-term Intervention with Pravastatin in Ischemic Disease (LIPID) Trial (19) and the Cholesterol and Recurrent Events Trial (CARE) (20), have included women and have demonstrated a decrease in cardiac event rate and mortality with cholesterol-lowering agents. Women with heart disease may have an even greater benefit from cholesterol reduction than men (21). In secondary prevention trials comparing cholesterol-lowering agents with hormone replacement therapy, HMG CoA reductase inhibitors were shown to lower total cholesterol, LDL-cholesterol and triglycerides more than hormone replacement therapy and to increase HDL similarly to combined estrogen and progestin (22). Cholesterol-lowering agents combined with estrogen have been demonstrated to have a synergistic effect with a significant decrease in LDL-cholesterol and increase in HDL-cholesterol levels with no change in triglyceride level (23).

OBESITY OR SEDENTARY LIFESTYLE

Obesity and sedentary lifestyle are risk factors for CVD among Canadian women. Women need to become more aware of lifelong healthy weight management. The majority of Canadian women are not physically active but should be encouraged to exercise regularly. Women are also not aware of the increased risk of developing hypertension, diabetes and hypercholesterolemia in association with obesity and physical inactivity.

DIABETES

Diabetes is a strong independent risk factor for premature CVD in women (4,24). Women are usually protected from heart disease until menopause; however, among diabetics, this protection is lost and a woman's risk of CVD is the same as for an age-matched male. The American Diabetes Association has produced recommendations for the management of diabetes with an emphasis on controlling concomitant risk factors (25), and further recommendations are provided in the chapter on diabetes.

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MENOPAUSE

Statistics have shown that the CVD death rate among women increases significantly after menopause, and data from the Framingham Study (2) clearly demonstrate that natural or surgical menopause increases the risk of CVD compared with age-matched premenopausal women.

Many large observation primary prevention studies (Nurse's Health Study [26], Framingham study [27], Leisure World Study [28]) have demonstrated a 40 % to 50 % reduction in the cardiovascular event rate (MI/sudden death) in postmenopausal women who use estrogen replacement therapy. The Postmenopausal Estrogen/Progestin Intervention (PEPI) Trial (29) demonstrated the beneficial effects of estrogen in lowering total cholesterol and LDL-cholesterol while increasing HDL-cholesterol and triglycerides. This effect was diminished with the addition of synthetic progesterone. Estrogen is also a potent antioxidant and may reduce lipid peroxidation in the atherosclerotic arterial wall. Animal studies demonstrated that estrogen, and estrogen and progesterone significantly alter atherosclerotic plaque formation in ovariectomized monkeys fed a high fat diet (30).

Animal and human studies have also demonstrated that estrogen receptors exist on vascular smooth muscle cells and that estrogen can alter endothelial function by enhancing coronary artery dilation and coronary blood flow in normal and atherosclerotic coronary arteries (31). Estrogen has also been shown to have an effect on the balance between thrombosis and fibrinolysis (32).

Concerns have been raised about the risk of estrogen replacement therapy with regard to the potential negative effects on lipids and coagulation, and the risk of certain cancers (33). In addition, the combined effects of long term estrogen and progesterone on the cardiovascular system are unknown.

Randomized, controlled trials using estrogen and progesterone in postmenopausal women for primary prevention of CVD are ongoing and will demonstrate the long term effects of estrogen,

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and estrogen and progesterone on cardiovascular event rate, mortality, cancer rate and quality of life (National Institutes of Health's-Women's Health Initiative [NIH-WHI] [34]). Until the results are known, recommendations for long term hormonal replacement therapy for the primary prevention of ischemic heart disease for all women cannot be mandated but should be individualized based on each patient's risk of CVD and potential benefits. A large secondary prevention trial, Heart and Estrogen/progestin Replacement Study (HERS), did not demonstrate a reduction of coronary artery disease events in postmenopausal women with established coronary disease randomized to estrogen and progestin (35). In addition, there was a higher rate of venous thromboembolic complications in women treated with hormones than in women given placebo. Further studies are needed to determine whether these results are applicable to all postmenopausal women with established coronary disease.

[Guide to risk reduction for women](#)

Raloxifene, a selective estrogen receptor modulator with estrogen-antagonistic effects in the breast and uterus, has been shown to alter serum lipids and coagulation factors favourably in postmenopausal women (36). Further trials are needed to determine whether these effects are associated with a reduction in cardiovascular events in postmenopausal women.

CONCLUSIONS

There are some differences in cardiovascular risk factor management between men and women. Guidelines for preventive cardiology for women recently produced by a joint American Heart Association/American College of Cardiology medical/scientific consensus panel have been reviewed and supported in Canada (Table 1) (37). The scientific basis for recommendations and areas of potential future recommendations are presented below.

Progress in the management of CVD in women will come from coordinated efforts in the education of women with respect to CVD being a major health concern and ensuring that all interventions that have been demonstrated to modify CVD, such as identification and aggressive management of cardiac risk factors, be implemented. Earlier diagnosis and

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appropriate medical and surgical management of CVD, especially for high risk groups, need to be addressed. The complex interaction among psychosocial, socioeconomic and health behaviours needs to be studied further, especially in women. Sex-relevant basic science or basic mechanism re-search should continue to focus on the effect of diabetes, lipid levels, hypertension, obesity, inactivity and hormones on the progression of atherosclerosis. Clinical trial results will justify new therapeutic options for women in the management and prevention of CVD. Health promotion, education and prevention of CVD should be the focus of health care expenditures.

RECOMMENDATIONS FOR CARDIOVASCULAR RISK FACTOR MANAGEMENT IN WOMEN

Cardiac risk factors in women should be treated as aggressively as those in men.

Smoking cessation should be a priority in CVD prevention in women (**Level I, Grade A**).

Hypertension in women, including elderly women, should be controlled and managed to decrease cardiovascular risk, particularly the risk of stroke (**Level I, Grade A**).

Cholesterol-lowering agents should be used in high risk women (**Level I, Grade A**).

Women should be encouraged to be physically active on a regular basis, to have healthy diets and to maintain a healthy body mass index (**Level II, Grade A**).

Women with diabetes, with or without established coronary artery disease, should have aggressive risk factor modification including tight glucose control (**Level II, Grade A**).

Hormone replacement therapy should be considered in postmenopausal women, but final recommendations about its use in primary prevention must await the outcome of ongoing trials (**Level III, Grade B**). One randomized trial looking at the use of hormone replacement therapy for secondary prevention did not demonstrate a decrease in cardiovascular risk (**Level II, Grade A**).

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The use of low dose estrogen oral contraceptive birth control preparations should be confined largely to women less than 35 years of age who do not smoke and who do not have hypertension (**Level II, Grade A**).

RESEARCH RECOMMENDATIONS

Means to improve earlier diagnosis and treatment of CVD should be developed.

Studies should be done to evaluate interactions between behavioural and socioeconomic factors in women.

Further studies are required on hormone replacement therapy.

Better interventions to improve the compliance to manage CVD risk factors are needed.

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REFERENCES

1. Heart Disease and Stroke in Canada. Ottawa: Heart and Stroke Foundation of Canada, 1997.
2. Gordon T, Kannel WB, Hjortland MC, McNamara PM. Menopause and coronary heart disease. The Framingham Study. *Ann Intern Med* 1978;89:157-61.
3. Lerner DJ, Kannel WB. Patterns of coronary heart disease morbidity and mortality in the sexes: A 26-year follow-up of the Framingham population. *Am Heart J* 1986;111:383-90.
4. Mosca L, Manson JE, Sutherland SE, Langer RD, Manolio T, Barrett-Connor E. Cardiovascular disease in women: A statement for healthcare professionals from the American Heart Association. Writing Group. *Circulation* 1997;96:2468-82.
5. Jaglal SB, Goel V, Naylor CD. Sex differences in the use of invasive coronary procedures in Ontario. *Can J Cardiol* 1994;10:239-44.
6. Schrott HG, Bittner V, Vittinghoff E, Herrington DM, Hulley S. Adherence to National Cholesterol Education Program Treatment goals in postmenopausal women with heart disease. The Heart and Estrogen/Progestin Replacement Study (HERS). The HERS Research Group. *JAMA* 1997;277:1281-6.
7. Bartecchi CE, MacKenzie TD, Schrier RW. The human costs of tobacco use. *N Engl J Med* 1994;330:907-12,975-80.
8. Prevention of stroke by antihypertensive drug treatment in older persons with isolated systolic hypertension. Final results of the Systolic Hypertension in the Elderly Program (SHEP). SHEP Cooperative Research Group. *JAMA* 1991;265:3255-64.
9. Dahlöf B, Lindholm LH, Hansson L, et al. Morbidity and mortality in the Swedish Trial in Old Patients with Hypertension (STOP-Hypertension). *Lancet* 1991;338:1281-5.
10. Medical Research Council trial of treatment of hypertension in older adults: principal results. MRC Working Party. *BMJ* 1992;304:405-12.

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11. Gueyffier F, Boutitie F, Boissel JP, et al. Effect of antihypertensive drug treatment on cardiovascular outcomes in women and men: A meta-analysis of individual patient data from randomized, controlled trials. The INDANA Investigators. Ann Intern Med 1997;126:761-7.
12. Petitti DB, Sidney S, Bernstein A, Wolf S, Quesenberry C, Ziel HK. Stroke in users of low-dose oral contraceptives. N Engl J Med 1996;335:8-15.
13. Acute myocardial infarction and combined oral contraceptives: results of an international multicentre case-control study. WHO Collaborative Study of Cardiovascular Disease and Steroid Hormone Contraception. Lancet 1997;349:1202-9.
14. LaRosa JC. Triglycerides and coronary risk in women and the elderly. Arch Intern Med 1997;157:961-8.
15. Manolio TA, Pearson TA, Wenger NK, Barrett-Connor E, Payne GH, Harlan WR. Cholesterol and heart disease in older persons and women. Review of an NHLBI workshop. Ann Epidemiol 1992;2:161-76.
16. Furberg CD, Adams HP Jr, Applegate WB, et al. Effects of lovastatin on early carotid atherosclerosis and cardiovascular events. Asymptomatic Carotid Artery Progression Study (ACAPS) Research Group. Circulation 1994;90:1679-87.
17. Downs IR, Clearfield M, Weis S, et al. Primary prevention of acute coronary events with lovastatin in men and women with average cholesterol levels: results of AFCAPS/TexCAPS. Air Force/Texas Coronary Atherosclerosis Prevention Study. JAMA 1998;279:1615-22.
18. Randomised trial of cholesterol lowering in 4444 patients with coronary heart disease: the Scandinavian Simvastatin Survival Study (4S). Lancet 1994;344:1383-9.
19. The Long-Term Intervention with Pravastatin in Ischaemic Disease (LIPID) Study Group. Prevention of cardiovascular events and death with pravastatin in patients with coronary

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heart disease and a broad range of initial cholesterol levels. N Engl J Med 1998;339:1349-57.

20. Lewis SJ, Sacks FM, Mitchell JS, et al. Effect of pravastatin on cardiovascular events in women after myocardial infarction: the cholesterol and recurrent events (CARE) trial. J Am Coll Cardiol 1998;32:140-6.
21. Gotto AM Jr. Cholesterol management in theory and practice. Circulation 1997;96:4424-30.
22. Darling GM, Johns JA, McCloud PI, Davis SR. Estrogen and progestin compared with simvastatin for hypercholesterolemia in postmenopausal women. N Engl J Med 1997;337:595-601.
23. Davidson MH, Testtolin LM, Maki KS, von Duvillard S, Drennan KB. A comparison of estrogen replacement, pravastatin, and combined treatment for the management of hypercholesterolemia in postmenopausal women. Arch Intern Med 1997;157:1186-92.
24. Manson JE, Spelsberg A. Risk modification in the diabetic patient. In: Manson JE, Ridker PM, Gaziano JM, Hennekens CH, eds. Prevention of Myocardial Infarction. New York: Oxford University Press, 1996:241-73.
25. The American Diabetes Association. Clinical Practice Recommendations 1998. Diabetes Care 1998;21(Suppl 1):S23-32.
26. Stampfer MJ, Colditz GA, Willett WC, et al. Postmenopausal estrogen therapy and cardiovascular disease. Ten-year follow-up from the nurses' health study. N Engl J Med 1991;325:756-62.
27. Wilson PWF, Garrison RJ, Castelli WP. Postmenopausal estrogen use, cigarette smoking, and cardiovascular morbidity in women over 50. The Framingham Study. N Engl J Med 1985;313:1038-43.
28. Henderson BE, Paganini-Hill A, Ross RK. Decreased mortality in users of estrogen replacement therapy. Arch Intern Med 1991;151:75-8.

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29. Effects of estrogen or estrogen/progestin regimens on heart disease risk factors in postmenopausal women. The Postmenopausal Estrogen/Progestin Intervention (PEPI) Trial. The Writing Group for the PEPI Trial. JAMA 1995;273:199-208.
30. Adams MR, Kaplan JR, Manuck SB, et al. Inhibition of coronary artery atherosclerosis by 17-beta estradiol in ovariectomized monkeys. Lack of an effect of added progesterone. Arteriosclerosis 1990;10:1051-7.
31. Farhat MY, Lavigne MC, Ramwell PW. The vascular protective effects of effects of estrogen. FASEB J 1996;10:615-24.
32. Shahar E, Folsom AR, Solomaa VV, et al. Relation of hormone-replacement therapy to measures of plasma fibrinolytic activity. Atherosclerosis Risk in Communities (ARIC) Study Investigators. Circulation 1996;93:1970-5.
33. Colditz GA, Hankinson SE, Hunter DJ, et al. The use of estrogens and progestins and the risk of breast cancer in postmenopausal women. N Engl J Med 1995;332:1589-93.
34. Rossouw JE, Finnegan LP, Harlan WR, et al. The evolution of the Women's Health Initiative: perspective from the NIH. J Am Med Womens Assoc 1995;50:50-5.
35. Hulley S, Grady D, Bush T, et al. Randomized trial of estrogen plus progestin for secondary prevention of coronary heart disease in postmenopausal women. Heart and Estrogen/progestin Replacement Study (HERS) Research Group. JAMA 1998;280:605-13.
36. Walsh BW, Kuller LH, Wild RA, et al. Effects of raloxifene on serum lipids and coagulation factors in healthy postmenopausal women. JAMA 1998;279:1445-51.
37. Mosca L, Grundy SM, Judelson MD, et al. AHA/ACC scientific statement: consensus panel statement. Guide to preventive cardiology for women. American Heart Association/American College of Cardiology. J Am Coll Cardiol 1999;33:1751-5.

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Section 3: Cardiovascular disease prevention in the elderly

Gilles R Dagenais MD, Arun Chockalingam PhD

The life expectancy of Canadians has significantly increased in the 20th century to the point that, in 1996, men and women aged 65 or older, defined as elderly in this report, constituted 12% of the population. This proportion is expected to nearly double by 2030. About 45% of the elderly die from cardiovascular diseases (CVD). In the decades following menopause, the mortality of women attributed to ischemic heart disease (IHD) almost approaches that of men, while mortality due to stroke after 65 years of age is similar in both sexes. The elderly account for close to 20% of Canadian health care spending, and CVD constitute the most important cost category (1).

RISK FACTORS IN THE ELDERLY

There are no national data on the prevalence and incidence of nonfatal CVD and risk factors among elderly Canadians except for risk factors in nearly 3000 women and men aged 65 to 74 reported by the Canadian Heart Health Surveys done from 1986 to 1992 (Table 1) (2). Among these elderly Canadians, 37% of women and 24% of men had at least two of the following risk factors: smoking, obesity, elevated cholesterol and elevated blood pressure. Except for smoking, elderly women have a higher prevalence of risk factors than elderly men. However, if current trends continue, there will be more smokers among women than among men. Furthermore, among the elderly, 12% have diabetes, and 75% do not exercise regularly three or more times per week.

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According to the Framingham Study, men and women aged 65 years and older have an incidence of IHD and stroke twice as high as those aged less than 65 years. The difference is much more pronounced among women (3).

Table 1

Prevalence (%) of major risk factors among Canadian women and men aged 65 to 74 years in the Canadian Heart Health Survey

	Women (n=1387)	Men (n=1529)
Smoking	12	16
Body mass index kg/m ²	45	39
Cholesterol 5,2 mmol/L	80	65
Blood pressure		
Diastolic 90 mmHg*	38	27
Systolic 140 mmHg*	50	50

** Or on nonpharmacological or pharmacological treatment*

PROGNOSTIC IMPACT OF RISK FACTORS IN THE ELDERLY

In the elderly with IHD, stroke or peripheral vascular dis-ease, the annual rate of major events such as CVD death, myocardial infarction or stroke is approximately 4% to 5% (unpublished data from the Heart Outcomes Prevention Evaluation [HOPE]). In the elderly without clinical CVD, smoking increases the risk of IHD and peripheral artery dis-ease two-and four-fold, respectively, but increases the risk of stroke to a lesser degree. Female smokers may be more

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sensitive than male smokers to the risk of myocardial infarction (4). Blood cholesterol levels decrease with advancing age (3), having very little impact on the incidence of IHD in persons aged 80 years or older (5). However, the high density lipoprotein cholesterol level may be a better predictor. In the Framingham Study (6), a linear relationship between blood pressure elevation and mortality was noted among men and women aged 75 to 94 years without clinical evidence of CVD. Persons with noninsulin-dependent diabetes, who often have other risk factors such as obesity, hypertension and hyperlipidemia, have two to five times the risk of IHD compared with persons without diabetes. This increased risk is more pronounced in women than in men (7). A body mass index of 27 or more may increase the risk of IHD in the elderly (8). Physical inactivity is associated with a higher CVD mortality (9).

The relative risk (calculated as the rate of specific events among those exposed to a risk factor divided by the rate of specific events among those less exposed to the factor or not having the factor) of CVD among elderly exposed to a given risk factor is lower than that observed in individuals less than 65 years of age. However, the absolute risk (calculated as the risk of individuals developing events during a defined period) is much higher in the elderly. In other words, after 65 years of age, the relative risk attenuates, but the event rate (absolute risk) is much higher than in those aged less than 65 years. The impact of risk factors on the occurrence of a CVD event is shown in tables prepared by the Framingham investigators (Appendix, Table 1, pages 11G-12G). These tables may facilitate clinicians in the task of stratifying the elderly according to their specific risk factors for stroke up to age 86 years and for IHD up to age 74 years (10).

ASSESSMENT OF PREVENTION OF CVD IN THE ELDERLY

The risk profile of the elderly may be assessed according to the following:

- Personal characteristics - age, sex, functional capacity, and the presence of CVD and its complications;
- Lifestyles - smoking, diet and physical inactivity;
- Biological factors - lipids, blood pressure, glucose, obesity and others;

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- Socioeconomic factors - income and education.
- In the elderly, secondary causes of hypercholesterolemia, hypertension and obesity must be sought, and other diseases limiting the prognosis should always be considered, as well as the likelihood of side effects of medications.

Why should we assess and treat high risk elderly patients to increase their life expectancy by one or two years? The issue is not only a question of treatment to increase life expectancy by a couple of years but also of treatment to improve quality of life. Preventing a stroke or congestive heart failure has an impact on the quality of life of the patient and on health care cost. For some clinicians, the problem is related to the maximum age at which these persons should be actively treated. To solve this problem, clinicians should consider the prognostic impact of risk factors in the elderly as outlined above as well as the 'physiological age' of the elderly. Although there are a few clinical trials involving the elderly with high blood pressure (11,12), there are no such large clinical trials in the elderly with dyslipidemia. However, some trials have included participants aged 70 to 75 years (13,14).

MANAGEMENT FOR PREVENTING CVD IN THE ELDERLY

Patient characteristics - Previous CVD event:

- Elderly patients with IHD are at high risk for a recurrent event; this risk may be reduced to a greater extent than for younger persons. Preventive measures to reduce the risk of a recurrent IHD event, pump failure or dysrhythmia should be similar to those administered to younger patients and should include management with proven effective therapy such as with acetylsalicylic acid (ASA) or angiotensin-converting enzyme inhibitors and, if significant functional limitations remain despite optimal medical therapy for patients with multiple coronary vessel disease, then with revascularization (15) **(Level II, Grade B)**.
- Elderly patients who have had a stroke or a transient ischemic attack are at higher risk of a recurrent event, particularly if they have cardiac disease, hypertension, or dyslipidemia, or if they smoke. Risk factors should be managed to reduce subsequent

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risk. The risk of recurrent stroke is reduced with antiplatelet or antithrombotic agents such as ASA, ticlopidine or warfarin, and with the combination endarterectomy and ASA. These last interventions have been shown to significantly reduce the rate of recurrent stroke in elderly patients with symptomatic stenosis of 70% to 99%, as outlined in the chapter on stroke (**Level I, Grade A**).

- Atrial fibrillation is the most prevalent sustained dysrhythmia and is documented in nearly 10% of the elderly. Atrial fibrillation is associated with 20% and 30% risk of stroke if the patient is aged 70 to 79 and more than 80 years of age, respectively. At least two out of three strokes can be prevented by anticoagulant therapy with warfarin administered to patients with atrial fibrillation. A close surveillance of the INR is recommended for the elderly aged 75 years and older because older persons have a higher risk of bleeding than younger persons (16). If there is no contraindication, anticoagulation is the treatment of choice; patients who cannot be anticoagulated should take ASA if the drug is not contraindicated (**Level I, Grade A**).
- Elderly patients with claudication, and often with other risk factors, may benefit as much as younger patients from revascularization and management of risk factors (**Level III, Grade A**).

Lifestyle:

- Smoking is a preventable risk factor in the elderly (17); within three to five years of smoking cessation, the risk decreases to that of persons who have never smoked. Clinicians should be proactive both in having their patients stop smoking (**Level II, Grade A**) and in discouraging patient exposure to passive smoking (**Level II, Grade A**).
- Improper diet contributes to the risk of CVD. However, there are no major clinical trials in the elderly on diet and CVD. Nevertheless, diet may have an impact on risk factors of several high risk elderly groups with obesity and diabetes. A diet low in saturated fat and high in vegetables, fruits and fibres combined with regular exercise may reduce elevated cholesterol levels for hypercholesterolemic elderly patients, as observed in men aged 30 to 64 and women aged 45 to 64 years (18). Recommendations to reduce salt intake are

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controversial. However, for patients with heart failure, excess salt intake may have deleterious effects, and sodium restriction associated with weight loss in the elderly with treated hypertension reduces elevated blood pressure (19) (**Level II, Grade B**).

- Regular exercise (30 mins three or more times a week) may reduce CVD mortality (9) and total mortality (9,20) (**Level II, Grade A**) and may improve the quality of life of the elderly. Regular exercise potentiates intervention of other factors such as obesity, diabetes, elevated blood pressure and dyslipidemia.

Biological risk factors:

- Hyperlipidemia is reduced by a lipid-lowering diet and pharmacological therapies that have been shown to reduce the risk of recurrent or new CVD events (13,14,21,22). Some of these cohort studies have enrolled individuals as old as 73 years (14,21)(**Level I, Grade A**). A grey zone exists for pharmacological treatment of dyslipidemia in the elderly aged 75 years and older without CVD. There is a growing consensus in treating these elderly patients with ischemic CVD, while treatment for those without IHD should be individualized (23).
- Hypertension is a frequent finding in the elderly and may be due to renovascular disease or primary aldosteronism. Reduced sodium intake and weight loss may lower blood pressure in treated hypertensives aged 60 to 80 years (19). Decreasing systolic hypertension with a thiazide or a second-generation calcium blocker can reduce stroke by 30% to 40% (11,12) (**Level I, Grade A**). Although antihypertensive medications reduce CVD death and heart failure, their impact on IHD has been limited. This limitation may be attributed to the failure of control of other factors, particularly hyperlipidemia, alcohol and salt excesses, and/or obesity (24).
- Diabetes increases the risk of recurrent events in patients with CVD and the incidence of new events in elderly without clinical CVD. According to substudies of clinical trials, the management of hyperlipidemia and hypertension in patients with diabetes seems to reduce the risk of CVD events (7) (**Level II, Grade B**). In managing patients with

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diabetes and recent myocardial infarction, optimal control of blood glucose reduced recurrent events (7).

- Obesity is often associated with diabetes, hypertension, hyperlipidemia or CVD. Although there are no large clinical trials in the elderly on weight reduction and CVD, reducing weight in these persons improves surrogate end points such as elevated lipid levels, blood glucose and blood pressure and may improve the quality of life of elderly patients with ischemic CVD (**Level III, Grade B**).
- Other interventions in high risk elderly patients include therapy with vitamin E or folate, both of which have been shown to reduce CVD events in some, but not all, observational studies and randomized clinical trials (vitamin E). However, final recommendations on these agents should await the results of ongoing clinical trials (**Level I, Grade C**).

Socioeconomic factors:

- Socioeconomic factors such as low income or less education are associated with a higher prevalence of CVD risk factors. The socioeconomic status may be an important variable in the success of optimal management of risk factors and CVD, considering compliance and the accessibility to medication and care (25).

CONCLUSION

Elderly patients have a high prevalence of risk factors, and an increased absolute risk of CVD mortality and morbidity. Elderly patients with CVD have worse outcomes than younger patients. The evidence from clinical trials for the management of the high risk elderly is limited. Nevertheless, the optimal management of risk factors, particularly smoking, hypertension, atrial fibrillation, hyperlipidemia, diabetes and physical inactivity may reduce the CVD burden. Further data are needed, particularly on the management of hyperlipidemia, diet and obesity in the elderly.

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REFERENCES

1. Johanson H, Nair C, Bond J. Who goes to hospital? An investigation of high users of hospital days. Health Report 1994;6:253-69
2. MacLean DR, Petrasovits A, Nargundkar M, et al. Canadian heart health surveys: A profile of cardiovascular risk. Survey methods and data analysis. Canadian Heart Health Surveys Research Group. CMAJ 1992;146:1969-74.
3. Kannel WB, Vokonas PS. Preventive cardiology in the elderly: The Framingham study. In: Pearson TA, Criqui MH, Luepker RV, Oberman A, Winston M. Primer in Preventive Cardiology. Dallas: American Heart Association, 1994:261-72.
4. Prescott E, Hippe M, Schnohr P, Hein HO, Vestbo J. Smoking and risk of myocardial infarction in women and men: longitudinal population study. BMJ 1998;316:1043-7.
5. Weverling-Rijnsburger AW, Blauw GJ, Lagaay AM, Knook DL, Meinders AE, Westendorp RG. Total cholesterol and risk of mortality in the oldest old. Lancet 1997;350:1119-23.
6. Kannel WB, D'Agostino RB, Silbershatz H. Blood pressure and cardiovascular morbidity and mortality rates in the elderly. Am Heart J 1997;134:58-63.
7. Diabetes and the heart. Lancet 1997;350(Suppl I):I32.
8. Harris TB, Launer LJ, Madans J, Feldman JJ. Cohort study of effect of being overweight and change in weight of coronary heart disease in old age. BMJ 1997;314:1791-4.
9. Wannamethee SG, Shaper AG, Walker M. Changes in physical activity, mortality, and incidence of coronary heart disease in older men. Lancet 1998;351:1603-8.
10. Healthy Heart Kit. Ottawa: Health Canada, 1999.
11. Prevention of stroke by antihypertensive drug treatment in older persons with isolated systolic hypertension. Final results of the Systolic Hypertension in the Elderly Program (SHEP). SHEP Cooperative Research Group. JAMA 1991;265:3255-64.

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12. Staessen JA, Fagar R, Thijs L, et al. Randomized double-blind comparison of placebo and active treatment for older patients with isolated systolic hypertension. The Systolic Hypertension in Europe (Syst-Eur) Trial Investigators. Lancet 1997;350:757-64.
13. Randomised trial of cholesterol lowering in 4444 patients with coronary heart disease: the Scandinavian Simvastatin Survival Study (4S). Lancet 1994;344:1383-9.
14. The Long-Term Intervention with Pravastatin in Ischemic Disease (LIPID) Study Group. Prevention of cardiovascular events and death with pravastatin in patients with coronary heart disease and broad range of initial cholesterol levels. N Engl J Med 1998;339:1349-57.
15. Fallen EL, Cairns J, Dafoe W, et al. Management of the postmyocardial infarction patient: a consensus report - revision of 1991 CCS Guidelines. Can J Cardiol 1995;11:477-86.
16. Prystowsky EN, Benson DW Jr, Fuster V, et al. Management of patients with atrial fibrillation. A statement for Healthcare Professionals from the Subcommittee on Electrocardiography and Electrophysiology. American Heart Association. Circulation 1996;93:1262-77.
17. LaCroix AZ, Lang J, Scherr P, et al. Smoking and mortality among older men and women in three communities. N Engl J Med 1991;324:1619-25.
18. Stefanick ML, Mackey S, Sheehan M, Ellsworth N, Haskell WL, Wood PD. Effects of diet and exercise in men and postmenopausal women with low levels of HDL cholesterol and high levels of LDL cholesterol. N Engl J Med 1998;339:12-20.
19. Whelton PK, Appel LJ, Espeland MA, et al. Sodium reduction and weight loss in the treatment of hypertension in older persons: a randomized controlled trial of nonpharmacologic interventions in the elderly (TONE). TONE Collaborative Research Group. JAMA 1998;279:839-46.

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20. Hakim AA, Petrovitch H, Burchfiel CM, et al. Effects of walking on mortality among nonsmoking retired men. N Engl J Med 1998;338:94-9.
21. Downs JR, Clearfield M, Weis S, et al. Primary prevention of acute coronary events with lovastatin in men and women with average cholesterol levels: Results of AFCAPS/TexCAPS. Air Force/Texas Coronary Atherosclerosis Prevention Study. JAMA 1998;279:1615-22.
22. Influence of pravastatin and plasma lipids on clinical events in the West of Scotland Coronary Prevention Study (WOSCOPS). Circulation 1998;97:1440-5.
23. Grundy SM, Balady GJ, Criqui MH, et al. Primary prevention of coronary heart disease: Guidance from Framingham. A statement for health care professionals from the AHA Task Force on risk reduction. Circulation 1998;97:1876-87.
24. The sixth report of the Joint National Committee on prevention, evaluation, and treatment of high blood pressure. Arch Intern Med 1997;157:2413-46.
25. Morrison C, Woodward M, Leslie W, Tunstall-Pedoe H. Effect of socioeconomic group on incidence of, management of, and survival after myocardial infarction and coronary death: analysis of community coronary event register. BMJ 1997;314:541-6.

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Section 3: Cardiovascular diseases and aboriginal peoples

Sonia Anand MD, Vincent Tookenay MD

Aboriginal people of Canada (AC) comprise people of North American Indian, Inuit (Arctic-dwelling) and Métis (mixed French and Cree origin) ancestry. In Canada, aboriginal peoples may be classified as status Indians, which includes people who are registered with the Federal Government as Indian, or nonstatus, which refers to AC who are not registered under the Indian Act. In the 1996 Census, 799,010 people reported that they were of North American Indian, Métis or Inuit origin, which is about 3% of the total Canadian population. Over the next two decades, the segment of the AC population aged 35 to 54 years is expected to increase by 62%. Until recently, the majority of status AC lived on reserves; however, today 25% of all AC live in urban areas, and this proportion is increasing. Therefore, given that the birth rate and life expectancy of AC are increasing, in the face of changing lifestyle practices, AC are undergoing a health transition as the rates of communicable diseases are declining, and chronic diseases (eg, cardiovascular diseases [CVD] and cancer) are increasing.

THE BURDEN OF CVD AMONG AC

It is difficult to generate accurate CVD morbidity and mortality estimates among AC because death certificates do not record ethnicity, not all AC are registered with a central agency, classification of deaths is often limited to reserve populations, and misclassification and under-

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reporting of deaths occur. Accepting these limitations, morbidity and mortality rates for all causes are higher among AC than among the general Canadian population (1,2). CVD is the leading cause of death among AC women and, after deaths due to violence and injuries, it is the leading cause of death among AC men. Although ischemic heart disease (IHD) mortality rates among AC males and other Canadian males are similar, the IHD mortality rate is 61% higher among AC women than among other Canadian women (1). The stroke mortality rate is 44% and 93% higher among AC men and women, respectively, than among the general Canadian population (1). Furthermore, despite recent declines in CVD rates among AC that have occurred in parallel with secular trends, CVD rates among AC are projected to increase due to a decrease in the number of deaths from accidents and poisonings, to an increase in the number of individuals at risk for CVD as the AC population ages, and to an increase in the prevalence of conventional CVD risk factors (ie, elevated serum cholesterol, diabetes and tobacco use) (2).

CVD RISK FACTORS AMONG AC

The common CVD risk factors among AC men and women are glucose intolerance, cigarette smoking and obesity, on a background of relatively low socioeconomic status (SES) and high psychosocial stressors. The rapid change in diet and adoption of a sedentary lifestyle combined with some unique genetic features have likely contributed to the high prevalence of morbidity and mortality in this group. **Diabetes:** Diabetes mellitus (DM) and impaired glucose tolerance (IGT) occur in 45% of AC above the age of 45 years, which is four to five times higher than in other Canadians (3,4). In a national survey of diabetes in AC in which DM was diagnosed by history alone, the prevalence of DM ranged from 0.8% in the Northwest Territories to 8.7% in Atlantic Canada, and highlighted that the rates of diabetes increased as AC resided closer to urban centres (usually in southern latitudes) (3). Despite the regional variations in the prevalence of DM and IGT among AC groups, it is accepted that the rates of DM and IGT are four to five times higher than the rates in the general Canadian population.

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Tobacco: The prevalence of smoking among three Indian communities in northwestern Ontario is 56%, which is higher than the rate among the general Ontario population (31%) (5). Alarming, smoking appears to be most prevalent among those aged 15 to 24 years (73.6%). Furthermore, recent data from the Sandy Lake project in Northern Ontario indicate that the prevalence of regular smoking is approximately 70%, and 80% in participants aged 19 to 29 years. Therefore, given the strong evidence that supports a causal relationship between cigarette smoking and CVD, and the high prevalence of smoking among AC (especially among the youth), tobacco use is likely an important modifiable risk factor for CVD among AC.

Hypertension: The rates of hypertension are usually equal or lower among people of aboriginal ancestry compared with people of European origin. In an Ontario study of AC, the prevalence of hypertension was 13%, which is similar to the national rate of 15% (6). However, the prevalence of hypertension increases dramatically among AC who suffer from IGT or obesity. For example, in Algonquins from Quebec with IGT and DM, the mean systolic blood pressure is 12 mmHg higher than in people with normal glucose tolerance (7).

Overweight: Obesity is a significant health problem among AC, especially women. The prevalence of obesity (body mass index [BMI] greater than 27 kg/m²) ranges from 50% to 70% in women and 30% to 50% among men (6). The pattern of obesity seen in AC is predominantly abdominal, which is usually associated with IGT, hypertension and increased rates of coronary artery disease.

Lipids: Elevated levels of total and low density lipoprotein (LDL) cholesterol are powerful risk factors for CVD in white populations. However, few studies in Canada report cholesterol values for AC. In a study of 176 Mohawks in Quebec, 13% of men and 19% of women had hypercholesterolemia (greater than 7.25 mmol/L) (8). In Algonquins from Quebec, the mean LDL-cholesterol and triglyceride (TG) levels were significantly higher in people with DM and IGT than in those without. (LDL 3.6 versus 2.8 mmol/L, P<0.001; TG 2.0 versus 1.3 mmol/L, P<0.01) (7). Therefore, although serum cholesterol likely is an important CVD risk factor among AC, no Canadian studies have directly compared cholesterol values among AC with the development of CVD.

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Dietary factors: The contribution of diet to the excess burden of coronary artery disease among AC has not been studied extensively. Urbanization has led to a transition from consumption of traditional foods to a more refined, high fat, low fibre diet. The increased availability of carbohydrates and fats in the diet, along with the decreased dietary fibre and a more sedentary lifestyle, is associated with an increased prevalence of obesity, dyslipidemia and glucose metabolic abnormalities (9). Macronutrient consumption analysis from Northern Ontario indicates that the diet of Ojibwa-Cree origin was high in total fat (36% of total calories), high in simple sugars (22% of total calories), especially among people less than age 20 years (ie, table sugar and soft drinks) and low in dietary fibre (11 g/day - about half that of other Canadians). Deficiencies in critical micronutrients also exist within this group and include deficiencies in vitamins such as B12, A, C and folate as well as calcium. Deficiencies in folate and B12 may be associated with the development of CVD mediated through increased concentrations of plasma homocysteine. This hypothesis requires further exploration.

Socioeconomic status: The SES of AC is closely linked to their poor health because low SES is usually associated with less knowledge about disease prevention and unhealthy lifestyles. The economic conditions (high unemployment, low household income and crowded housing) of AC are much lower than the general Canadian population, and although those of socioeconomic conditions have improved since 1986, they are still well below the national average (2,5).

Clinical application: Given the increasing rate of CVD and CVD risk factors among AC, clinicians must reject the belief that AC are 'protected' from CVD, and accept that risk factor screening and management is critical. This means that improved prevention programs are needed at the primary (after a risk factor develops), secondary (after CVD is apparent) and tertiary (rehabilitation after a CVD event) prevention levels. In addition, primordial prevention (before a risk factor develops) is essential, and educational programs in school and in the community must be directed toward young AC given their high rate of obesity, IGT and tobacco use, and because many of these risk factors track from childhood to adulthood (10). However, direct application of the traditional western biomedical models of prevention to AC will likely not succeed (2). Public health programs and health care workers must be sensitive to the unique cultural features of the AC lifestyle; health care professionals must be better educated in

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aboriginal customs and traditional aboriginal medicine practices to improve communication between health care providers and aboriginal people.

PUBLIC HEALTH PREVENTION, EDUCATION AND BIOMEDICAL PRACTITIONERS TRAINING

Most physicians and public health authorities advocate primary prevention to reduce the prevalence of multiple risk factors. While smoking cessation, cholesterol reduction, control of hypertension, maintenance of ideal body weight and regular exercise all appear to reduce the risk of heart disease substantially, the effectiveness of available strategies to modify personal risk behaviour and lifestyle is variable. To be effective, strategies for behavioural change must be directed to both the providers and the individuals in the communities through education emphasizing social factors that protect traditional subsistence activities, ensuring the availability of foods at affordable prices and promote the local marketing of appropriate foods (11). Health professionals who serve AC are confronted with a need to adapt their treatment strategies and education programs to the culture and social environment of their AC patients (10). Researchers working with aboriginal communities should be creative in their approaches and use interactive or participatory research that incorporates native culture into the design of the intervention studies (10).

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PREVENTION STRATEGIES

To devise effective preventive strategies for CVD in AC, more research to determine the relative importance of conventional and emerging risk factors for CVD is needed. However, given our current understanding of CVD in AC, culturally tailored strategies aimed at the prevention of obesity, smoking, physical inactivity and IGT should be developed.

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REFERENCES

1. Mao Y, Moloughney BW, Semenciw RM, Morrison HI. Indian reserve and registered Indian mortality in Canada. *Can J Public Health* 1992;83:350-3.
2. Canada. Royal Commission on Aboriginal Peoples. Report of the Royal Commission on Aboriginal Peoples, vol 3. Ottawa: Canada Communications Group - Publishing, 1996.
3. Young TK, Sevenhuysen GP, Ling N, Moffatt ME. Determinants of plasma glucose level and diabetic status in a northern Canadian Indian population. *CMAJ* 1990;142:821-30.
4. Harris SB, Gittelsohn J, Hanley A, et al. The prevalence of NIDDM and associated risk factors in Native Canadians. *Diabetes Care* 1997;20:185-7.
5. Smart RG, Adlal EM, Walsh GW. The Ontario Student Drug Use Survey: Trends between 1977 and 1993. Toronto: Alcoholism and Drug Addiction Research Foundation, 1991.
6. McIntyre L, Shah CP. Prevalence of hypertension, obesity and smoking in three Indian communities in northwestern Ontario. *CMAJ* 1986;134:345-9.
7. Delisle H, Rivard M, Ekoe J. Prevalence estimates of diabetes and other cardiovascular estimates of diabetes and other cardiovascular risk factors in the two largest Algonquin communities of Quebec. *Diabetes Care* 1995;18:1253-8.
8. Montour L, Macualy A, Adelson N. Diabetes mellitus in Mohawks of Kahnawake, PQ: a clinical and epidemiological description. *CMAJ* 1989;141:549-52.
9. Wolever TM, Hamad S, Gittelsohn J, et al. Nutrient intake and food use in an Ojibwa Cree community in Northern Ontario assessed by 24 hour dietary recall. *Nutr Res* 1997;17:603-18.
10. Macaulay AC, Paradis G, Potvin L, et al. The Kahnawake schools diabetes prevention project: intervention, evaluation, and baseline Results of a diabetes primary prevention program with a native community in Canada. *Prev Med* 1997;26:779-90.

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11. Waldram, JB, Herring DA, Young TK. Aboriginal Health in Canada: Historical, Cultural and Epidemiological Perspectives. Toronto: University of Toronto Press, 1995.

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aboriginal customs and traditional aboriginal medicine practices to improve communication between health care providers and aboriginal people.

PUBLIC HEALTH PREVENTION, EDUCATION AND BIOMEDICAL PRACTITIONERS TRAINING

Most physicians and public health authorities advocate primary prevention to reduce the prevalence of multiple risk factors. While smoking cessation, cholesterol reduction, control of hypertension, maintenance of ideal body weight and regular exercise all appear to reduce the risk of heart disease substantially, the effectiveness of available strategies to modify personal risk behaviour and lifestyle is variable. To be effective, strategies for behavioural change must be directed to both the providers and the individuals in the communities through education emphasizing social factors that protect traditional subsistence activities, ensuring the availability of foods at affordable prices and promote the local marketing of appropriate foods (11). Health professionals who serve AC are confronted with a need to adapt their treatment strategies and education programs to the culture and social environment of their AC patients (10). Researchers working with aboriginal communities should be creative in their approaches and use interactive or participatory research that incorporates native culture into the design of the intervention studies (10).

proved prevention programs are needed at the primary (after a risk factor develops), secondary (after CVD is apparent) and tertiary (rehabilitation after a CVD event) prevention levels. In addition, primordial prevention (before a risk factor develops) is essential, and educational programs in school and in the community must be directed toward young AC given their high rate of obesity, IGT and tobacco use, and because many of these risk factors track from childhood to adulthood (10). However, direct application of the traditional western biomedical models of prevention to AC will likely not succeed (2). Public health programs and health care workers must be sensitive to the unique cultural features of the AC lifestyle; health care professionals must be better educated in aboriginal customs and traditional aboriginal medicine practices to improve communication between health care providers and aboriginal people.

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PREVENTION STRATEGIES

To devise effective preventive strategies for CVD in AC, more research to determine the relative importance of conventional and emerging risk factors for CVD is needed. However, given our current understanding of CVD in AC, culturally tailored strategies aimed at the prevention of obesity, smoking, physical inactivity and IGT should be developed.

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REFERENCES

1. Mao Y, Moloughney BW, Semenciw RM, Morrison HI. Indian reserve and registered Indian mortality in Canada. *Can J Public Health* 1992;83:350-3.
2. Canada. Royal Commission on Aboriginal Peoples. Report of the Royal Commission on Aboriginal Peoples, vol 3. Ottawa: Canada Communications Group - Publishing, 1996.
3. Young TK, Sevenhuysen GP, Ling N, Moffatt ME. Determinants of plasma glucose level and diabetic status in a northern Canadian Indian population. *CMAJ* 1990;142:821-30.
4. Harris SB, Gittelsohn J, Hanley A, et al. The prevalence of NIDDM and associated risk factors in Native Canadians. *Diabetes Care* 1997;20:185-7.
5. Smart RG, Adlal EM, Walsh GW. The Ontario Student Drug Use Survey: Trends between 1977 and 1993. Toronto: Alcoholism and Drug Addiction Research Foundation, 1991.
6. McIntyre L, Shah CP. Prevalence of hypertension, obesity and smoking in three Indian communities in northwestern Ontario. *CMAJ* 1986;134:345-9.
7. Delisle H, Rivard M, Ekoe J. Prevalence estimates of diabetes and other cardiovascular estimates of diabetes and other cardiovascular risk factors in the two largest Algonquin communities of Quebec. *Diabetes Care* 1995;18:1253-8.
8. Montour L, Macualy A, Adelson N. Diabetes mellitus in Mohawks of Kahnawake, PQ: a clinical and epidemiological description. *CMAJ* 1989;141:549-52.
9. Wolever TM, Hamad S, Gittelsohn J, et al. Nutrient intake and food use in an Ojibwa Cree community in Northern Ontario assessed by 24 hour dietary recall. *Nutr Res* 1997;17:603-18.
10. Macaulay AC, Paradis G, Potvin L, et al. The Kahnawake schools diabetes prevention project: intervention, evaluation, and baseline Results of a diabetes primary prevention program with a native community in Canada. *Prev Med* 1997;26:779-90.

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11. Waldram, JB, Herring DA, Young TK. Aboriginal Health in Canada: Historical, Cultural and Epidemiological Perspectives. Toronto: University of Toronto Press, 1995.

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Section 3: Cardiovascular diseases in ethnic groups

Sonia Anand MD, Salim Yusuf MD

Throughout the world and within Canada, cardiovascular disease (CVD) mortality varies substantially by geographic region, sex and ethnic origin (1). An ethnic group refers to a population that shares common cultural characteristics, such as language, religion and diet. Therefore, the concept of ethnicity relies more on a shared cultural definition of identity than solely on biological similarity.

ETHNIC GROUPS IN CANADA

Ethnicity research is particularly relevant in a country such as Canada, given that non-Canadian-born individuals constitute 17.4% of the Canadian population (2). The sources of immigration to Canada have changed markedly during the past century, and in 1996 people of European origin accounted for 47% of the total immigrant population. Traditionally, European-born immigrants came from the United Kingdom, Germany or Italy, whereas now the majority come from Eastern European countries. The fastest growing group of new immigrants in Canada is from Asia (31% in 1996), and nearly a quarter of all recent immigrants are from China and India. The third-largest immigrant group in Canada is from Central and South America.

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MORTALITY PATTERNS IN SELECTED ETHNIC POPULATIONS IN CANADA

Until recently, there were no Canadian data on the pattern of CVD morbidity and mortality by ethnic group. The process of assigning ‘ethnicity’ to individuals, while controversial, is also difficult and requires advanced planning. Although there is now a self-defined ‘ethnicity’ category on the Census form, the Canadian National Mortality Database (CNMD) does not code ethnic origin on death certificates. Therefore, various approaches to studying ethnic differences in mortality have been adopted (3).

TABLE 1
Age-standardized mortality rates/100,000 (age 35 to 74 years), 1979 to 1993

Chronic disease	European Canadians	South Asians	Chinese
Cardiovascular disease	308	320	147
Coronary artery disease	208	232	72
Stroke	42	43	45
Cancer	287	127	212
Lung cancer	85	16	53
Colorectal cancer	31	7	23
Breast cancer	29	16	12

The overall health of immigrants appears to be better than that of the ‘average’ Canadian. An analysis of Census data, vital statistics and data from the Health and Activity Limitation Survey (4) demonstrates that immigrants, especially those from non-European countries, have a longer life expectancy, and more years of life free of disability and dependency than Canadian-born individuals. This likely reflects the ‘healthy immigrant effect’, in which only the healthier (and usually wealthier) section of a population from a given country migrates to another country, excluding refugees. A recent analysis of the CNMD since 1979 suggests that the rates

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of chronic diseases such as CVD and cancer vary significantly among ethnic populations. Specifically, Canadians of European origin have high rates of cancer and CVD mortality, Canadians of South Asian origin (people who originate from India, Bangladesh, Pakistan and Sri Lanka) have high rates of CVD yet relatively lower rates of cancer, and Canadians of Chinese origin (people who originate from Mainland China, Hong Kong and Taiwan) have low rates of CVD but relatively high rates of cancer (Table 1) (5). This variation in mortality rates raises the possibility that different risk and protective factors exist in Canadians of different ethnic origin for the two most common chronic diseases in Canada - diseases that usually share some of the same risk factors.

ONGOING RESEARCH IN CANADA

The recent analysis of the CNMD solidified the rationale for the Study of Health Assessment of Risk in Ethnic Groups (SHARE), an ongoing National cohort study of 300 South Asian, 300 Chinese and 300 European Canadians designed to determine risk factors for CVD in ethnic populations in Canada. Preliminary results from the SHARE pilot study show intriguing differences in lifestyle factors, dietary intake and metabolic factors among Canadians of South Asian, Chinese and European origin despite a similar 'acculturation' period in Canada (approximately 17 years) among immigrant populations (Table 2) (6).

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TABLE 2

Study of Health Assessment of Risk in Ethnic Groups (SHARE) pilot study results

Variable	South Asian (n=30)	Chinese (n=2)	European Canadian (n=21)
Mean age (years)	48	47	49
Women (%)	40	60	52
Years in Canada (mean)	18	15	47
Ever smoked (%)	21	17	62*†
University educated (%)	67‡	17	43†
Vegetarian (%)	10	0	0
Impaired glucose tolerance (%)	35*‡	17	9.5
Fasting cholesterol (mmol/L)	5.10	4.79	4.99
Low density lipoprotein cholesterol (mmol/L)	3.16	2.90	3.01
High density lipoprotein cholesterol (mmol/L)	1.05*‡	1.23	1.24
Lipoprotein(a) (mg/dL)	5.50*‡	4.73	4.58
Body mass index (kg/m ²)	27.19	24.33	26.38
Waist to hip ratio (cm)	0.91	0.86†‡	0.95

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SPECIFIC GROUPS

In the following sections, the CVD profiles of the major ethnic groups in Canada are reviewed. Given that there is very little 'Canadian'-specific research, a synthesis of the world literature that is most relevant to the Canadian population is presented.

People of Chinese origin: In the 1996 Census, 921,585 people in Canada reported being of Chinese origin, which makes them the largest nonwhite ethnic group in Canada (2). Although the overall mortality from CVD is relatively lower among Chinese in Canada and in China than among western countries, it is the most common cause of death in mainland China and Taiwan.

Common risk factors: Data from China reveal that hypertension and cigarette smoking are the major CVD risk factors. A case control study from Hong Kong of acute myocardial infarction (MI) sufferers indicates that the odds ratio for MI associated with cigarette smoking is 4.3, 3.3 with hypertension and 2.4 with diabetes (7). Cigarette smoking is highly prevalent among Chinese men - approximately 40% to 60% of men smoke - and there is evidence that these rates are increasing (8). Although the mean serum cholesterol level among Chinese individuals living in China is low by western standards, a prospective observational study of approximately 9000 Chinese people living in urban Shanghai demonstrated that serum cholesterol level was directly related (continuous relationship) to ischemic heart disease (IHD) mortality, even at these low levels (9). However, with increasing urbanization (including migration to Canada) and subsequent increase in serum cholesterol levels, a synergistic adverse interaction between smoking and cholesterol may lead to increased rates of IHD, as is observed among people of European origin who have multiple risk factors (10). Furthermore, data from Chinese migrants to Mauritius and Singapore suggest that, although the prevalence of hypertension and smoking declines with migration, the rates of obesity, late onset diabetes, elevated serum cholesterol and IHD increase (11).

Prevention strategies: Although people of Chinese origin traditionally have a very low prevalence of IHD, they will likely not remain protected from developing IHD with the increasing loss of traditional lifestyle practices. Important prevention strategies in this group include

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smoking prevention or cessation, promotion of a 'traditional diet' (eg, high fibre, fish, fruit and vegetable consumption, and low fat consumption) and regular physical activity, prevention of increase in body mass index (BMI), and optimal management of diabetes, serum dyslipidemia and hypertension.

People of South Asian origin: In the 1996 Census, 723,345 individuals in Canada reported being of South Asian origin. Studies of South Asian migrants to countries such as the United Kingdom, South Africa, Singapore and North America provide evidence that South Asians suffer from 1.11 to 3.19 times higher IHD mortality than other ethnic groups (12).

Common risk factors: South Asians, despite having increased rates of IHD, do not display an excess of conventional CVD risk factors, such as smoking, hypertension or elevated cholesterol levels (13,14). However, these factors are strongly associated with the development of IHD in South Asians. Data from an ongoing case control study in India (15) show an increasing relative risk of MI as the number of conventional risk factors increased. The odds ratio for smoking was 3.6, 2.6 for diabetes and 2.7 for hypertension. Cross-sectional studies of IHD risk factors in South Asians have identified that this group suffers a high prevalence of impaired glucose tolerance, central obesity, elevated triglycerides and low high density lipoprotein cholesterol (16). The prevalence of impaired glucose tolerance and noninsulin-dependent diabetes mellitus is four to five times higher in South Asian migrants than in Europeans by the age of 55 years (20% versus 4%) (14,16). Furthermore, there is preliminary evidence that South Asians in the United Kingdom and North America have elevated levels of lipoprotein(a) - a lipoprotein that is genetically associated with increased atherosclerosis and thrombogenesis (17,18).

Prevention strategies: The change in the risk factor profile of South Asians is attributed to lifestyle changes associated with urbanization, such as decreased physical activity and dietary changes (higher fat consumption, decreased vegetarianism and decreased fibre intake) that lead to obesity and its harmful sequelae. Clearly, strategies to prevent the development of obesity are required to decrease the number of South Asians who suffer from glucose intolerance, its associated dyslipidemia and, ultimately, IHD.

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People of African origin: Data from the 1996 Census indicate that there are 510,945 black Canadians, 47% of whom are 'nonimmigrants' and 44% of whom are of African origin. Common countries of origin are the West Indies, Africa and the United States. There is little information regarding the CVD risk profile and morbidity patterns among black Canadians; however, a substantial body of literature among African Americans exists because they are the largest nonwhite population in the United States. CVD is the leading cause of death among African Americans, and the incidence of cerebrovascular disease is higher in African Americans than in white Americans. Although mortality rates from CVD have declined in both African Americans and white Americans during the past 30 years, these declines have been less marked in African Americans (19).

Common risk factors: Compared with whites, African Americans develop high blood pressure at an earlier age, and it is more severe (19). The cause of black-white differences in hypertension prevalence likely involves a complex interaction between environmental response to diet and stress, and potential differences in sodium or potassium excretion. Serum cholesterol levels are not higher among African Americans than among white Americans, and on average African Americans have higher high density lipoprotein cholesterol levels than whites, a difference that is more marked among women (19). The prevalence of cigarette smoking is greater among African American men (33% versus 27%) than in white men, whereas fewer African American women smoke than white American women (19). Obesity is an emerging problem in women. Approximately 50% of African American women are reported to be overweight compared with 33% of white American women (19). Furthermore, the prevalence of diabetes in African Americans is higher than in white Americans (9.9% compared with 6%) (19). However, even after consideration of 'biomedical' differences in conventional risk factors, other factors likely play a role in the slower decline in CVD rates among blacks. The lower socioeconomic status of African Americans than white Americans results in decreased access for African Americans to medical therapies and hospital services, and accounts for at least 30% of the excess IHD mortality between blacks and whites (20).

Prevention strategies: As in other populations, conventional CVD risk factors are important; however, the dominant CVD risk factor among black Americans is likely hypertension. The

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black-white differential in socioeconomic status, in disease rates, risk factors and access to medical treatments necessitates primary prevention programs promoting the avoidance of poor dietary practices and cigarette smoking.

APPLICATION OF ETHNIC-SPECIFIC DATA BY CLINICIANS

It is important for clinicians and health care personnel to be aware of the differences in risk factor profiles by ethnic group. Although laboratory tests often have defined 'normal ranges', clinicians should keep in mind that these ranges are usually based on the normal distribution of people of European origin and may vary by ethnic group. For example, a serum cholesterol value of 5.0 mmol/L, while classified as 'normal' by Canadian standards, may be quite abnormal for a person of Chinese or South Asian origin. It is also important to note that the response of patients to particular medications may vary by ethnic origin (ie, blood pressure-lowering agents or anticoagulants), although little information concerning these variations is available. Furthermore, clinicians should acknowledge that socioeconomic differentials and cultural barriers may exist in nonwhite populations, and they must facilitate the equal delivery of health care services to all patients, regardless of ethnic origin.

CONCLUSIONS

Elevated serum cholesterol, elevated blood pressure, cigarette smoking and glucose intolerance are clearly the major risk factors for CVD in most populations. However, the prevalence of these factors and the strength of association of these factors to CVD varies by ethnic group. Identification of new risk or protective factors by ethnic group should be developed. Furthermore, research into reasons for social disparity and its impact on the distribution of CVD risk factors among ethnic groups must be continued so that specific interventions may be developed to reduce the adoption of un-healthy lifestyle behaviours and to reduce barriers to health care services. Ultimately, this information will lead to special strategies for prevention that may be tailored to ethnic populations and will generate important areas for future study.

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GENERAL RECOMMENDATIONS

Clinicians should be aware of the varying risk factor profile by ethnic group.

Clinicians should be cognizant of potential cultural barriers to health care access among immigrant groups and facilitate equal access to care.

RESEARCH NEEDED

Ethnic group-specific research in Canadians is needed because the risk factor profiles and disease rates may be much different than those observed in the United States or United Kingdom.

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REFERENCES

1. Heart Disease and Stroke in Canada. Ottawa: Heart and Stroke Foundation of Canada, 1995.
2. Census 1996. Ottawa: Statistics Canada, 1996.
3. Sheth T, Nargundkar M, Nair C, Chagani K, Anand S, Yusuf S. Methodological issues in classification of ethnicity among South Asians and Chinese utilizing a National Mortality Database. Can J Cardiol 1997;13(Suppl B):48B. (Abst)
4. Chen J, Ng E, Wilkins R. The health of Canada's immigrants in 1994-95. Health Reports 1996;7:33-45.
5. Sheth T, Chagani K, Nargundkar M, Anand S, Nair C, Yusuf S. Cardiovascular and cancer mortality among Canadians of European, South Asian and Chinese origin 1979 to 1993: An analysis of 1.2 million deaths. CMAJ 1999;161:132-8.
6. Anand SS, Yusuf S. Risk Factors for cardiovascular disease in Canadians of South Asian and European origin: a pilot study of the Study of Heart Assessment and Risk in Ethnic Groups (SHARE). Clin Invest Med 1997;20:204-10.
7. Donnan SP, Ho SC, Woo J, et al. Risk factors for acute myocardial infarction in a southern Chinese population. Ann Epidemiol 1994;4:46-58.
8. Tao SC, Huang ZD, Wu XG, et al. CHD and its risk factors in the People's Republic of China. Int J Epidemiol 1989;18:S159-63.
9. Chen Z, Peto R, Collins R, MacMahon S, Lu J, Li W. Serum cholesterol concentration and coronary heart disease in population with low cholesterol concentrations. BMJ 1991;303:276-82.
10. Stamler J, Dyer AR, Shekelle RB, Neaton J, Stamler R. Relationship of baseline major risk factors to coronary and all-cause mortality, and to longevity: findings from long-term follow-up of Chicago cohorts. Cardiology 1993;82:191-222.

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11. Hughes K, Yeo PP, Lun KC, et al. Cardiovascular diseases in Chinese, Malays, and Indians in Singapore. II. Differences in risk factor levels. J Epidemiol Commun Health 1990;44:29-35.
12. Enas EA, Yusuf S, Mehta J. Prevalence of coronary artery disease in Asian Indians. Am J Cardiol 1992;70:945-9.
13. McKeigue PM, Marmot MG. Mortality from coronary heart disease in Asian communities in London. BMJ 1988;297:903.
14. Jha P, Enas EA, Yusuf S. Coronary artery disease in Asian Indians: Prevalence and risk factors. Asian Am Pacific Islander J Health 1993;1:161-75.
15. Pais P, Pogue J, Gerstein H, et al. Risk factors for acute myocardial infarction in Indians: a case-control study. Lancet 1996;348:358-63.
16. McKeigue PM, Shah B, Marmot MG. Relation of central obesity and insulin resistance with high diabetes prevalence and cardiovascular risk in South Asians. Lancet 1991;337:382-6.
17. Anand SS, Enas EA, Pogue J, Haffner S, Pearson T, Yusuf S. Elevated lipoprotein(a) levels in South Asians in North America. Metabolism 1998;47:182-4.
18. Bhatnagar D, Anand IS, Durrington PN, et al. Coronary risk factors in people from the Indian subcontinent living in west London and their siblings in India. Lancet 1995;345:405-9.
19. Heart and Stroke Facts: 1996 Statistical Supplement. Dallas: American Heart Association, 1995.
20. Geronimus AT, Bound J, Waidmann TA, Hillemeier MM, Burns PB. Excess mortality among blacks and whites in the United States.

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Section 4: Lipids and cardiovascular diseases

Allan D Sniderman MD, Jiri Frohlich MD

Cardiovascular diseases (CVD) continue to exact an appalling toll on our society and, therefore, the recent mass of evidence from angiographic (1-3) and clinical (4-18) trials that coronary events in patients with symptomatic CVD can be reduced with low density lipoprotein (LDL) lowering may be a significant advance in cardiovascular therapeutics. It has produced widespread enthusiasm for LDL-lowering therapy. Unfortunately, critical questions such as whether all patients with CVD and individuals with dyslipidemia will benefit from treatment and what the goals of treatment should be are unanswered.

LDL-LOWERING IN CVD

The conclusion that plasma LDL should be lowered in patients with ischemic heart disease (IHD) is based on several randomized clinical trials in which the overall results are concordant (4-18). With LDL lowering as attained in the trials, ie, reduction of approximately 35% in LDL-cholesterol, death would be reduced by approximately 25% and clinical events by somewhat more (1-18).

Limitations remain in our knowledge, one of the most important being whether only coronary patients with moderately or frankly elevated cholesterol levels should be treated. Most of the

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participants in the primary and secondary prevention trials had at least moderately elevated cholesterol levels. A subset analysis of the Cholesterol and Current Events (CARE) trial indicated that there is little advantage to therapy in patients with IHD and LDL-cholesterol below 3.5 mmol/L (less than 135 mg/dL). On the other hand, the results of the Air Force/Texas Coronary Atherosclerosis Prevention Study (AFCAPS/TEXCAPS) (18) stand in contrast to the CARE (15) results. In the AFCAPS/TEXCAPS study, the average entry LDL-cholesterol level was

3.9 mmol/L, and administration of a statin produced a 36% reduction in the frequency of the composite end point of unstable angina, myocardial infarction or death. Importantly, risk reduction was independent of baseline LDL-cholesterol concentration. AFCAPS/TEXCAPS was a primary prevention trial, whereas CARE was a secondary prevention study. However, results similar to those of AFCAPS/TEXCAPS were noted in the Long-Term Intervention with Pravastatin in Ischaemic Disease (LIPID) trial (16), which, like CARE, was a secondary prevention trial and included patients with total cholesterol levels between 4 and 7 mmol/L. Over a six-year follow-up in 9014 patients, myocardial infarction and all cardiovascular events were reduced by 24% and 34%, respectively. In the LIPID study, there was no evidence of a threshold level below which LDL lowering was ineffectual.

The issue of target levels for LDL lowering in CVD patients is also a critical question for clinical practice. The choice of the National Cholesterol Education Program (NCEP) (19) and Canadian Working Group on Dyslipidemias (WGD) (20) of an LDL-cholesterol level less than 2.5 mmol/L as the target level in patients with CVD was based on epidemiological data without clinical trial evidence. With one exception, none of the LDL-lowering trials were designed to test the hypothesis that more LDL lowering is better than less. The exception is an angiographic trial, the Post Coronary Artery Bypass Graft (Post-CABG) trial, which focused on disease in saphenous vein bypass grafts

(21). This trial demonstrated that more intensive LDL lowering (the mean attained value was 2.3 mmol/L) would result in less angiographic progression in saphenous vein bypass grafts than in those with less intensive therapy (mean achieved LDL-cholesterol less than 3.4 mmol/L). In a recent subanalysis of the Scandinavian Simvastatin Survival Study (4S),

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additional benefit was seen in patients who reached target levels below 2.6 mmol/L (22).

Data from large epidemiological studies such as Prospective Cardiovascular Münster (PROCAM) study suggest a log-linear (or curvilinear) relationship between plasma LDL-cholesterol and the difference in the number of events associated with 30% reduction in LDL (23). Thus, the current recommendation from the Canadian WGD, namely an LDL-cholesterol target of less than 2.5 mmol/L, appears reasonable (20) (**Level II, Grade B**). The argument has also been advanced that the percentage reduction from initial levels rather than absolute final levels should be the therapeutic objective (23). This approach would produce a series of clinical objectives very different from the target level approach. The evidence presented in support is consistent with the conclusions reached. Unfortunately, this approach is unlikely ever to be tested in a clinical trial.

TABLE 1
Recommendations for assessment with fasting lipid profile (total cholesterol, high density lipoprotein cholesterol, triglyceride and low density lipoprotein levels) in various patient groups

Patient group	Frequency
Patients with coronary artery disease, CAD or peripheral vascular disease	Annually
Patients with xanthomata or a family history of early CAD with genetic dyslipidemia	One measurement during youth, repeated at age 30 years; if no evidence of genetic dyslipidemia, resume testing every five years from age 40 (for men) or 50 (for women)
Adults with diabetes	Repeat every one to three years or as clinically indicated
Men aged 40 to 70 years, women aged 50 to 70 years	Every five years

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Clinical judgement should be used for patients with multiple risk factors who are approaching these target ages. Note that the translation of number of risk factors into risk levels is incorrect outside of these age ranges. CAD Coronary artery disease

IDENTIFICATION OF HYPERLIPIDEMIA IN INDIVIDUALS WITH OR WITHOUT CVD

Until recently, only cholesterol levels above the 95th percentile were defined as elevated. The virtue of the approach was that abnormal values were markedly deviant from the average and the affected patients were individually at high risk for disease. Additionally, the small numbers of patients so identified limited the economic cost of therapy to prevent disease. The apparent disadvantage of this selective approach was that only a minority of patients with premature coronary IHD have markedly elevated cholesterol levels and, therefore, cholesterol may not be seen to be an important determinant of risk. The definition of hypercholesterolemia then changed, with the upper limit of normal dropping successively from the 95th to the 90th (24) and then to the 75th percentile (25). In consequence, the percentage of our society with hypercholesterolemia rose progressively from 5% to 10% to 25%. In spite of this, the majority of patients with IHD were not hypercholesterolemic (26). The numbers of patients eligible for preventive therapy, however, increased enormously. In Canada, this trend was extended by lowering the upper limit to the 50th percentile (27), automatically making half our population 'diseased', the vast majority of whom would not develop premature CVD. It is for these reasons that both the NCEP (19) and Canadian WGD (20) recommendations link the definition of hyperlipidemia to the assessment of overall risk for IHD. Table 1 lists the recommendations for testing in various groups of patients.

LIPOPROTEIN PARAMETERS

That the data so far have dealt primarily with LDL-cholesterol does not mean that it is the parameter of choice for a therapeutic target or that it should be the only parameter used.

Total and LDL-cholesterol: The data linking an increased risk of CVD to increased total and LDL-cholesterol levels are voluminous but weak:

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Notwithstanding that IHD risk rises progressively with increases in total and LDL-cholesterol, most patients with CVD do not have markedly elevated levels of either. For example, the most recent survey (26) confirms the results of earlier ones (28-31) by demonstrating that only 23% of patients with IHD have a total cholesterol level greater than 6.2 mmol/L (the 75th percentile of the population), and only 26% have an LDL-cholesterol level greater than 4.2 mmol/L (also the 75th percentile of the population). Thus, only a small minority of patients with coronary disease have even moderately elevated levels of total or LDL-cholesterol.

The measurement of LDL-cholesterol has important methodological limitations: LDL-cholesterol is usually not measured directly. Rather, it is calculated based on fasting total cholesterol, triglyceride and high density lipoprotein cholesterol (HDL-C) levels. The measurement of LDL-cholesterol, HDL-C and triglycerides is not standardized, and approved methods may involve considerable inaccuracy (32).

Fasting samples are required to measure LDL-cholesterol, thus increasing cost and decreasing compliance for hypolipidemic therapy.

Newer, as yet unvalidated and unstandardized methods such as direct measurement of LDL-cholesterol are being developed. They will add considerable expense and overcome none of the limitations inherent in that parameter.

Nevertheless, because of the availability of numerous data that link total plasma cholesterol with other major risk factors (such as Framingham tables), total and LDL cholesterol continue to be widely used in the assessment of IHD risk.

Apolipoprotein B: All hepatic apolipoprotein (apo) B lipoproteins contain one molecule of apo B100 per particle, and that molecule of apo B100 stays with the particle during its biological lifetime. The plasma apo B is the sum of the total very low density lipoprotein, intermediate density lipoproteins, LDL, chylomicrons and lipoprotein(a) particles in plasma. Plasma apo B is, therefore, a measure of the total number of atherogenic lipoprotein particles in plasma because

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all the lipoprotein particles that are thought to be proatherogenic are included in the estimate. Given the complexity of lipoprotein metabolism, that simplicity would be a major advantage in ensuring more widespread implementation of appropriate hypolipidemic therapy to reduce CVD.

Measuring LDL-cholesterol incompletely and inaccurately estimates the risk of CVD from LDL. An increased number of small dense LDL particles that contain less cholesterol than normal is one of the most common abnormalities associated with IHD, being present in half or more of the patients with coronary disease (32-36).

The Quebec Cardiovascular Study has shown the importance of apo B as a risk factor for the development of IHD (36). The argument is not that apo B should replace all the other lipid parameters to estimate risk, but rather that measurement of apo B is more informative than measurement of LDL-cholesterol, the parameter that is the cornerstone of the present system. Thus, a patient with a normal LDL-cholesterol level may have an elevated apo B level, just as patients with an increased LDL-cholesterol level may have an even more elevated apo B level. Of particular importance are the data from the Quebec Cardiovascular Study that deal with hypertriglyceridemia: namely, that hypertriglyceridemia with a normal apo B level does not increase risk, whereas hypertriglyceridemia with an elevated apo B level does (37). Such data that powerfully reinforce previous data from cross-sectional studies (38-42) should be critical in constructing strategies to prevent CVD in asymptomatic individuals. Such a strategy would be truly cost effective because large numbers of patients being treated but now known to be not at risk (such as hypertriglyceridemic patients with normal apo B levels) would not have to be treated.

From a laboratory perspective, the measurement of plasma apo B is superior to LDL-cholesterol because it has been standardized (43) and automated, and does not require fasting. The measurement is precise and accurate, and measurements with different techniques or from separate laboratories yields the same answer. Therefore, apo B levels could easily be measured accurately in all routine clinical laboratories. The measurement of

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plasma apo B would greatly simplify the management of the atherogenic dyslipoproteinemias, for both the patient and the physician, and there is now adequate evidence to support its general application (**Level I, Grade A**). **HDL-C, total cholesterol to HDL-C ratio and plasma tri-glyceride levels:** Low HDL-C is common in patients with premature IHD, and the risk of coronary disease is inversely related to HDL-C levels. However, the mechanism by which low HDL-C increases the risk of vascular disease is elusive because some forms of even severely reduced HDL-C levels are not associated with increased vascular risk (44). There is no direct evidence that increasing HDL-C reduces clinical events.

One of the best predictors of future IHD events is the ratio of LDL to HDL-C, or, more practical and accurate (because of possible additional error due to calculation of LDL-cholesterol), total cholesterol to HDL-C ratio. The ratio reflects the fact that, even at low plasma total cholesterol levels, low HDL-C concentrations significantly increase the risk of a future IHD event, while high HDL-C are protective even if total (and LDL) plasma cholesterol levels are high (45,46). Increases in the ratio are particularly significant if accompanied by higher (eg, greater than 2.0 mmol/L) tri-glyceride levels (46). Thus, the interim Canadian WGD recommendations (20) list both the ratio and triglyceride level as targets for treatment.

Whether hypertriglyceridemia is an independent risk factor for CVD is a contentious epidemiological issue (47). Elevated fasting plasma triglyceride levels are common in patients with IHD. Univariate analyses almost invariably identify triglyceride levels as a significant risk factor while multivariate analyses almost invariably do not. Many factors may account for this: plasma triglycerides interact with other lipoprotein variables; interindividual variation in plasma tri-glyceride levels is considerably larger than other plasma lipo-protein parameters; and plasma triglyceride levels are not normally distributed but rather are skewed to the right. There is also an absence of linearity of increased risk with increased plasma triglyceride levels. This lack of epidemiological evidence conforms to the biological reality: namely, the most elevated triglyceride levels are associated with disturbances of chylomicron metabolism, and cardiovascular risk is not commonly increased in such individuals. By contrast, mild to moderate elevations in plasma triglyceride levels are commonly found in patients with IHD.

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While the primary treatment target is LDL-cholesterol or apo B, hypertriglyceridemia, particularly when combined with low HDL-C, is a significant risk factor. This combination is often seen in the metabolic syndrome with visceral obesity, hypertension and insulin resistance and indicates a need for more aggressive therapy. Societies characterized by low IHD rates with low fatty acid intakes and proportionately higher carbohydrate intakes are characterized by low HDL-C and mild hypertriglyceridemia. Both cross-sectional and prospective studies (37-40) have shown that hypertriglyceridemia associated with increased LDL particle number, ie, hypertriglyceridemic hyperapo B, is associated with high cardiovascular risk, whereas hypertriglyceridemia with a normal apo B level is not. There is no clinical trial evidence that lowering triglyceride levels changes cardiovascular risk. There is no therapy to primarily change HDL-C. There are limited clinical trial data suggesting that fibrates may reduce cardiovascular risk (48,49), but multiple mechanisms may be responsible, including their effects on triglyceride and HDL-C levels, and LDL remodelling, making interpretation difficult. On the other hand, a recent eight-year follow-up in the Copenhagen male study (50,51) strongly suggests that high triglyceride/low HDL-C is at least as powerful a predictor of IHD as isolated high LDL-cholesterol.

There is no agreement on including testing for both HDL-C (or the total to HDL-C ratio) and fasting triglycerides (in addition to LDL-cholesterol) as criteria for treatment. However, there is sufficient evidence to justify screening and therapy for the combination of hypertriglyceridemia and low HDL-C (**Level II, Grade B**). HDL-C levels are a valid tool to gauge atherogenic risk (**Level II, Grade A**). The laboratory techniques used to measure lipid parameters need to be improved, and physicians need to be aware of their limitations.

TREATMENT OF PATIENTS WITH CEREBROVASCULAR DISEASE OR PERIPHERAL ARTERIAL DISEASE

There is increasing evidence supporting the recommendation that patients with cerebrovascular disease and/or peripheral arterial disease should be treated in the same way with regard to lipids as patients with symptomatic IHD. Such patients frequently also have

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coronary disease that may be asymptomatic. Initial data suggest that cerebrovascular events are also significantly reduced in patients in the major statin/LDL-lowering trials. These conclusions are based on sub-group analyses of the individual trials (52) and meta-analyses of the major trials (53-55) (**Level III, Grade C**).

Given the favourable risk to benefit ratio of statin therapy and acknowledging the need for direct testing of the issue by a specific clinical trial, physicians can reasonably use this therapy in individual patients with cerebrovascular or peripheral arterial disease.

DIABETES AS AN INDICATION FOR LDL-LOWERING THERAPY

There is preliminary evidence from subgroup analyses that persons with diabetes with moderate hypercholesterolemia and IHD benefit at least as much from LDL lowering as do persons without diabetes (56). Typically, persons with diabetes are hypertriglyceridemic, with small dense LDL particles and low HDL-C. Unfortunately, no randomized prospective clinical trial data are available to answer this question. However, recent reports (57,58) on mortality from IHD in type 2 diabetes strongly suggest that an intensive approach to the treatment of diabetic dyslipidemia is warranted, ie, treatment to an LDL-cholesterol target level above 3.0 mmol/L and a triglyceride level below 2.0 mmol/L for all patients with type 2 diabetes, and to IHD target levels for those with an additional risk factor. Increasingly, after discussion and informed consent, substantial numbers of persons with diabetes without symptomatic vascular disease are choosing lipid lowering therapy (**Level II, Grade B**).

CONCEPT OF ATTRIBUTABLE RISK

In determining the need for treatment or further investigations of patients with IHD, it is helpful to assess whether the sum of the patients' risk factors can account for the disease.

TREATMENT

Given that there is no evidence that primary prevention as advocated by the NCEP will prevent clinical events in those with anatomic but asymptomatic coronary disease, it is suggested that the concepts of primary and secondary prevention be replaced by the concepts of low and high

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risk as proposed by Canadian (20) and European guidelines (59). In their approach, only those at high risk are treated, and the treatment approach and objectives are the same for everyone in this group.

For those at high risk, the primary treatment objectives should be a serum LDL-cholesterol level below 2.5 mmol/L or apo B below 90 mg/dL.

Lifestyle factors, in particular diet and exercise, are cornerstones of therapy and should not be ignored.

Nevertheless, pharmacological therapy is required in the majority of high risk patients. Statins are the agents of first choice. In a number of patients, additional LDL lowering may be necessary, and bile acid sequestrants are the first choice to add to statin therapy. Nicotinic acid, if tolerated, is an inexpensive and very effective hypolipidemic agent and should be used when appropriate. Adding fibrates to statins is a possible option in patients who remain hypertriglyceridemic. There is, however, a small but real risk of significant skeletal muscle injury. Careful follow-up of such patients is advisable.

Serious consideration should be given to starting statin therapy before hospital discharge after an admission for an acute ischemic event.

Unless therapy is sustained, there will be only cost without benefit. Patient education is essential, and research into measures to improve compliance is highly desirable.

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REFERENCES

1. Brensike JF, Levy RI, Kelsey SF, et al. Effects of therapy and cholestyramine on progression of coronary atherosclerosis: Results of the NHLBI Type II Coronary Intervention Study. *Circulation* 1984;69:313-24.
2. Blankenhorn DH, Nessim SA, Johnson RI, Sanmaro ME, Azen SP, Cashin-Hemphill L. Beneficial effects of combined colestipol-niacin therapy on coronary atherosclerosis and coronary venous bypass grafts. *JAMA* 1987;257:3233-40.
3. Brown G, Albers JJ, Fisher LD, et al. Regression of coronary heart disease as a result of intensive therapy in men with high levels of apolipoprotein B. *N Engl J Med* 1990;323:1289-98.
4. Kane JP, Mallow M, Prots TA, Phillips NR, Dietil JC, Havel RJ. Regression of coronary atherosclerosis during treatment of familial hypercholesterolemia with combined drug regimens. *JAMA* 1990;264:3007-12.
5. Watts GF, Lewis B, Brunt JH, et al. Effects on coronary heart disease of lipid lowering diet, or diet plus cholestyramine, in the St. Thomas' Atherosclerosis Regression Study (STARS). *Lancet* 1992;339:565-9.
6. Blankenhorn DH, Azen SP, Krams DM, et al. Coronary angiographic changes with lovastatin therapy: The Monitored Atherosclerosis Regression Study (MARS). *Ann Intern Med* 1993;119:969-76.
7. Waters D, Higginson L, Gladstone P, et al. Effects of monotherapy with an HMG-CoA reductase inhibitor upon the progression of coronary atherosclerosis as assessed by serial quantitative arteriography: The Canadian Coronary Atherosclerosis Intervention Trial (CCAIT). *Circulation* 1994;89:959-68.
8. Sacks FM, Pasternak RC, Gibson CM, Rosner B, Stone PH. Effect on coronary atherosclerosis of decrease in plasma cholesterol concentrations in

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normocholesterolaemic patients. The Harvard Atherosclerosis Reversibility Project (HARP). Lancet 1994;344:1182-6.

9. Pitt B, Mancini GB, Ellis SG, Rosman HS, Park JS, McGovern ME. Pravastatin Limitation of Atherosclerosis in the Coronary Arteries (PLAC-1): Reduction in atherosclerosis progression and clinical events. J Am Coll Cardiol 1995;26:1133-9.
10. MAAS Investigators. Effect of simvastatin on coronary atheroma: The Multicentre Anti-Atheroma Study (MAAS). Lancet 1994;344:633-8.
11. Herd JA, Ballantyne M, Farmer JA, et al. The effect of fluvastatin on coronary atherosclerosis. The Lipoprotein and Coronary Atherosclerosis Study (LCAS). Circulation 1996;94(Suppl I):I597. (Abst)
12. Schuler G, Hambrecht R, Schlierf G, et al. Regular physical exercise and low fat diet: effect on progression of coronary heart disease. Circulation 1992;86:1-11.
13. Haskell WL, Alderman EL, Fair JM, et al. Effects of intensive multiple risk factor reduction on coronary atherosclerosis and clinical cardiac events in men and women with coronary heart disease: The Stanford Coronary Risk Intervention Project (SCRIP). Circulation 1994;89:975-90.
14. Scandinavian Simvastatin Survival Group. Randomized trial of cholesterol lowering in 4444 patients with coronary heart disease: The Scandinavian Simvastatin Survival Study (4S). Lancet 1994;344:1383-9.
15. Sacks FM, Pfeffer MA, Moye LA, et al. The effect of Pravastatin on coronary events after myocardial infarction in patients with average cholesterol levels. N Engl J Med 1996;335:1001-9.
16. The Long-Term Intervention with Pravastatin in Ischaemic Disease (Lipid) Study Group. Prevention of cardiovascular events and death with pravastatin in patients with coronary heart disease and a broad range of initial cholesterol levels. N Engl J Med 1998;339:1349-57.

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17. Shepherd J, Cobbe SM, Ford I, et al. Prevention of coronary heart disease with pravastatin in men with hypercholesterolemia. N Engl J Med 1995;333:1301-7.
18. Downs JR, Clearfield M, Weis S, et al. Primary prevention of acute coronary events with lovastatin in men and women with average cholesterol levels: results of AFCAPS/TexCAPS. The Air Force/Texas Coronary Atherosclerosis Prevention Study. JAMA 1998;279:1615-22.
19. Summary of the second report of the National Cholesterol Education Program (NCEP) Expert Panel on detection, evaluation, and treatment of high blood cholesterol in adults (Adult Treatment Panel II). JAMA 1993;269:3015-23.
20. Frohlich J, Fodor G, McPherson R, Genest J, Langner N. Rationale for and outline of the recommendations of the Working Group on Hypercholesterolemia and other Dyslipidemias: Interim report. Can J Cardiol 1998;14(Suppl A):17A-21A.
21. The Post Coronary Artery Bypass Graft Trial Investigators. The effect of aggressive lowering of low-density lipoprotein cholesterol levels and low dose anticoagulation on obstructive changes in saphenous-vein coronary artery bypass grafts. N Engl J Med 1997;336:153-62.
22. Pedersen TR, Olsson AG, Faergeman O, et al. Lipoprotein changes and reduction in the incidence of major coronary heart disease events in the Scandinavian Simvastatin Survival Study (4S). Circulation 1998;97:1453-60.
23. Thompson GR, Hollyer J, Waters DD. Percentage change rather than plasma level of LDL-cholesterol determines therapeutic response in coronary heart disease. Curr Opin Lipidol 1995;6:386-8.
24. Cullen P, Assman G. Treatment goals for LDL-cholesterol in the secondary prevention of coronary heart disease. Am J Cardiol 1997;80:1287-94.

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25. National Cholesterol Education Program Expert Panel. Report of the National Cholesterol Education Program Expert Panel on Detection, Evaluation and Treatment Consensus of High Blood Cholesterol in Adults. Arch Intern Med 1988;148:36-9.
26. Rubins HB, Robins SJ, Collins D, et al. Distribution of the lipids in 8,500 men with coronary artery disease. Am J Cardiol 1995;75:1196-201.
27. Canadian Consensus Conference on Cholesterol: Final Report. The Canadian Consensus Conference in the prevention of heart and vascular disease by altering serum cholesterol and lipoprotein risk factors. Can Med Assoc J 1988;139(Suppl):1-8.
28. Kannel WB, Castelli WP, Gordon T, McNamara PM. Serum cholesterol, lipoprotein, and the risk of coronary heart disease. The Framingham Study. Ann Intern Med 1974;74:1-12.
29. Gotto AM, Gorro GA, Thompson JR, et al. Relationship between plasma lipid concentration and coronary artery disease in 496 patients. Circulation 1977;56:875-83.
30. Holmes DR Jr, Elveback LR, Fraye RL, et al. Association of risk factor variables and coronary artery disease documented with angiography. Circulation 1981;63:293-9.
31. Blank D, Silberberg J, Sniderman AD. Trade-offs on cutpoints for the treatment of hyperlipidemia. Coron Artery Dis 1990;1:455-9.
32. Teng B, Thompson GR, Sniderman AD, Forte TM, Krauss RM, Kwiterovich PO. Composition and distribution of low-density lipoprotein fractions in hyperapobetalipoproteinemia, normolipidemia and familial hypercholesterolemia. Proc Natl Acad Sci USA 1983;80:6662-6.
33. Griffin BA, Freeman DJ, Tait GW, et al. Role of plasma triglyceride in the regulation of plasma low density lipoprotein (LDL) subfractions: relative contribution of small, dense LDL to coronary heart disease risk. Atherosclerosis 1994;106:241-53.
34. Crouse JR, Parks JS, Schey HM. Studies of low density lipoprotein molecular weight in human beings with coronary artery disease. J Lipid Res 1985;26:566-74.

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35. Lamarche B, Tchernof A, Moorjani S, et al. Small, dense low-density lipoprotein particles as a predictor of the risk of ischemic heart disease in men. Prospective results from the Québec Cardiovascular Study. *Circulation* 1997;95:69-75.
36. Lamarche B, Moorjani S, Lupien PJ, et al. Apolipoprotein A-1 and B levels and the risk of ischemic heart disease during a five-year follow-up of men in the Québec Cardiovascular Study. *Circulation* 1996;94:273-8.
37. Lamarche B, Despres JP, Moorjani S, et al. Prevalence of dyslipidemic phenotypes in ischemic heart disease (prospective results from the Quebec Cardiovascular Study). *Am J Cardiol* 1995;75:1189-95.
38. Sniderman AD, Wolfson C, Teng B, Franklin FA, Bachorik PS, Kwiterovich PO Jr. Association of hyperapobetalipoproteinemia with endogenous hypertriglyceridemia and atherosclerosis. *Ann Intern Med* 1982;97:833-9.
39. Brunzell JD, Schrott HG, Motulsky AG, Bierman EL. Myocardial infarction in the familial forms of hypertriglyceridemia. *Metabolism* 1976;25:313-20.
40. Durrington PN, Hunt L, Ishola M, Kane JP, Stephens WP. Serum apolipoproteins A1 and B and lipoproteins in middle aged men with and without previous myocardial infarction. *Br Heart J* 1986;56:206-12.
41. Barbir M, Wile D, Trayner I, Aber VR, Thompson GR. High prevalence of hypertriglyceridemia and apolipoprotein abnormalities in coronary artery disease. *Br Heart J* 1988;60:397-403.
42. Kukita H, Hamada M, Hiwada K, Kokubu T. Clinical significance of measurements of serum apolipoprotein AI, AII and B in hypertriglyceridemic male patients with and without coronary artery disease. *Atherosclerosis* 1985;55:143-9.
43. Marcovina SM, Albers JJ, Kennedy H, Mei JV, Henderson LO. International Federation of Clinical Chemistry standardization project for measurements of apolipoprotein A-I and

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B. IV. Comparability of apolipoprotein B values by use of international reference material. Clin Chem 1994;40:586-92.

44. Calabresi L , Franceschini G. High density lipoprotein and coronary heart disease: insights from mutations leading to low high density lipoprotein. Curr Opin Lipidol 1997;8:219-24.
45. Grover SA, Coupal L, Hu XP. Identifying adults at increased risk of coronary disease. How well do the current cholesterol guidelines work? JAMA 1995;274:801-6.
46. Gordon T, Castelli WP, Hjortland MC, Kannel WB, Dawber TR. High density lipoprotein as a protective factor against coronary heart disease; The Framingham Study. Am J Med 1977;62:707-14.
47. Hokanson JE, Austin MA. Plasma triglyceride level is a risk factor for cardiovascular disease independent of high-density lipoprotein cholesterol level: a meta-analysis of population-based prospective studies. J Cardiovasc Risk 1996;3:213-9.
48. Frick MH, Elo O, Haapa K, et al. Helsinki Heart Trial: primary-prevention trial with gemfibrozil in middle-aged men with dyslipidemia. N Engl J Med 1987;317:1237-45.
49. Ericsson CG, Hamsten A, Nilsson J, Grip L, Svane B, de Faire U. Angiographic assessment of effect of bezafibrate on progression of coronary artery disease in young male post infaction patients. Lancet 1996;347:849-53.
50. Jeppesen J, Hein HO, Suadicani P, Gyntelberg F. Triglyceride concentration and ischemic heart disease: An 8 year follow up in the Copenhagen male study. Circulation 1998;97:1029-36. Can J Cardiol Vol 15 Suppl G December 1999 55G Lipids and CVD

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CANADIAN CARDIOVASCULAR SOCIETY 1998 CONSENSUS CONFERENCE ON THE PREVENTION OF CARDIOVASCULAR DISEASES: THE ROLE OF THE CARDIOVASCULAR SPECIALIST

Section 4: The 1999 Canadian recommendations for the management of hypertension

RD Feldman MD, On behalf of the Task Force for the Development of the 1999 Canadian Recommendations for the Management of Hypertension

Hypertension is a significant and reversible risk factor for cerebrovascular disease, coronary artery disease and congestive heart failure, as well as for renal failure and peripheral vascular disease. There is general agreement that the cardiovascular complications of hypertension can be effectively treated with both lifestyle modification and pharmacological therapy of the disease. Hypertension can be diagnosed noninvasively, and the resources for the diagnosis and monitoring of blood pressure are readily available, yet this disease is poorly managed. The Canadian Heart Health Survey reported that only about half of Canadians with hypertension are aware of their diagnosis and only 16% have adequate blood pressure control - a dismal record, but one that is comparable with that seen in other industrialized countries (1).

The 1999 Canadian Recommendations for the Management of Hypertension follow a process initiated in the early 1980s by the Canadian Hypertension Society and revisited in 1993 (2-6). These initial versions of the recommendations were notable in that they were one of the earliest attempts at evidence-based guidelines in hypertension, using strict criteria for grading of evidence. Further, the recommendations were, wherever possible, based on the identification of therapies that not only effectively decrease blood pressure, but also reduce the ultimate end points, ie, decreased rates of hypertension-related cardiovascular complications.

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The current recommendations are also the culmination of the current cycle of consensus conferences organized to review Canadian hypertension recommendations, including the report of the Canadian Hypertension Society Consensus Conference on Management of Hypertensive Disorders in Pregnancy (7-9) and the report on Lifestyle Modifications to Prevent and Control Hypertension (10-16).

TABLE 1 - Levels of evidence for rating studies of diagnosis

- I.
 - a. Independent interpretation of test procedure (without knowledge of result of diagnostic standard)
 - b. Independent interpretation of diagnostic standard (without knowledge of result of test procedure)
 - c. Selection of patients or subjects who are suspected but not known to have the disorder of interest
 - d. Reproducible description of both the test and the diagnostic standard
 - e. At least 50 patients with and 50 without the disorder
- II. Meets four of the criteria in I
- III. Meets three of the criteria in I
- IV. Meets two of the criteria in I
- V. Meets one of the criteria in I
- VI. Meets none of the criteria in I

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The task force for development of the 1999 Canadian Recommendations for the Management of Hypertension was organized at the direction of the Executive and Board of the Canadian Hypertension Society. The current recommendations reflect a collaboration between the Canadian Hypertension Society and nine partner organizations: the Canadian Coalition for High Blood Pressure Prevention and Control, Canadian Cardiovascular Society, Canadian Diabetes Association, Canadian Nurses Association, Canadian Society of Nephrology, Canadian Stroke Society, College of Family Physicians of Canada, Health Canada, and Heart and Stroke Foundation of Canada. Draft recommendations were circulated for voting to all participants in the consensus process, and recommendations that were approved by more than 75% of the consensus panel were presented in an open forum at a special symposium of the Canadian Hypertension Society, held in conjunction with the Canadian Cardiovascular Society meeting in Ottawa in October 1998. Areas of substantive comment were re-evaluated, and revised recommendations were recirculated for revoting and ultimate approval. The process was completed in April 1999. The recommendations approved through that process are described below.

TABLE 2 - Levels of evidence for rating studies of prognosis

- I.
 - a. Inception cohort
 - b. Reproducible inclusion and exclusion criteria
 - c. Follow-up of at least 80% of subjects
 - d. Statistical adjustment for extraneous prognostic factors (confounders)
 - e. Reproducible descriptions of outcome measures
- II. Inception cohort, but meets only three of the other criteria in I

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- III. Inception cohort, but meets only two of the other criteria in I
- IV. Inception cohort, but meets only one of the other criteria in I
- V. Inception cohort, but meets none of the other criteria in I
- VI. Inception cohort, but meets none of the criteria in I

TABLE 3 - Levels of evidence for rating studies of treatment, prevention and quality assurance

- I. A randomized controlled trial (RCT) that demonstrates a statistically significant difference in at least one important outcome, eg, survival or major illness
OR
If the difference is not statistically significant, an RCT of adequate sample size to exclude a 25% difference in relative risk with 80% power, given the observed results
- II. An RCT that does not meet the level I criteria
- III. A nonrandomized trial with contemporaneous controls selected by some systematic method (ie, not selected by perceived suitability for one of the treatment options for individual patients)
OR
Subgroup analysis of a randomized trial
- IV. A before-after study or case series (of at least 10 patients) with historical controls or controls drawn from other studies
- V. Case series (at least 10 patients) without controls
- VI. Case report (fewer than 10 patients)

The evidence and recommendations were graded according to the system previously used by the Canadian Hypertension Society (2-4) (Tables 1 to 5). Levels of evidence determined from review studies were not used in this process. It should be noted that the level of evidence for

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studies is graded numerically (I to VI) while the grading system for recommendations is alphabetical, with A being a recommendation based on one or more studies at Level I, and D where the best evidence available is lower than Level III and includes expert opinion.

What follows are the recommendations for the management of hypertension. It should be emphasized that this set of recommendations was written both to guide the care of patients with hypertension, and as a technical document for development of clinical practice guidelines and broader implementation strategies for improving blood pressure control and reducing cardiovascular complications. They are written from the perspective of optimal management as extrapolated from the best available clinical trials evidence. Neither public health policy nor health care economic considerations contributed to this process. Additionally, individual patient preferences were not considered in the development of these recommendations, which may have a significant impact on the implementation of a number of these recommendations, especially in the context of diagnosis and risk stratification.

TABLE 4 - Levels of evidence for rating review articles	
I.	<div>a. Comprehensive search for evidence</div> <div>b. Avoidance of bias in the selection of articles</div> <div>c. Assessment of the validity of each cited article</div> <div>d. Conclusions supported by the data and analysis presented</div>
II.	Meets only three of the criteria in I
III.	Meets only two of the criteria in I
IV.	Meets only one of the criteria in I

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V. Meets none of the criteria in I

TABLE 5 - Grading system for recommendations

- A. The recommendation is based on one or more studies at level I
- B. level I
- C. The best evidence available was at Level III
- D. The best evidence available was lower than Level III and included expert opinion

THE DIAGNOSIS OF HYPERTENSION

Accurate measurement of blood pressure:

The blood pressure of all adult patients should be assessed at all appropriate visits for determination of cardiovascular risk and monitoring of antihypertensive treatment by persons who have been specifically (re)trained to measure blood pressure accurately (**Grade C**).

Use of standardized measurement technique (Table 6) is recommended when assessing blood pressure for determination of cardiovascular risk and monitoring of antihypertensive treatment (**Grades B to D**).

Criteria for the diagnosis of hypertension and the recommendations for follow-up:

Patients presenting as a hypertensive emergency/urgency are diagnosed as hypertensive at their first (initial) visit and require immediate management (**Grade D**).

If the initial (visit 1) blood pressure is high, then, in the same session, two readings should be taken according to the recommended procedure for accurate blood pressure determination (Table 6), and the patient should be scheduled for further visits (**Grade A**).

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Patients with target organ damage can be diagnosed as hypertensive at or after visit 3 (Grade B).

The search for target organ damage, associated risk factors and exogenous causes of elevated blood pressure should proceed as follows (Grade D):

TABLE 6 - Recommended technique for measuring blood pressure

- i. Measurements are preferably taken with a mercury manometer, but a recently calibrated aneroid or a validated and recently calibrated electronic device can be used. Aneroid devices and mercury columns need to be clearly visible at eye level.
- ii. Choose a cuff with an appropriate bladder width (bladder width $\times 2.5$) ± 4 cm = the arm circumference.
- iii. Place the cuff so that the lower edge is 3 cm above the elbow crease and the bladder is centered over the brachial artery. The patient should be resting comfortably for 5 mins in the seated position with back support. The arm should be bare and supported with the antecubital fossa at heart level. There should be no talking, and the patient's legs should not be crossed. Blood pressure also should be assessed after standing for 2 mins and at times when the patient complains of symptoms suggestive of postural hypotension.
- iv. Increase the pressure rapidly to 30 mmHg above the level at which the radial pulse is extinguished (to exclude the possibility of auscultatory gap).
- v. Place the head of the stethoscope gently but firmly over the brachial artery.
- vi. Open the control valve so that the rate of drop in the vicinity of the systolic and diastolic level is 2 mmHg per beat.
- vii. Read the systolic level - the first appearance of a clear tapping sound (phase I Korotkoff) - and the diastolic level - the point at which the sounds disappear (phase V Korotkoff). Record the blood pressure to the closest 2 mmHg on the manometer (or 1 mmHg on electronic devices) as well as the arm used and whether the patient was supine, sitting

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or standing. Record the heart rate. The seated blood pressure is used to determine and monitor treatment decisions. The standing blood pressure is used to examine for postural hypotension, if present, which may modify treatment.

- viii. If Korotkoff sounds persist as the level approaches 0 mmHg, then the point of muffling of the sound is used (phase IV) to indicate the diastolic pressure.
- ix. In the case of arrhythmia, additional readings may be required to estimate the average systolic and diastolic pressure. Isolated extra beats should be ignored. Note the rhythm and pulse rate.
- x. Leaving the cuff partially inflated for too long fills the venous system and makes the sounds difficult to hear. To avoid venous congestion, it is recommended that at least 1 min should elapse between readings.
- xi. Blood pressure should be taken at least once in both arms, and if an arm has a consistently higher pressure, then that arm should be used subsequently.

1. On the first visit, the patient should be questioned about and the medical record reviewed for myocardial infarction, angina pectoris, transient ischemic attacks or cerebrovascular accident, peripheral arteriovascular insufficiency or renal insufficiency.
2. At visit 2, if the blood pressure is still elevated, further history and physical examination should be taken. Diagnostic tests should be arranged before visit 3.

If the visit 1 blood pressure is between 140/90 and 180/105 mmHg, at least four further visits are required to diagnose hypertension. These measurements can be taken over the next six months (**Grade B**).

If, at the last diagnostic visit, the blood pressure is less than 140/90 mmHg and the patient has no evidence of target organ damage or associated risk factors, the patient should be assessed yearly (**Grade D**).

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Such patients are at low risk (**Grade A for prognosis**) and should not be labelled hypertensive (**Grade D**).

Follow-up of patients on antihypertensive drug treatment should proceed as follows:

1. Patients should be seen monthly until two blood pressure readings are below the target on antihypertensive medication (**Grade D**).
2. Shorter intervals between visits are needed for symptomatic patients, and those with severe hypertension, intolerance to antihypertensive drugs and target organ damage (**Grade D**).
3. Once the target blood pressure has been reached, patients should be seen at three-to six-month intervals (**Grade D**).

For patients on lifestyle modification (nonpharmacological treatment), follow-up visits at three-to six-monthly intervals are reasonable (**Grade D**).

Routine laboratory tests for the investigation of all patients with hypertension:

The following routine laboratory tests (**Grade D**) should be included in the investigation of all patients with hypertension:

Urinalysis;

Complete blood cell count;

Blood chemistry (potassium, sodium and creatinine);

Fasting glucose;

Total cholesterol, high density lipoprotein cholesterol, low density lipoprotein cholesterol and triglyceride levels;

Standard 12-lead electrocardiogram.

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Home blood pressure monitoring:

Home blood pressure monitoring in selected patients has the following specific roles:

1. Regular use of home blood pressure monitoring should be considered in patients suspected to be noncompliant under close clinical supervision and among diabetic patients (**Grade B noncompliant patients; Grade D diabetic patients**).
2. When home monitoring is used to assess patients for white coat hypertension, those identified to have white coat effect should be further assessed with the use of ambulatory blood pressure monitoring if available.

Patients should be advised to purchase and use only home blood pressure monitoring devices that have met the standards of the Association for the Advancement of Medical Instrumentation or the British Hypertension Society, or both (**Grade D**).

Home blood pressure values of approximately 135/83 mmHg or greater should be considered elevated (**Grade B**).

If patients measure their blood pressure at home, health care professionals should ensure that patients have adequate training in measuring their blood pressure and adequate information about interpreting these readings (**Grade D**).

The accuracy of all individual patients' devices (especially electronic devices) and technique (especially acoustic devices) must be checked regularly against a device of known calibration, for example, a mercury column sphygmomanometer (**Grade D**).

Ambulatory blood pressure monitoring:

Physicians should use only ambulatory blood pressure monitoring devices that have been validated independently according to established protocols (**Grade A**).

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A decision to withhold drug therapy, based on the ambulatory blood pressure, should take into account normal values for 24 h and awake ambulatory blood pressure (**Grade B**).

Ambulatory blood pressure monitoring should be considered for untreated patients whenever an office-induced increase in blood pressure is suspected, including patients with mild to moderate clinic blood pressure elevations, without target organ damage (**Grade A**).

Among treated patients, ambulatory blood pressure monitoring should be considered for patients suspected of having an office-induced increase in blood pressure, including apparent resistance to drug therapy, symptoms suggestive of hypotension and fluctuating office blood pressure readings (**Grade B**).

Changes in nocturnal blood pressure should be taken into account in any decision to withhold drug therapy based on ambulatory blood pressure (**Grade A, prognosis**).

Role of echocardiography in hypertension:

Routine echocardiographic evaluation of all hypertensive patients is not recommended (**Grade D**).

Echocardiographic assessment of left ventricular mass as well as of systolic and diastolic left ventricular function is recommended for hypertensive patients suspected to have left ventricular dysfunction or coronary artery disease (**Grade D**).

Echocardiography should not be used to track therapeutic regression of left ventricular hypertrophy (**Grade D**).

THE PHARMACOLOGICAL TREATMENT OF HYPERTENSION

Indications for drug treatment:

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Drug therapy for hypertension should be strongly considered in all adults under 60 years of age with sustained diastolic blood pressure of 90 mmHg or higher (**Grade A**).

Drug therapy should be considered in adults less than 60 years of age with isolated systolic hypertension (>160 mmHg), particularly those with target organ damage, concomitant diseases like diabetes mellitus or other independent cardiovascular risk factors (**Grade D**).

1. Drug therapy should be prescribed for all hypertensive adults under 60 years of age with target organ damage related to uncontrolled hypertension (**Grade C**) or one of the following diseases: diabetes mellitus, renal parenchymal disease or cardiovascular disease (**Grade C**) (refer to specific chapters of this supplement for details).
2. The presence of other independent cardiovascular risk factors such as older age, male sex, being postmenopausal, black race, elevated systolic blood pressure, continued cigarette smoking, glucose intolerance or abnormal blood lipid profile should strongly influence the decision to initiate drug therapy (**Grade C**). Other factors, including a strong family history of hypertension or premature cardiovascular disease, increased body mass index or truncal obesity and sedentary lifestyle, should also be taken into account (**Grade D**).

Irrespective of any other factors, drug therapy for hypertension should be prescribed for all adults under 60 years of age with diastolic blood pressure readings averaging 100 mmHg or higher (**Grade A**).

For all adults over 60 years of age, drug therapy is indicated for isolated systolic hypertension in which systolic blood pressure is 160 mmHg or higher (**Grade A**), or for diastolic blood pressures >105 mmHg (**Grade A**).

TABLE 7 - Preferred antihypertensive therapies for patients with diabetes		
	Preferred therapy	Grade
Albuminuria >300 mg/day	ACE inhibitor	A

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<300 mg/day	ACE inhibitor	A
Beta-adrenergic antagonist		A
Patients with diabetes, isolated systolic hypertension, over 60 years of age	Low dose thiazide diuretics or long acting dihydropyridine calcium blockers	C

ACE Angiotensin-converting enzyme

Choice of therapy in adults younger than 60 years with uncomplicated hypertension:

Initial therapy should be monotherapy with a thiazide diuretic, preferably in a low dose, a beta-adrenergic antagonist or an angiotensin-converting enzyme (ACE) inhibitor (**Grade A**). If the response is inadequate or there are adverse effects, another drug from the initial drug therapy group should be substituted (**Grade D**).

Combination therapy, with either a thiazide diuretic and beta-adrenergic antagonist, or a thiazide diuretic and ACE inhibitor, should be used if there is only a partial response to monotherapy (**Grade A**).

If blood pressure is still not controlled, or there are adverse effects, other classes of antihypertensive drugs should be tried (calcium entry blocker, angiotensin II receptor antagonist, alpha-adrenergic antagonist or centrally acting agent) either singly or in combination (**Grade D**). Possible reasons for poor response to therapy, including noncompliance, secondary causes of hypertension or interactions between prescribed treatment and diet or other drugs, should be considered (**Grade D**).

Choice of therapy in adults older than 60 years of age with uncomplicated hypertension:

For uncomplicated hypertension without contraindication, the preferred therapy in hypertensive patients over the age of 60 years is low dose thiazide diuretics (**Grade A**) and long acting dihydropyridine calcium channel blockers (**Grade A**).

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Although beta-adrenergic antagonists may be useful as adjunctive therapy in elderly patients taking diuretics, they are not recommended as first line therapy (**Grade A**).

An ACE inhibitor (**Grade B**) or AT1 receptor antagonist (**Grade D**) should be considered as alternative therapy when diuretics or calcium channel blockers are ineffective, contraindicated or not tolerated.

Centrally acting agents and alpha-adrenergic antagonists are effective for decreasing blood pressure and reducing events (**Grade B**). However, cognitive impairment resulting from therapy with methyldopa, postural hypotension from alpha-adrenergic antagonists (eg, prazosin, terazosin and doxazosin), drowsiness, and rebound hypertension and depression from reserpine may limit the use of these otherwise effective antihypertensives in older people.

Goal of therapy:

The goal of diastolic blood pressure treatment is a blood pressure level of less than 90 mmHg (**Grade A**). For systolic blood pressure, the goal is a pressure level of less than 140 mmHg (**Grade D**).

Hypertension and hyperlipidemia:

In the setting of dyslipidemia, therapy for hypertension should follow the recommendations for uncomplicated hypertension or for patients with other concurrent risk factors or diseases, as appropriate, with the following additional considerations:

1. High doses of thiazides and beta-adrenergic antagonists without intrinsic sympathetic activity may worsen lipid profiles (**Grade B**).
2. Alpha-adrenergic antagonists can improve the lipid profile (**Grade B**).

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Cigarette smoking:

Benefits of beta-adrenergic antagonist therapy in hypertensive smokers are uncertain. Thus, in the absence of target organ damage or concurrent cardiovascular disease, beta-adrenergic antagonists are not recommended for hypertensive patients who smoke (**Grade C**).

Diabetes:

Hypertension in people with diabetes (blood pressure greater than 140/90 mmHg) should be treated to obtain target blood pressure less than 130/80 mmHg (**Grade C**).

People with diabetes and hypertension with blood pressure of 130/80 mmHg to 139/89 mmHg and with target organ damage should be treated to obtain target blood pressure less than 130/80 mmHg (**Grade D**).

For patients with diabetes and hypertension without overt nephropathy and who are under the age of 60 years, the preferred therapy is either an ACE inhibitor or cardioselective beta-adrenergic antagonist (**Grade A**) (Table 7).

Second-line therapy includes low dose thiazide (**Grade B**), long acting calcium channel blocker (**Grade B**) and alpha-adrenergic antagonists (**Grade C**). Alpha-adrenergic antagonists and centrally acting antihypertensive agents should be used with caution in the presence of autonomic neuropathy (**Grade C**).

Preferred therapy for patients with diabetes, hypertension and overt nephropathy (albuminuria greater than 300 mg/day) is an ACE inhibitor (**Grade A**).

For patients who experience adverse effects to an ACE inhibitor, an angiotensin II receptor antagonist may be substituted (**Grade D**).

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Preferred therapy for patients with diabetes, isolated systolic hypertension and age over 60 years is either low dose thiazide diuretics or long acting dihydropyridine calcium channel blockers (**Grade C**).

If monotherapy with first-line agents is ineffective, contraindicated or associated with adverse side effects, the following should be considered:

- A long acting calcium channel blocker may be combined with an ACE inhibitor (**Grade B**). A low dose thiazide diuretic may be added to an ACE inhibitor without adversely affecting microalbuminuria (**Grade B**).
- For patients with overt nephropathy, a loop diuretic may be required to control volume and blood pressure (**Grade C**).
- Indapamide may be substituted for low dose thiazide because it may reduce microalbuminuria (**Grade C**).

Ischemic heart disease:

For patients with stable angina and hypertension, beta-adrenergic antagonists are preferred as initial therapy (**Grade D**).

Alternative therapies include long acting calcium channel blockers (**Grade B**). Short acting calcium channel blockers should not be used (**Grade C**).

Patients with hypertension and a recent myocardial infarction should be treated with either beta-adrenergic antagonists or ACE inhibitors, or both. Both classes protect against reinfarction and death (**Grade A**).

Alternative therapies include verapamil (**Grade A**) and diltiazem (**Grade C**), but only in the setting of normal left ventricular function.

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Systolic dysfunction:

In patients with hypertension and systolic dysfunction, ACE inhibitors are recommended for initial therapy. Diuretics are recommended as additive therapy (**Grade A**).

A combination of hydralazine and isosorbide dinitrate (**Grade A**) or an AT1 (angiotensin II type I) antagonist (**Grade A** in patients older than 65 years) is recommended as an alternative therapy.

For patients with left ventricular systolic dysfunction who remain hypertensive despite optimal doses of ACE inhibitors or alternative first-line therapies, additional therapies include beta-adrenergic blockade with carvedilol (**Grade A**) or metoprolol (**Grade A**), or the long acting dihydropyridine calcium channel antagonist amlodipine (**Grade A**) or felodipine (**Grade B**).

Peripheral vascular disease:

For hypertensive patients with peripheral vascular disease and no other risk factors or target organ disease, therapeutic recommendations follow those for uncomplicated hypertension, with the following considerations:

1. Alpha-adrenergic antagonists, verapamil or ACE inhibitors do not worsen symptoms of peripheral vascular disease. Beta-adrenergic antagonists may be used in mild to moderate disease but may aggravate the symptoms of severe disease (**Grade B**).
2. ACE inhibitors may cause renal impairment in patients with underlying renal artery stenosis (**Grade B**).

In patients with Raynaud's phenomenon, vasodilators, including alpha-adrenergic antagonists, calcium channel blockers and ACE

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inhibitors/angiotensin II receptor antagonists, may be of benefit (**Grade B**), in preference to beta-adrenergic antagonists (**Grade B**).

Arrhythmias and conduction disturbances:

Beta-adrenergic antagonists or the nondihydropyridine calcium antagonists can be used for the control of the ventricular response to atrial fibrillation or to attempt suppression of specific supraventricular tachycardias in hypertensive patients with these arrhythmias (**Grade B**).

In hypertensive patients with sinus node disease or atrioventricular conduction disorders, beta-adrenergic antagonists, verapamil, diltiazem, clonidine and methyldopa should be avoided (**Grade D**).

Cerebrovascular disease:

A major goal in the treatment of hypertension is the prevention of stroke. Whether the blood pressure should be lowered as part of the management of acute stroke has not been established. During the recovery phase following cerebral infarction, ACE inhibition can lower systemic blood pressure without affecting cerebral blood flow. Hypertensive patients with prior stroke are at a high risk of recurrence, which can be reduced by antihypertensive therapy. Choice of antihypertensive therapy for patients with hypertension and cerebrovascular disease should be based on consideration of other concurrent diseases and risk factors.

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APPENDIX 1 - Considerations in the use of antihypertensive drug classes

Class of medications	When to use	When not to use
Beta-adrenergic antagonists	Post-MI, angina, uncomplicated hypertension (preferred therapy), diabetes (without nephropathy)	Asthma, peripheral vascular disease (severe)
ACE inhibitors	Diabetes, post-MI, heart failure, renal disease, uncomplicated hypertension (preferred therapy)	Bilateral renovascular disease, pregnancy
Angiotensin II antagonists	Diabetes (alternative therapy), heart failure (alternative therapy), uncomplicated hypertension (alternative therapy)	Bilateral renovascular disease, pregnancy
Alpha-adrenergic antagonists/ centrally acting agents	Uncomplicated hypertension (alternative therapy)	Autonomic dysfunction
Diuretics Loop diuretics Potassium-sparing agents	Renal insufficiency Additional therapy in combination with thiazide diuretics, primary hyperaldosteronism	Gout Renal insufficiency

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Thiazides	Uncomplicated hypertension (preferred therapy), systolic hypertension in the elderly (preferred therapy, including for older diabetics without nephropathy)	Gout, dyslipidemia (high dose)
Calcium channel blockers Nondihydropyridines Dihydropyridines	Uncomplicated hypertension (alternative therapy) Systolic hypertension (preferred therapy), uncomplicated hypertension (alternative therapy)	Heart block, heart failure

ACE Angiotensin-converting enzyme; MI Myocardial infarction

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APPENDIX 2 - Considerations in the individualization of antihypertensive therapy

Risk factor/disease	Preferred therapy	Alternative therapy	Avoid therapy
Dyslipidemia	ACE inhibitors, thiazide diuretics (low dose), beta-adrenergic antagonists (with ISA)	Alpha-adrenergic antagonists, calcium channel blockers, angiotensin II antagonists, centrally acting agents	Beta-adrenergic antagonists (non-ISA) thiazides (high dose)
Diabetes mellitus	With nephropathy: ACE inhibitors; without nephropathy: ACE inhibitors or beta-adrenergic antagonists; with systolic hypertension: low dose thiazide or longer acting dihydropyridine calcium channel blockers	Angiotensin II antagonists	High dose diuretics, alpha-adrenergic antagonists and centrally acting agents (in the setting of autonomic neuropathy)
Smoking	Thiazide diuretics, ACE		Beta-adrenergic

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	inhibitors		antagonists
Systolic hypertension, older than 60 years	Diuretics, calcium channel blockers	Angiotensin II antagonists, ACE inhibitors	Alpha-adrenergic antagonists, centrally acting agents
Angina/prior myocardial infarction	Beta-adrenergic antagonists, ACE inhibitors	Calcium channel blockers (diltiazem, verapamil)	
Heart failure	ACE inhibitors, diuretics (as additive therapy)	Angiotensin II antagonists, hydralazine/isosorbide dinitrate	
Peripheral arterial disease	As for uncomplicated hypertension	As for uncomplicated hypertension	Beta-adrenergic antagonists (with severe disease)
Renal disease	ACE inhibitors (diuretics as additive therapy)	Dihydropyridine calcium channel blockers	

ACE Angiotensin-converting enzyme; ISA Intrinsic sympathetic activity

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Left ventricular hypertrophy:

The reversal of left ventricular hypertrophy by antihypertensive therapy may lower the rate of subsequent cardiovascular morbid events (**Grade C**). Most antihypertensive drugs reduce left ventricular hypertrophy over a six-month treatment period in proportion to the reduction in blood pressure (**Grade A**); the exceptions are arteriolar vasodilators, such as hydralazine or minoxidil, which can increase left ventricular hypertrophy (**Grade C**). At present, there is insufficient evidence to base initial therapy on the reported effects of specific drugs on left ventricular hypertrophy.

Renal disease:

For patients with nondiabetic renal disease, the target blood pressure is less than 130/80 mmHg (mean arterial pressure [MAP] 98 mmHg) (**Grade C**).

For patients with proteinuria greater than 1 g/day, the target blood pressure is less than 125/75 mmHg (MAP 92) (**Grade C**).

For patients with hypertension and renal disease, the preferred initial therapy is with an ACE inhibitor (**Grade A**).

Diuretics are recommended as additive antihypertensive therapy because patients with renal insufficiency usually have difficulty with sodium balance (**Grade D**).

Dihydropyridine calcium channel blockers are recommended as alternative therapy for renoprotection in patients with nondiabetic renal disease (**Grade B**).

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Reversible and nonreversible airway disease:

In patients with reversible airway disease, beta-adrenergic antagonists should be avoided (**Grade A**).

In patients taking beta-adrenergic agonists as bronchodilators, if diuretic treatment is prescribed, a combination of a potassium-sparing diuretic and a thiazide is preferred (**Grade B**).

Hyperuricemia and gout:

Asymptomatic hyperuricemia (ie, in the absence of gout) does not require treatment per se and is not a contraindication to diuretic therapy (**Grade D**).

Obese men and men with high alcohol intake are the most prone to develop gout on a thiazide diuretic. In these patients, one may want to avoid diuretic therapy (**Grade D**).

In patients with a history of gout, diuretics should be avoided. If a diuretic is essential for the control of hypertension in a patient with a history of gout, gout can be prevented by the concurrent use of allopurinol (**Grade D**).

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Steering Committee: Dr Ross Feldman (Chair) London; Dr Norman Campbell, Calgary; Dr Pierre Larochelle, Montreal; Dr Robert Petrella, London; Dr Gregory Taylor, Ottawa

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REFERENCES

1. Joffres MR, Ghadirian P, Fodor JG, Petrasovits A, Chockalingam A, Hamet P. Awareness, treatment, and control of hypertension in Canada. *Am J Hypertens* 1997;10:1097-102.
2. Carruthers SG, Larochelle P, Haynes RB, Petrsovits A, Schiffrin EL. Report of the Canadian Hypertension Society Consensus Conference: 1. Introduction. *CMAJ* 1993;149:289-93.
3. Haynes RB, Lacourcière Y, Rabkin SW, et al. Report of the Canadian Hypertension Society Consensus Conference: 2. Diagnosis of hypertension in adults. *CMAJ* 1993;149:409-18.
4. Ogilvie RI, Burgess ED, Cusson JR, Feldman RD, Leiter LA, Myers MG. Report of the Canadian Hypertension Society Consensus Conference: 3. Pharmacologic treatment of essential hypertension. *CMAJ* 1993;149:575-84.
5. Reeves RA, Fodor JG, Gryfe CI, Patterson C, Spence JD. Report of the Canadian Hypertension Society Consensus Conference: 4. Hypertension in the elderly. *CMAJ* 1993;149:815-20.
6. Dawson KG, McKenzie JK, Ross SA, Chiasson JL, Hamet P. Report of the Canadian Hypertension Society Consensus Conference: 5. Hypertension and diabetes. *CMAJ* 1993;149:821-6.
7. Helewa ME, Burrows RF, Smith J, Williams K, Brain P, Rabkin SW. Report of the Canadian Hypertension Society Consensus Conference: 1. Definitions, evaluation and classification of hypertensive disorders in pregnancy. *CMAJ* 1997;157:715-25.
8. Moutquin JM, Garner PR, Burrows RF, et al. Report of the Canadian Hypertension Society Consensus Conference: 2. Nonpharmacologic management and prevention of hypertensive disorders in pregnancy. *CMAJ* 1997;157:907-19.

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9. Rey E, LeLorier J, Burgess E, Lange IR, Leduc L. Report of the Canadian Hypertension Society Consensus Conference: 3. Pharmacologic treatment of hypertensive disorders in pregnancy. CMAJ 1997;157:1245-54.
10. Campbell NRC, Burgess E, Choi BCK, et al. Lifestyle modifications to prevent and control hypertension: 1. Methods and overview of the Canadian recommendations. CMAJ 1999;160(9 Suppl):S1-6.
11. Leiter LA, Abbott D, Campbell NRC, Mendelson R, Ogilvie RI, Chockalingam A. Lifestyle modifications to prevent and control hypertension: 2. Recommendations on obesity and weight loss. CMAJ 1999;160(9 Suppl):S7-12.
12. Campbell NRC, Ashley MJ, Carruthers SG, Lacourcière Y, McKay DW. Lifestyle modifications to prevent and control hypertension: 3. Recommendations on alcohol consumption. CMAJ 1999;160(9 Suppl):S13-20.
13. Cléroux J, Feldman RD, Petrella RJ. Lifestyle modifications to prevent and control hypertension: 4. Recommendations on physical exercise training. CMAJ 1999;160(9 Suppl):S21-8.
14. Fodor JG, Whitmore B, Leenen F, Larochelle P. Lifestyle modifications to prevent and control hypertension: 5. Recommendations on dietary salt. CMAJ 1999;160(9 Suppl):S29-34.
15. Burgess E, Lewanczuk R, Bolli P, et al. Lifestyle modifications to prevent and control hypertension: 6. Recommendations on potassium, magnesium and calcium. CMAJ 1999;160(9 Suppl):S35-45.
16. Spence JD, Barnett PA, Linden W, Ramsden V, Taenzer P. Lifestyle modifications to prevent and control hypertension: 7. Recommendations on stress management. CMAJ 1999;160(9 Suppl):S46-50.

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CANADIAN CARDIOVASCULAR SOCIETY 1998 CONSENSUS CONFERENCE ON THE PREVENTION OF CARDIOVASCULAR DISEASES: THE ROLE OF THE CARDIOVASCULAR SPECIALIST

Section 4: Preventing cardiovascular diseases in people with diabetes

Hertzel C Gerstein MD

Diabetes is a metabolic disorder characterized by hyperglycemia. It is diagnosed by a fasting plasma glucose level 7.0 mmol/L or greater, or a random glucose level 11.1 mmol/L or greater, with signs or symptoms of hyperglycemia. A plasma glucose level of 11.1 mmol/L or more following ingestion of 75 g of glucose also identifies patients with diabetes. Confirmation of the diagnosis requires at least two abnormal results (1).

Population studies have noted that diabetes affects approximately 10% of the general population and 20% of people over the age of 65 years (2). Whites of European origin have a relatively low prevalence of diabetes; North American aboriginal populations have the highest documented age-adjusted prevalence of diabetes in the world, ranging from 26% to 50% (3,4). Because mild degrees of hyperglycemia may not cause obvious clinical signs, approximately 50% of all people with diabetes are unaware of their diagnosis (2). The prevalence of diabetes is likely to continue rising as the population ages and as ethnic groups with a higher underlying rate of diabetes immigrate to Canada.

DIABETES AS A RISK FACTOR FOR CARDIOVASCULAR DISEASES

Diabetes is a strong risk factor for retinal, renal and neurological disease. Indeed, the glucose thresholds that define diabetes were chosen so as to identify people at high risk for these

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'microvascular' complications. Diabetes is also a strong risk factor for cardiovascular diseases (CVD). Compared with their nondiabetic counterparts, the relative risk of CVD for men with diabetes is two to three, and that for women with diabetes is three to four (5-10); the annual risk of fatal and nonfatal CVD in middle-aged diabetic individuals is 2% to 5% (5,11-14). This risk is independent of the risk associated with other risk factors such as hypercholesterolemia, smoking and hypertension (5). Population-based studies suggest that approximately 45% of white adults with diabetes have coronary artery disease (compared with 25% of nondiabetic individuals) (15).

As well as increasing the risk of CVD, diabetes also confers a worse prognosis after a cardiovascular event. For example, data from several large prospective studies show that the relative risk of mortality following a myocardial infarction is two to three times higher in diabetic than in nondiabetic individuals (16,17). Moreover, recent evidence that patients with diabetes may not derive the same benefit from angioplasty as nondiabetic patients suggests that they may respond differently to some therapies (18).

Despite the high absolute risk of CVD in patients with diabetes, few trials of cardiovascular preventive therapies explicitly included patients with diabetes. In some cases, the best data are from post hoc subanalyses of diabetic patients who were enrolled. The best evidence that is available with respect to reducing the risk of CVD in patients with diabetes is reviewed below.

INTERVENTIONS IN PATIENTS WITH DIABETES TO REDUCE THE RISK OF CVD

Glucose control: Recent prospective, large epidemiological studies have consistently shown that, in patients with diabetes, higher levels of glucose (ie, poor degrees of glycemic control) are associated with a higher incidence of CVD (19-23). Indeed, this relationship between glucose and cardiovascular risk extends below the thresholds required for a diagnosis of diabetes; the glucose level below which people are not at increased risk for CVD has not been determined (24-26). Therefore, elevated glucose levels above some dysglycemic threshold and extending into the diabetic range are a continuous risk factor for future cardiovascular events. This conclusion is also supported by surrogate outcome data in which higher glucose

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levels in nondiabetic people are associated with higher degrees of carotid artery narrowing (27-29).

Whether lowering glucose levels will prevent future cardiovascular events in patients with diabetes is unknown. For patients with type 1 diabetes, there is very strong evidence that improved glucose control from using intensified insulin therapy dramatically reduces the risk of eye, kidney and nerve disease (30,31). One small study in atypical Japanese patients with type 2 diabetes reported the same benefit of insulin-mediated intensified glucose control (32). Although neither of these studies was powered to detect a cardiovascular benefit, both showed a trend toward a lower cardiovascular event rate (31,32).

The most comprehensive assessment of the effect of glucose lowering on the risk of CVD comes from the recently published United Kingdom Prospective Diabetes Study (UKPDS) of 3867 newly diagnosed patients of mean age 54 years, followed for 11.1 years (33). Participants were randomized to a policy of conventional glucose control or more intensive control with chlorpropamide, glibenclamide (ie, glyburide), glipizide or bedtime insulin (at doses targeting premeal plasma glucose levels of 4 to 7 mmol/L). Participants randomized to insulin therapy whose premeal or bedtime levels exceeded 7 mmol/L were prescribed supplemental regular insulin with meals. Overweight patients randomized to intensive therapy had the additional possibility of being allocated to metformin. This subgroup was studied in a different analysis of 1704 patients with a median follow-up of 10.7 years (34). Intensified glucose control led to a 12% relative risk reduction (RRR) for any diabetes-related end point ($P=0.0046$) and a 25% RRR ($P=0.0099$) in the number of patients who developed microvascular disease (ie, retinopathy requiring photocoagulation, vitreous bleeding, or fatal or nonfatal renal failure).

For cardiovascular outcomes, there was an almost significant 16% RRR in myocardial infarction ($P=0.052$). This effect was consistent regardless of whether insulin or sulphonylureas were used as the initial glycemic therapy. Of interest, overweight participants had a 39% RRR with metformin ($P=0.0023$) - an effect that was not observed with other therapies. This observation is tempered by the finding that patients prescribed metformin after sulphonylurea

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failure had an increased risk of diabetes-related death ($P=0.039$). Finally, intensive glucose control was associated with a 53% RRR in sudden death ($P=0.047$). In an epidemiological analysis of the UKPDS results presented at the European diabetes meeting (European Association for the Study of Diabetes, Barcelona, 1998), a continuous relation-ship between glucose levels and cardiovascular events was observed. For every 1% decrease in hemoglobin A1c, the risk of all-cause mortality, myocardial infarction and stroke decreased 17%, 18% and 15%, respectively ($P<0.0001$ for all three).

The UKPDS clearly showed that a policy of intensive glycemic control for patients with type 2 diabetes has many positive health benefits that are likely to include cardiovascular benefits. It also clearly showed that a policy of intensive glycemic control with any therapy including insulin does not increase the risk of myocardial infarction. The results are all the more impressive because this study was very much a 'real world' study. The median difference in glycated hemoglobin between the two groups was only 0.9% over 10 years, and the glycated hemoglobin rose slowly in both groups. This suggests that a glucose control policy that can maintain stable good control over long periods of time may be even more effective and highlights the need for future, more effective therapies for diabetes.

Other evidence that glucose may be a modifiable risk factor was shown in a Scandinavian study of 620 diabetic individuals after myocardial infarction who were randomized to receive a 24 h infusion of insulin followed by frequent insulin injections or conventional therapy. The intervention group had a relative and absolute risk reduction in total mortality of 28% and 11%, respectively, that was sustained for more than three years (35,36). Whether the benefit was due to the initial infusion, the subsequent glucose control or a combination of both is unclear, as is the potential confounding effect of the withdrawal of oral agents from the intervention group.

RECOMMENDATIONS

To reduce the risk of CVD, patients with diabetes should strive for a fasting glucose level of 4 to 7 mmol/L and a glycated hemoglobin level 110% above the upper limit of normal. Levels as close to these as possible should be the goal for

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patients in whom these goals are not feasible because of other conditions (**Level II, Grade B**).

Achieving the target glycemic goals requires appropriate interactions with certified diabetes educators, and may entail one or more of dietary and exercise interventions, oral agents or insulin; it also requires ongoing self blood glucose monitoring and the active participation of the patient in his or her diabetes management (**Level II, Grade B**).

When required, one or more injections of insulin therapy should be used to achieve optimal glycemic control in people at risk for CVD; insulin may be combined with oral agents (**Level II, Grade B**).

Intensified insulin therapy should be used and may prevent mortality following a myocardial infarction (**Level II, Grade B**).

Blood pressure control: Up to 70% of adult patients with type 2 diabetes have hypertension (37). In hypertensive diabetic patients, blood pressure is clearly a risk factor for CVD (5). Therapy of hypertension with diuretics (38), angiotensin-converting enzyme (ACE) inhibitors or cardioselective beta-blockers (39,40) decreases the risk of stroke in patients with diabetes and hypertension; adverse effects of these drugs on glucose tolerance and dyslipidemia suggest that other regimens of metabolically neutral drugs may be even more effective in people with diabetes. Trials of other regimens in patients with diabetes are underway. All of the evidence, however, suggests that therapy of hypertension would at least be as effective at preventing CVD in diabetic patients as in nondiabetic patients.

Up to 30% of middle-aged patients with diabetes have microalbuminuria (urinary albumin excretion rate of 30 to 300 mg/day). Compared with those with no albuminuria, these individuals are twice as likely to be hypertensive and to develop CVD (41). ACE inhibitors have clearly been shown to reduce albuminuria in patients with diabetes and may theoretically be cardioprotective; this hypothesis is under study (42). Because strict blood pressure control may

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also prevent renal disease in diabetic patients, targets for blood pressure control are below 130/80 mmHg (43).

RECOMMENDATIONS

Hypertension should be treated in patients with diabetes; the therapeutic goal is a blood pressure below 130/80 mmHg (**Level II, Grade B**).

Acceptable first line antihypertensive agents in patients with diabetes are ACE inhibitors, calcium channel blockers, alpha-blockers and low dose diuretics (**Levels I and II, Grade B**).

All patients with diabetes should be screened for microalbuminuria (defined as a albumin to creatinine ratio on a random collection of 2.8 mg/mmol or greater in women and 2.0 mg/mmol or greater in men) to identify those with the highest risk for cardiovascular events (**Level II, Grade B**).

Acetylsalicylic acid: Studies of the cardiovascular benefit of acetylsalicylic acid (ASA) therapy in patients with diabetes and analyses of the diabetic subgroup in other randomized controlled trials indicate that ASA reduces cardiovascular events in patients with diabetes (44,45) (**Level I, Grade A**).

RECOMMENDATION

Unless ASA therapy is contraindicated, patients with diabetes and one or more other cardiovascular risk factors (such as previous CVD, hyperlipidemia, hypertension, smoking, albuminuria or a positive family history) should be prescribed low dose (81 to 325 mg/day) ASA (**Level I, Grade A**).

Lipid lowering: Few of the randomized controlled trials of lipid lowering have studied large numbers of patients with diabetes. Nevertheless, post hoc analyses of multicentre trials

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support the conclusion that lipid lowering provides a comparable (or even higher) absolute risk reduction for cardiovascular events in diabetic patients with that in nondiabetic patients (46). The higher baseline risk of CVD in people with diabetes needs to be considered when deciding whether to initiate lipid-lowering therapy and may account for a higher absolute risk reduction.

RECOMMENDATION

Either hepatic hydroxymethylglutaryl coenzyme A reductase inhibitors or fibrates should be prescribed to reduce the risk of CVD in high risk dyslipidemic patients with diabetes who have not responded to lifestyle modification (**Level II, Grade B**).

Smoking cessation: Patients with diabetes who smoke are up to four times more likely to suffer a cardiovascular death than nonsmokers; moreover, compared with that in nondiabetic patients, the absolute risk of cardiovascular death increases more steeply with the amount smoked (5). Patients with diabetes are likely to derive benefits from smoking cessation that are similar to those in nondiabetic individuals, although this relationship is not well studied.

RECOMMENDATION

Patients with diabetes should not smoke (**Grade A**).

Beta-blockers: Because beta-blockers may impair glucose tolerance and lead to diminished recognition of hypoglycemia, they have been avoided in patients with diabetes. Nevertheless, it is increasingly clear that, following a myocardial infarction, diabetic patients may derive a benefit from these drugs that is equivalent to or even greater than that in non-diabetic individuals (47,48); this benefit may even extend to high risk individuals who have not yet had a myocardial infarction (49).

RECOMMENDATION

Unless contraindicated, selected beta-blockers should be prescribed to patients with diabetes following a myocardial infarction (**Level I, Grade A**).

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REFERENCES

1. Expert Committee on the Diagnosis and Classification of Diabetes Mellitus. Report of the Expert Committee on the Diagnosis and Classification of Diabetes Mellitus. Diabetes Care 1997;20:1183-97.
2. Kenny SJ, Aubert RE, Geiss LS. Prevalence and incidence of non-insulin-dependent diabetes. In: Harris MI, Cowie CC, Stern MS, Boyko EJ, Reiber GE, Bennett PH, ed. Diabetes in America, 2nd edn. NIH Publication No. 95-1468. Bethesda: National Institutes of Health, 1995:47-68.
3. King H, Rewers M, WHO Ad Hoc Diabetes Reporting Group. Global estimates for prevalence of diabetes mellitus and impaired glucose tolerance in adults. Diabetes Care 1993;16:157-77.
4. Harris SB, Gittelsohn J, Hanley A, et al. The prevalence of NIDDM and associated risk factors in native Canadians. Diabetes Care 1997;20:185-7.
5. Stamler J, Vaccaro O, Neaton JD, Wentworth D. Diabetes, other risk factors, and 12-yr cardiovascular mortality for men screened in the Multiple Risk Factor Intervention Trial. Diabetes Care 1993;16:434-44.
6. Kannel WB, McGee DL. Diabetes and cardiovascular disease. The Framingham study. JAMA 1979;241:2035-8.
7. Fuller JH, Shipley MJ, Rose G, Jarrett RJ, Keen H. Mortality from coronary heart disease and stroke in relation to degree of glycemia: the Whitehall study. Br Med J Clin Research Ed 1983;287:867-70.
8. Barrett-Connor E, Cohn BA, Wingard DL, Edelstein SL. Why is diabetes mellitus a stronger risk factor for fatal ischemic heart disease in women than in men? The Rancho Bernardo Study. JAMA 1991;265:627-31.
8. Goldbourt U, Yaari S, Medalie JH. Factors predictive of long-term coronary heart disease mortality among 10059 male Israeli civil servants and municipal employees. A

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23 year mortality follow-up in the Israeli Ischemic Heart Disease Study. *Cardiology* 1993;82:100-21.

9. Manson JE, Colditz GA, Stampfer MJ, et al. A prospective study of maturity-onset diabetes mellitus and risk of coronary heart disease and stroke in women. *Arch Intern Med* 1991;151:1141-7.
10. Morrish NJ, Stevens LK, Fuller JH, Keen H, Jarrett RJ. Incidence of macrovascular disease in diabetes mellitus: the London follow-up to the WHO multinational study of vascular disease in diabetics. *Diabetologia* 1991;34:584-9.
11. ETDRS Investigators. Aspirin effects on mortality and morbidity in patients with diabetes mellitus. Early treatment of diabetic retinopathy study report 14. *JAMA* 1992;266:1292-300.
12. Damsgaard EM, Froland A, Jorgensen OD, Mogensen CE. Eight to nine year mortality in known non-insulin dependent diabetes and controls. *Kidney Int* 1992;42:731-5
13. Neil A, Hawkins M, Potok M, Thorogood M, Cohen DA, Mann J. A prospective population-based study of microalbuminuria as a predictor of mortality in NIDDM. *Diabetes Care* 1993;16:996-1003.
14. Wingard DL, Barrett-Connor E. Heart disease and diabetes. In: Harris MI, Cowie CC, Stern MS, Boyko EJ, Reiber GE, Bennett PH, eds. *Diabetes in America*, 2nd edn. Bethesda: National Institutes of Health, 1995:429-48.
15. Behar S, Boyko EJ, Reicher-Reiss H, Goldbourt U. Ten year survival after acute myocardial infarction: comparison of patients with and without diabetes. *Am Heart J* 1997;133:290-6.
16. 17. Mak KH, Moliterno DJ, Granger CB, et al. Influence of diabetes mellitus on clinical outcome in the thrombolytic era of acute myocardial infarction. GUSTO-1 investigators. *J Am Coll Cardiol* 1997;30:171-9.

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17. Bypass Angioplasty Revascularization (BARI) Investigators. Comparison of coronary bypass surgery with angioplasty in patients with multivessel disease. *N Engl J Med* 1996;335:217-25.
18. Moss SE, Klein R, Klein BEK, Meuer SM. The association of glycemia and cause-specific mortality in a diabetic population. *Arch Intern Med* 1994;154:2473-9.
19. Kuusisto J, Mykkanen L, Pyorala K, Laakso M. NIDDM and its metabolic control predict coronary heart disease in elderly subjects. *Diabetes* 1994;43:960-7.
20. Andersson DKG, Svardsudd K. Long-term glycemic control relates to mortality in type II diabetes. *Diabetes Care* 1995;18:1534-43.
21. Gall M-A, Borch-Johnsen K, Hougaard P, Nielsen FS, Parving H-H. Albuminuria and poor glycemic control predict mortality in NIDDM. *Diabetes* 1995;44:1303-9.
22. Agewall S, Wikstrand J, Ljungman S, Fagerberg B, Risk Factor Intervention Study Group. Usefulness of microalbuminuria in predicting cardiovascular mortality in treated hypertensive men with and without diabetes mellitus. *Am J Cardiol* 1997;80:164-9.
23. Coutinho M, Gerstein HC, Wang Y, Yusuf S. The relationship between glucose and incident cardiovascular events. A metaregression analysis of published data from 20 studies of 95,783 individuals followed for 12.4 years. *Diabetes Care* 1999;22:233-40.
24. Gerstein HC, Yusuf S. Dysglycaemia and risk of cardiovascular disease. *Lancet* 1996;347:949-50.
25. Gerstein HC. Glucose: a continuous risk factor for cardiovascular disease. *Diabetic Med* 1997;14(Suppl 3):S25-31.
26. Yamasaki Y, Kawamori R, Matsushima H, et al. Asymptomatic hyperglycaemia is associated with increased intimal plus medial thickness of the carotid artery. *Diabetologia* 1995;38:585-91.

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27. Beks PH, Mackaay AJ, de Vries H, de Neeling JN, Bouter LM, Heine RJ. Carotid artery stenosis is related to blood glucose level in an elderly caucasian population: the Hoorn study. *Diabetologia* 1997;40:290-8.
28. Vitelli LL, Shahar E, Heiss G, et al. Glycosylated hemoglobin level and carotid intimal-medial thickening in nondiabetic individuals. The Atherosclerosis Risk in Communities Study. *Diabetes Care* 1997;20:1454-8.
29. Diabetes Control and Complications Trial Research Group. The effect of intensive treatment of diabetes on the development and progression of long-term complications in insulin-dependent diabetes mellitus. *N Engl J Med* 1993;329:977-86.
30. Diabetes Control and Complications Trial (DCCT) Research Group. Effect of intensive diabetes management on macrovascular events and risk factors in the diabetes control and complications trial. *Am J Cardiol* 1995;75:894-903.
31. Ohkubo Y, Kishikawa H, Araki E, et al. Intensive insulin therapy prevents the progression of diabetic microvascular complications in Japanese patients with non-insulin-dependent diabetes mellitus: a randomized prospective 6-year study. *Diabetes Res Clin Pract* 1995;28:103-17.
32. UK Prospective Diabetes Study (UKPDS) Group. Intensive blood-glucose control with sulphonylureas or insulin compared with conventional treatment and risk of complications in patients with type 2 diabetes. *Lancet* 1998;352:837-53.
33. UK Prospective Diabetes Study (UKPDS) Group. Effect of intensive blood glucose control with metformin on complications in overweight patients with type 2 diabetes (UKPDS 34). *Lancet* 1998;352:854-65.
34. Malmberg K, Ryden L, Efendic S, et al. Randomized trial of insulin-glucose infusion followed by subcutaneous insulin treatment in diabetic patients with acute myocardial infarction (DIGAMI study): Effects on mortality at 1 year. *J Am Coll Cardiol* 1995;26:57-65.

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35. Malmberg K, DIGAMI Study Group. Prospective randomised study of intensive insulin treatment on long term survival after acute myocardial infarction in patients with diabetes mellitus. BMJ 1997;314:1512-5.
36. Cowie CC, Harris MI. Physical and metabolic characteristics of persons with diabetes. In: Harris MI, Cowie CC, Stern MS, Boyko EJ, Reiber GE, Bennett PH, eds. Diabetes in America, 2nd edn. NIH Publication No 95-1468. Bethesda: National Institutes of Health, 1995:117-64.
37. Curb JD, Pressel SL, Cutler JA, et al. Effect of diuretic-based antihypertensive treatment on cardiovascular disease risk in older diabetic patients with isolated systolic hypertension. Systolic Hypertension in the Elderly Program Cooperative Research Group. JAMA 1996;276:1886-92.
38. UK Prospective Diabetes Study (UKPDS) Group. Tight blood pressure control and risk of macrovascular and microvascular complications in type 2 diabetes: UKPDS 38. BMJ 1998;317:703-13.
39. UK Prospective Diabetes Study (UKPDS) Group. Efficacy of atenolol and captopril in reducing risk of macrovascular and microvascular complications in type 2 diabetes: UKPDS 39. BMJ 1998;317:713-20.
40. Dinneen SF, Gerstein HC. The association of microalbuminuria and mortality in non-insulin-dependent diabetes mellitus. Arch Intern Med 1997;157:1413-8.
41. Gerstein HC, Bosch J, Pogue J, et al. Rationale and design of a large study to evaluate the renal and cardiovascular effects of an ACE inhibitor and vitamin E in high-risk patients with diabetes. The MICRO-HOPE study. Diabetes Care 1996;19:1225-8.
42. American Diabetes Association. Standards of medical care for patients with diabetes mellitus. Diabetes Care 1998;21(Suppl 1):S23-31.
43. Colwell JA. Aspirin therapy in diabetes (Position Statement). Diabetes Care 1997;20:1772-3.

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44. Colwell JA. Aspirin therapy in diabetes (Technical Review). Diabetes Care 1997;20:1767-71.
45. Pyorala K, Pedersen TR, Kjekshus J, et al. Cholesterol lowering with simvastatin improves prognosis of diabetic patients with coronary heart disease. Diabetes Care 1997;20:614-20.
46. Malmberg K, Ryden L, Hamsten A, Herlitz J, Waldenstrom A, Wedel H. Mortality prediction in diabetic patients with myocardial infarction: experiences from the DIGAMI study. Cardiovasc Res 1997;34:248-53.
47. Zuanetti G, Latini R. Impact of pharmacological treatment on mortality after myocardial infarction in diabetic patients. J Diabetes Comp 1997;11:131-6.
48. Jonas M, Reicher-Reiss H, Boyko V, et al. Usefulness of beta-blocker therapy in patients with non-insulin dependent diabetes mellitus and coronary artery disease. Bezafibrate Infarction Prevention (BIP) Study Group. Am J Cardiol 1996;77:1273-7.

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Section 4: Obesity and cardiovascular diseases

Bruce Reeder MD, Claude Bouchard PHD

Body fat and its distribution are significantly related to the development of cardiovascular (CVD) and other chronic diseases. In men and women of all ages, crude all-cause mortality rates show a J-shaped relationship with adiposity as measured by body mass index (BMI) expressed as kg/m² (1). Although there is consistent evidence of increased total mortality rates with obesity (2), whether the apparent rise in mortality associated with low BMI (less than 22 kg/m²) is due to failure to control the effects of smoking and occult disease is debatable (2-5). Mortality rates from total CVD, ischemic heart disease (IHD) and stroke (2) rise in a linear fashion with obesity even after adjustment for concurrent CVD risk factors. Men with a BMI of 26 kg/m² or more have 2.5 times the risk of death from CVD compared with those with a BMI less than 22.5 kg/m² (3). Women aged 30 to 55 years with a BMI of 29 kg/m² or more have four times the risk of death from CVD compared with those with a BMI of less than 21 kg/m² (4). Recent analyses suggest that the role of obesity in CVD (and cancer) mortality may vary depending on the presence or absence of other risk factors (6).

In the majority of published studies, the incidence of IHD rises with increasing levels of obesity. In men, an approximate doubling of risk is seen from the lowest to highest BMI quintiles (1,7,8), whereas in women, those with a BMI of 29 kg/m² or more have 3.6 times the risk compared with those with a BMI of less than 21 kg/m² (9). Independent of body weight, weight gain during adult life may play a contributing role in the development of IHD (4,8,9).

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The distribution of body fat is a key factor in the relationship between obesity and health. Although the exact mechanisms remain uncertain (10,11), several large prospective studies have demonstrated the increased risk of developing and dying from CVD associated with an abdominal distribution of fat. Men (12) and women (13-15) with an abdominal distribution of fat, measured by a waist to hip circumference ratio in the upper quintile, have two to three times the risk of developing and dying from CVD as those in the lower quintile. This association is attenuated, but not eliminated, by multivariate adjustment for blood pressure, serum cholesterol, smoking habit and physical activity, and is seen at all levels of BMI. An abdominal accumulation of fat appears in a number of these studies to be a stronger predictor of CVD morbidity and mortality than total excess body mass (13,15). However, other evidence suggests that this relationship may depend on age, with total body fat being the best predictor in younger adults and an abdominal distribution of fat the best predictor in those over the age of 65 years (16).

Once manifestations of IHD have developed, obesity does not act as an independent prognostic variable. Left ventricular dysfunction, residual myocardial ischemia, age, smoking and the physiological correlates of obesity, diabetes, hypertension and dyslipidaemia, do (17-20). Obesity at the time of operation, however, does appear to be an independent predictor of acute myocardial infarction following coronary artery bypass surgery (21).

PREVALENCE OF OBESITY IN CANADA

The World Health Organization and the International Obesity Task Force have recently released an important consensus statement on preventing and managing the global epidemic of obesity (22). The statement proposes a classification of body weight based on BMI: less than 18.5 kg/m² indicates underweight; 18.5 kg/m² to 24.9 kg/m² a healthy weight; 25 kg/m² to 29.9 kg/m² overweight; and 30 kg/m² or more obesity. According to this definition, the 1986 to 1992 Canadian Heart Health surveys found that 39% of men and 46% of women have a healthy body weight, while 44% and 25% are overweight and 13% and 14% are obese, respectively. The prevalence of obesity is highest among men (19%) and women (27%) aged

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55 to 64 years and among those with lower levels of education (23). It is greater in Atlantic Canada than in the West, with the lowest levels seen in Quebec and British Columbia (24,25). In Western Canada, rural men and women are more likely than urban dwellers to be obese (25). Overall, in Canada, 55% of men and 18% of women have an abdominal distribution of body fat (waist circumference of 90 cm or more) with the highest prevalence in men (79%) and women (36%) aged 55 to 64 years (23,26).

In recent decades, the prevalence of obesity has increased substantially in the United States (27), The United Kingdom and Germany, but not in Finland or The Netherlands (28). In Canada, since 1978, the prevalence of obesity (BMI of 30 kg/m² or more) has increased from 7% to 13% in men and from 9% to 14% in women, although the proportion of the population with a BMI of 27 kg/m² or more changed little during this period (23).

Major morbidities associated with excess body fat include CVD, noninsulin-dependent diabetes mellitus, hypertension, stroke, sleep apnea, osteoarthritis, menstrual irregularities, hirsutism, depression and other psychological disorders. The prevalence and the severity of several of these comorbidities increase with severity of the obesity, and some are seen in almost all of the obese with a BMI greater than 40 kg/m² (22). Endometrial, breast, prostate and colon cancers are also more commonly observed in the obese population.

OBESITY AND HYPERTENSION

Obesity produces an increase in cardiac mass and in blood volume. Stroke volume and cardiac output are elevated almost in proportion to the excess weight. Obesity is also associated with an increase in systolic and diastolic blood pressure, as shown by cross-sectional and prospective observational studies (29). An excess body mass of 10 kg has been calculated to cause, on the average, increases of 5 mmHg in the systolic blood pressure and 3 mmHg in the diastolic blood pressure. These increases in blood pressure have been estimated to augment the risk of CVD by approximately 15% (30).

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OBESITY AND HYPERLIPIDEMIA

Obesity is associated with a number of dyslipidemic features. Longitudinal studies have shown that obesity and weight gain are associated with increased cholesterol levels and a higher incidence of hypercholesterolemia (31,32). Similarly, triglyceride levels are augmented with BMI as shown by both cross-sectional and longitudinal studies. High density lipoprotein (HDL) cholesterol levels are lower in obese men and women, and weight gain causes a significant reduction in HDL-cholesterol. For instance, an increase in BMI of 10 units is associated with a decrease in HDL-cholesterol of 0.28 mmol/L in young men and 0.08 mmol/L in young women (33). Based on cross-sectional observations, an increase in BMI from 20 kg/m² to 30 kg/m² is associated with a 0.26 mmol/L increase in low density lipoprotein cholesterol, which in turn is thought to correspond to a 10% increase in IHD over a five-to 10-year period (34,35). In addition, very low density lipoprotein and apolipoprotein B production are increased with obesity, which may be a reflection of the hyperinsulinemic state commonly observed among obese individuals. Moreover, lipoprotein lipase activity of the adipose tissue is elevated, particularly in the abdominal depot, while the activity of hepatic lipase is diminished in the obese. These alterations are thought to play a role in the dyslipidemia associated with obesity, especially abdominal obesity (11,36).

OBESITY AND DIABETES

Glucose intolerance and insulin resistance are common features of human obesity. Insulin resistance and the associated hyperinsulinemic state are thought to be mechanisms by which further body fat gain is limited (37). However, these alterations in insulin metabolism are clearly maladaptive in terms of risk for common diseases, including noninsulin-dependent diabetes mellitus, hypertension and vascular diseases (22). A number of longitudinal studies have shown that obesity and weight gain over time are associated with an augmented risk of developing diabetes (38-41). It was estimated recently that 27% of the new cases of noninsulin-dependent diabetes mellitus in The United States were attributable to a weight gain of 5 kg or more in the adult years (42). Abdominal obesity also appears to be an even greater risk than excess body mass (39,41,43,44).

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STRATEGIES FOR PREVENTION

Strategies for the prevention of obesity should include population-level efforts to alter our 'obesigenic' environment as well as clinical efforts directed at those with a high risk of developing the condition (22,45,46). Comprehensive community-based efforts such as the Stanford Five-City Project, but not the Minnesota Heart Health Program, have demonstrated a significantly slower rate of increase in the prevalence of obesity in the intervention, compared with the control, communities (47-49). More effective, possibly targeted, methods of population intervention are needed (49).

The scientific literature on the prevention and treatment of obesity at the clinical level has been well reviewed recently by Glenny et al (50) and by an expert panel of the National Heart, Lung, and Blood Institute (29). Family therapy appears effective at preventing the progression to severe obesity in children compared with no treatment. There is insufficient evidence to evaluate clinical preventive manoeuvres in adults; in particular, there are no randomized trials to assess the independent effect of weight loss on prognosis in obese patients with IHD (51). In the treatment of obesity, behavioural therapy in combination with diet and moderate exercise is more effective at providing sustained weight loss (one year or more) than any individual component alone (**Level III, Grade C**). Daily weight charting and the provision of meal plans and grocery lists are useful. Involving the patient's spouse is of unclear benefit in the short term, but valuable for the maintenance of weight loss. High fibre to low fat or low fat alone diets are not superior for weight loss to those restricting only calories. In general, maintenance strategies involving continued therapist contact or self-help groups are more effective than no contact.

Pharmacological interventions produce short term (**Level II, Grade B**), but not sustained, weight loss. Surgical intervention, in particular gastric bypass, is effective in the morbidly obese (BMI greater than 40 kg/m²)(**Level II, Grade B**).

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OTHER RECOMMENDATIONS

BMI and waist circumference should be measured periodically in all adult patients to assess adiposity and abdominal fat content, respectively.

All adults and children over the age of two years should follow a diet that is balanced, rich in fruits, vegetables and fibres, low in fat and simple carbohydrates, and promotes optimal growth for children and a healthy weight for adults (BMI 20 kg/m² to 24.9 kg/m²).

All adults and children should be physically active for a sufficient intensity and duration each day to promote optimal lifetime weight (**Level III, Grade C**).

RESEARCH

Improve the understanding of pathophysiology of abdominal obesity;

Improve the prevention of and treatment methods for obesity.

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REFERENCES

1. Pi-Sunyer FX. Health implications of obesity. Am J Clin Nutr 1991;53(Suppl):1595S-603S.
2. Solomon CG, Manson JE. Obesity and mortality: a review of the epidemiologic data. Am J Clin Nutr 1997;66(Suppl):1044S-50S.
3. Lee IM, Manson JE, Hennekens CH, Paffenbarger RS. Body weight and mortality. A 27 year follow-up of middle-aged men. JAMA 1993;270:2823-8.
4. Manson JE, Willett WC, Stampfer MJ, et al. Body weight and mortality among women. N Engl J Med 1995;333:677-85.
5. Troiano RP, Frongillo EA, Sobal J, Levitsky DA. The relationship between body weight and mortality: a quantitative analysis of combined information from existing studies. Int J Obesity 1996;20:63-75.
6. Carmelli D, Zhang H, Swan GE. Obesity and a 33-year follow-up for coronary heart disease and cancer mortality. Epidemiology 1997;8:378-3.
7. Rabkin SW, Mathewson FA, Hsu PH. Relation of body weight to development of ischemic heart disease in a cohort of young North American men after a 26 year observation period: The Manitoba Study. Am J Cardiol 1997;39:452-8.
8. Hubert HB, Feinleib M, McNamara PM, Castelli WP. Obesity as an independent risk factor for cardiovascular disease: a 26-year follow-up of participants in the Framingham Heart Study. Circulation 1983;67:968-76.
9. Willett WC, Manson JE, Stampfer MJ, et al. Weight, weight change, and coronary heart disease in women. JAMA 1995;273:461-5.
10. Seidell JC, Bouchard C. Visceral fat in relation to health: is it a major culprit or simply an innocent bystander? Int J Obesity 1997;21:626-31.

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11. Despres JP, Moorjani S, Lupien PJ, Tremblay A, Nadeau A, Bouchard C. Regional distribution of body fat, plasma lipoproteins, and cardiovascular disease. *Arteriosclerosis* 1990;10:497-511.
12. Larsson B, Svardsudd K, Welin L, Wilhelmsen L, Bjorntorp P, Tibblin G. Abdominal adipose tissue distribution, obesity, and risk of cardiovascular disease and death: 13 year follow up of participants in the study of men born in 1913. *BMJ* 1984;288:1401-4.
13. Lapidus L, Bengtsson C, Larsson B, Pennert K, Rybo E, Sjostrom L. Distribution of adipose tissue and risk of cardiovascular disease and death: a 12 year follow up of participants in the population study of women in Gothenburg, Sweden. *BMJ* 1984;289:1257-61.
14. Folsom AR, Prineas RJ, Kaye SA, Munger RG. Incidence of hypertension and stroke in relation to body fat distribution and other risk factors in older women. *Stroke* 1990;21:701-6.
15. Rexrode KM, Carey VJ, Hennekens CH, et al. Abdominal adiposity and coronary heart disease in women. *JAMA* 1998;280:1843-8.
16. Rimm EB, Stampfer MJ, Giovannucci E, et al. Body size and fat distribution as predictors of coronary heart disease among middle-aged and older US men. *Am J Epidemiol* 1995;141:1117-27.
17. Woo KS, White HD. Factors affecting outcome after recovery from myocardial infarction. *Annu Rev Med* 1994;45:325-9.
18. Chang J, Froelicher VF. Clinical and exercise test markers of prognosis in patients with stable coronary disease. *Curr Probl Cardiol* 1994;19:535-87.
19. Sigurdsson E, Sigfusson N, Agnarsson U, Sigvaldason H, Thorgeirsson G. Long-term prognosis of different forms of coronary heart disease: the Reykjavik study. *Int J Epidemiol* 1995;24:58-68.

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20. Bonow RO, Bohannon N, Hazzard W. Risk stratification in coronary artery disease and special populations. Am J Med 1996;101(Suppl 4A):17S-24S.
21. Van Brussel BL, Plokker HWM, Voors AA, et al. Multivariate risk factor analysis of clinical outcome 15 years after venous coronary artery bypass graft surgery. Eur Heart J 1995;16:1200-6.
22. Obesity - Preventing and Managing the Global Epidemic. Report of the WHO Consultation on Obesity. Geneva: World Health Organization, 1998.
23. Macdonald SM, Reeder BA, Chen Y, Despres JP. Canadian Heart Health Surveys Research Group. Obesity in Canada: a descriptive analysis. CMAJ 1997;157(1 Suppl):S3-9.
24. Health Canada. Canadians and Heart Health: Reducing the Risk. Ottawa: Minister of Supply and Services Canada, 1995.
25. Reeder BA, Chen Y, Macdonald S, Angel A, Sweet L. Canadian Heart Health Surveys Research Group. Regional and rural-urban differences in obesity in Canada. CMAJ 1997;157(1 Suppl):S10-6.
26. Pouliot MC, Despres JP, Lemieux S, et al. Waist circumference and abdominal sagittal diameter: best simple anthropometric indexes of abdominal visceral adipose tissue accumulation and related cardiovascular risk in men and women. Am J Cardiol 1994;73:460-8.
27. Kuczmarski RJ, Flegal KM, Campbell SM, Johnson CL. Increasing prevalence of overweight among US Adults. JAMA 1994;272:205-11.
28. Bjorntorp P. Obesity. Lancet 1997;350:423-6.
29. National Heart, Lung, and Blood Institute. Clinical guidelines on the identification, evaluation and treatment of overweight and obesity in adults. Bethesda: National Institutes of Health, 1998.

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30. Loggie JM, Horan MJ, Hohn AR, Gruskin AB, Dunbar JB, Havlik RJ. Juvenile hypertension: highlights of a workshop. J Pediatr 1984;104:657-63.
31. Shekelle RB, Shryock AM, Paul O, et al. Diet, serum cholesterol, and death from coronary heart disease. The Western Electric study. N Engl J Med 1981;304:65-70.
32. Manson JE, Colditz GA, Stampfer MJ, et al. A prospective study of obesity and risk of coronary heart disease in women. N Engl J Med 1990;322:882-9.
33. Anderson AJ, Sobocinski KA, Freedman DS, Barboriak JJ, Rimm AA, Gurchow HW. Body fat distribution, plasma, lipids and lipoproteins. Arteriosclerosis 1988;8:88-94.
34. Denke MA, Sempos CT, Grundy SM. Excess body weight. An under-recognized contributor to dyslipidemia in white American women. Arch Intern Med 1994;154:401-10.
35. Law MR, Wald NJ, Thompson SG. By how much and how quickly does reduction in serum cholesterol concentration lower risk of ischaemic heart disease? BMJ 1994;308:367-72.
36. Després JP. Dyslipidaemia and obesity. Baillières' Clin Endocrinol Metab 1994;8:629-60.
37. Eckel RH. Insulin resistance: an adaptation for weight maintenance. Lancet 1992;340:1452-3.
38. Lew EA, Garfinkel L. Variations in mortality by weight among 750,000 men and women. J Chronic Dis 1979;32:563-76.
39. Larsson B, Bjorntorp P, Tibblin G. The health consequences of moderate obesity. Int J Obes 1981;5:97-116.
40. Colditz GA, Willett WC, Stampfer MJ, et al. Weight as a risk factor for clinical diabetes in women. Am J Epidemiol 1990;132:501-13.

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41. Chan JM, Rimm EB, Colditz GA, Stampfer MJ, Willett WC. Obesity, fat distribution, and weight gain as risk factors for clinical diabetes in men. *Diabetes Care* 1994;17:961-9.
42. Ford ES, Williamson DF, Liu S. Weight change and diabetes incidence: findings from a national cohort of US adults. *Am J Epidemiol* 1997;146:214-22.
43. Ohlson LO, Larsson B, Svardsudd K, et al. The influence of body fat distribution on the incidence of diabetes mellitus. 13.5 years of follow-up of the participants in the study of men born in 1913. *Diabetes* 1985;34:1055-8.
44. Sparrow D, Borkan GA, Gerzof SG, Wisniewski C, Silbert CK. Relationship of fat distribution to glucose tolerance. Results of computed tomography in male participants of the Normative Aging Study. *Diabetes* 1986;35:411-5.
45. Rose GA. *The Strategy of Preventive Medicine*. New York: Oxford University Press, 1992.
46. Reeder BA. The public health implications of obesity in Canada. In: Angel A, ed. *Progress in Obesity Research*. London: John Libby and Co, 1996.
47. Taylor CB, Fortmann SP, Flora J, et al. Effect of long-term community health education on body mass index. *Am J Epidemiol* 1991;134:235-49.
48. Shah M, Hannan PJ, Jeffery RW. Secular trend in body mass index in the adult population of three communities from the upper mid-western part of the USA: the Minnesota Heart Health Program. *Int J Obesity* 1991;15:499-503.
49. Jeffery RW. Population perspectives on the prevention and treatment of obesity in minority populations. *Int J Clin Nutr* 1991;53:1621S-4S.
50. Glenny AM, O'Meara S, Melville A, Sheldon TA, Wilson C. The treatment and prevention of obesity: a systematic review of the literature. *Int J Obesity* 1997;21:715-37.

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51. Mertz CNB, Rozanski A, Forrester JS. The secondary prevention of coronary artery disease. Am J Med 1997;102:572-81.

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Section 4: Emerging risk factors associated with cardiovascular diseases

Jacques Genest Jr MD

HOMOCYSTEINE

Inborn errors of metabolism causing extreme plasma elevations of homocysteine with homocystinuria are associated with premature vascular disease, and widespread arterial and venous thrombotic phenomena. Several studies have reported the association of milder increases in plasma homo-cysteine levels with the presence of vascular disease, especially of large and medium-sized arteries, such as the coronary (1,2), iliac, femoral and carotid arteries.

Homocysteine and cardiovascular risk: In a recent meta-analysis, Boushey et al (3), concluded that homocysteine is an independent cardiovascular risk factor and that each 5 $\mu\text{mol/L}$ rise in homocysteine results in an increased odds ratio of 1.6 and 1.8 for cardiovascular diseases (CVD) in men and women, respectively. Furthermore, the authors calculated that normalizing homocysteine levels by increasing nutritional intake of folate may prevent 13,500 to 50,000 ischemic heart disease (IHD) deaths annually in the United States. A recent study by Nygard et al (4) showed that homo-cysteine levels are a strong predictor of mortality in patients with angiographically documented IHD. Plasma homocysteine levels are, in part, determined by plasma levels of vitamin B12, B6 and folate status and genetics. Although there is little correlation between homocysteine and the traditional risk factors for IHD (5,6), there is a correlation between homocysteine and smoking, d-dimers, fibrinogen and C-reactive protein.

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Genetics of homocysteine: The possible genetic defects involved in hyperhomocysteinemia include the heterozygous state for cystathionine beta-synthase deficiency, thermolabile 5,10-methylene tetrahydrofolate reductase (MTHFR) and genetic abnormalities of vitamin B12 metabolism. A thermolabile defect in MTHFR has been identified in subjects with elevated homocysteine and with IHD. Deficiencies of MTHFR are thought to be the most common defect of homocysteine metabolism. Recently, the molecular basis for thermolability of MTHFR has been characterized as a common mutation of the MTHFR gene (7,8).

Homocysteine and vascular damage: Homocysteine may have a deleterious effect on the normal prothrombolytic and anticoagulant activities of endothelial cells. Elevated levels of homocysteine have been found to decrease protein C activation by decreasing the activity of thrombomodulin. Homocysteine has also been shown to increase the activity of tissue factors in endothelial cells (9), to modulate tissue plasminogen activator binding to endothelial cell receptors and to enhance the activity of coagulation factor V in endothelial cells (10). Taken together, these data strongly suggest that elevated homocysteine levels are atherogenic by inducing a procoagulatory state. Recent data suggest that homocysteine enhances smooth muscle cell proliferation by acting at the DNA level (11,12).

RECOMMENDATIONS

No clinical studies have been performed on the treatment of hyperhomocysteinemia. There is insufficient evidence to recommend measuring plasma homocysteine in the general population. Unlike case control studies, prospective studies have been less consistent in showing that homocysteine is an independent risk factor for IHD. Homocysteine should be measured in patients with premature vascular disease, and possibly in patients with multiple cardiovascular risk factors and a strong family history of CVD (13,14) (**Level III, Grade C**). Mutational analysis of the genes involved in homocysteine metabolism is not recommended in clinical practice. Empirical treatment of patients with vitamin supplementation, although unlikely to cause harm, cannot be recommended at this time. Elevated homocysteine levels in a patient with established IHD may be treated with 0.4 to 1.0 mg/day of folic acid (**Level II, Grade B**). The benefits from such therapy are unknown. At least eight trials are underway to answer this question.

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LIPOPROTEIN(a)

Lipoprotein(a) [Lp(a)] is a cholesterol-rich lipoprotein composed of a low density lipoprotein (LDL) particle covalently linked to apolipoprotein(a) (apo A) - a large, highly glycosylated hydrophilic protein. apo A has an amino acid sequence similar to that of plasminogen and, due to a variable number of plasminogen-kringle 4 domains, it varies considerably in size from one person to another (200 to 800 kDa). Plasma concentrations of Lp(a) are genetically determined and vary from 1 mg/dL to more than 100 mg/dL. In a single individual, plasma Lp(a) concentration is remarkably stable over time and is not greatly influenced by age, sex, diet or most pharmacological interventions that significantly alter the plasma concentration of other lipoproteins (15,16).

Numerous cross-sectional and case control studies in subjects with coronary, carotid artery or peripheral vascular disease have demonstrated that elevated Lp(a) concentrations are associated with premature atherosclerosis (17). The significance of these retrospective studies has been questioned, however, because it is difficult to ascertain whether increased Lp(a) levels were a cause or a consequence of disease. This is particularly relevant in the case of Lp(a), which has been identified as a positive acute phase reactant (18). The acute phase response that occurs with acute coronary syndromes or surgical revascularization procedures may, therefore, exaggerate the importance of raised Lp(a) levels.

Several, but not all, large prospective studies have identified Lp(a) excess as an independent predictor of IHD (19-25). The most notable of these studies not showing a relationship between Lp(a) and IHD was the Helsinki Heart Study, in which Lp(a) levels did not differ between 138 subjects with IHD and 130 control subjects followed for five years; and the Quebec Cardiovascular Study, in which 116 subjects with a first coronary event did not have an increased prevalence of Lp(a) greater than 30 mg/dL (26,27). It has been proposed that different methods for measuring Lp(a), which have not been standardized, and the effects of variable length and temperature of sample storage may explain some of these different outcomes. An additional explanation for this inconsistency, which requires confirmation, is that the pathogenicity of Lp(a) is dependent on LDL-cholesterol levels (ie, LDL-cholesterol concentration modulates the ability of Lp(a) to promote atherosclerosis).

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The aforementioned epidemiological evidence implicating Lp(a) in the pathogenesis of atherosclerosis is supported by laboratory evidence showing that Lp(a) accumulates in atherosclerotic plaques (28); promotes thrombosis, due to its structural similarities with plasminogen (29); promotes foam cell formation by stimulating cellular cholesterol accumulation (30); stimulates smooth muscle cell proliferation (31); impairs endothelium-dependent vasodilation (32); and promotes monocyte chemoattractant activity in human vascular endothelial cells (33). Oxidized Lp(a) is taken up by macrophages and may cause foam cell formation. Interestingly, oxidized Lp(a) has been shown to increase vascular endothelial cell production of plasminogen activator inhibitor-1 (PAI-1) (34). Plasma Lp(a) levels correlate with reduced acetylcholine-mediated coronary vasodilation in human coronary arteries examined during diagnostic coronary angiography (35). Family studies have strongly implicated elevated Lp(a) levels in the development of IHD. The prevalence of Lp(a) excess was 18.6% in probands of families with premature IHD, compared with 14.7% for hypertriglyceridemia with low HDL and 13.7% for combined hyperlipidemia (36).

Genetics of Lp(a): Plasma levels of Lp(a) are strongly genetically determined. The heritability index for Lp(a) in twin studies, sib-pair analysis and family studies is the highest for any of the known lipoprotein cardiovascular risk factors (36). The main determinant of Lp(a) levels is related to the apo A gene. There is a strong, inverse and graded relationship between the length of the apo A gene (and, therefore, the number of kringle 4 repeats) and plasma apo A levels.

RECOMMENDATIONS AND CLINICAL CORRELATES

An elevated Lp(a) level appears to be an independent risk factor for IHD in many case control studies, but controversy remains concerning the role of Lp(a) in prospective studies. Methods to lower an elevated Lp(a) level through dietary or pharmacological means have proven difficult, with the exception of niacin and thyroxine in subjects with hypothyroidism. The question, therefore, is, in whom should Lp(a) be measured? Until an effective therapy is developed, and until epidemiological evidence shows that Lp(a) is a strong risk factor in

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prospective studies, the measurement of Lp(a) should be considered experimental and its treatment with niacin should be based on clinical judgment. Empirically, the use of antithrombotic medication (acetylsalicylic acid [ASA]) and lipid-lowering therapy aimed at reducing LDL cholesterol should be considered in subjects with elevated Lp(a).

CHLAMYDIA PNEUMONIAE

Interest in the concept that infectious agents may play a causal role in the etiology and pathogenesis of atherosclerosis has been rekindled because of technological advances in tissue localization of various proteins (for instance of viral or bacterial origin), and the ability to amplify specific DNA sequences in virtually any tissue specimen has opened novel avenues of investigation. Viral agents, especially herpes simplex and cytomegalovirus, have been implicated in athero-sclerosis. Bacterial agents such as *Helicobacter pylori* have been linked in some studies, but the association is controversial (37-40). In the present review, only data relevant to *Chlamydia pneumoniae* are presented. The link between *C pneumoniae* and IHD is based on evidence from relatively small case control studies. The relatively high prevalence of *C pneumoniae* antibodies in the normal population makes the association with IHD a controversial topic, especially from a public health perspective.

C pneumoniae is an obligate intracellular bacteria characterized by a complex growth cycle. It causes a variety of infections in humans. In the past 15 years or so, epidemiological evidence of a link between *C pneumoniae* and IHD has come to light. Immunocytochemistry, electron microscopy and polymerase chain reaction amplification of DNA have been used to establish the existence of *C pneumoniae* in atherosclerotic lesions, especially in smooth muscle cells. The pathogenesis of *C pneumoniae-induced* atherosclerosis remains to be established through appropriate animal models and clinical studies.

Two trials have been reported of the treatment of subjects with established IHD with antibiotics directed against *C pneumoniae*. In the roxithromycin in non-Q-wave coronary syndromes (ROXIS) trial (41), 202 subjects with unstable angina were given roxithromycin or placebo for 30 days. In the antibiotic-treated group, recurrent angina, acute myocardial infarction and

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deaths (combined triple end points) were significantly decreased ($P=0.036$ in patients who completed the 72 h course of treatment) after six months of follow-up. In a trial by Gupta et al (39), 220 patients were given the antibiotic azithromycin for three to six days, depending on the antibody titre to *C pneumoniae*, and followed for 18 months. The authors identified anti-*C pneumoniae* antibodies as a predictor of adverse recurrent events and a decrease in events in the azithromycin-treated group. Unfortunately, treatment directed against *C pneumoniae* does not always eradicate the infection, and recurrences occur.

Before implementing widespread screening and treatment against *C pneumoniae* in subjects with established IHD, well designed placebo controlled trials must be performed; several are underway.

RECOMMENDATIONS

On the basis of evidence, screening for *C pneumoniae* antibodies in subjects with established disease cannot be recommended yet, nor can treatment with antibiotics in subjects with elevated antibody levels. Improved detection techniques to assess the presence of *C pneumoniae* and its eradication will need to be developed to ascertain the efficacy of treatment.

COAGULATION FACTORS AND CVD

The coagulation system, more specifically, some hemo-static factors such as fibrinogen, platelets, factors VII and VIII, von Willebrand factor and decreased fibrinolysis, have been considered as factors or markers predisposing to ischemic CVD. Among these hemostatic factors, fibrinogen has probably been the main one studied that has shown a strong association with ischemic CVD.

Fibrinogen: In their meta-analysis of six prospective observational studies totalling 92,147 person-years, Ernst and Resch (42) calculated an odds ratio for IHD of 2.3 (95% CI 1.9 to 2.8) for elevated plasma levels of fibrinogen. Although there were some interactions between

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fibrinogen and other risk factors such as smoking, diabetes, different lipid fractions such as LDL-cholesterol and Lp(a), and menopause, fibrinogen was considered an independent factor in most studies and a strong marker in others. According to Ernst and Resch's re-view (42), there is evidence that fibrinogen is a predisposing factor to stroke, peripheral arterial diseases and atherosclerosis. There is also evidence that elevated fibrinogen increases the risk of acute IHD event rates in patients with angina (43). No data are available from large randomized trials showing that a reduction of fibrinogen levels reduces IHD events. However, smoking cessation and regular exercise decrease elevated fibrinogen levels. Decreases in elevated fibrinogen levels may reduce the risk of thrombosis by reducing plasma viscosity and interaction with other hemostatic factors. There is no indication to measure fibrinogen levels in all persons. However, such measurement may be useful in young, high risk persons to determine their prognosis more accurately for better management (**Level III, Grade C**).

Platelets: There are many studies supporting the important role of platelet aggregation in ischemic CVD. However, these studies do not explain the beneficial effects of ASA or other antiplatelet agents on the reduction of recurrent events or prevention of new events in high risk persons. Nevertheless, in the absence of contraindications, patients with an ischemic CVD or who are at high risk, particularly diabetic patients or persons with controlled hyperglycemia with other risk factors, should regularly take an antiplatelet agent (44,45) (**Level I, Grade A**).

Factor VII, factor VIII and von Willebrand factor: In prospective follow-up studies, such as the Prospective Cardiovascular Münster (PROCAM) study and Atherosclerosis Risk in Communities (ARIC) study, factor VIIc was not an independent risk factor for IHD (46,47). Factor VIII and von Willebrand factor, which were bound together, were a borderline risk factor in one study (48) and were not independently associated with CVD in another study (47).

Factors involved in fibrinolysis: Fibrinolysis is regulated by several factors but particularly the balance between tissue-type plasminogen activator (t-PA) promoting lytic action and PAI-1 inhibiting the lysis. Elevated PAI-1 inhibits t-PA release from the vascular endothelial cells. t-PA antigen and PAI-1 are elevated when fibrinolysis is prolonged. PAI-1 has been documented

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in young patients following an acute myocardial infarction and has been associated, when elevated, with a higher risk of recurrent events (49); this association does not persist in older patients. Further studies are required to establish whether these fibrinolytic components are independent risk factors.

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REFERENCES

1. Malinow MR. Homocyst(e)ine and arterial occlusive diseases. J Intern Med 1994;236:603-17.
2. Mayer EL, Jacobsen DW, Robinson K. Homocysteine and coronary atherosclerosis. J Am Coll Cardiol 1996;27:517-27.
3. Boushey CJ, Beresford SA, Omenn GS, Motulsky AG. A quantitative assessment of plasma homocysteine as a risk factor for vascular disease. Probable benefits of increasing folic acid intakes. JAMA 1995;274:1049-57.
4. Nygard O, Nordrehaug JE, Refsum H, Ueland PM, Farstad M, Vollset SE. Plasma homocysteine levels and mortality in patients with coronary artery disease. N Engl J Med 1997;337:230-6.
5. Selhub J, Jacques PF, Bostom AG, et al. Association between plasma homocysteine concentrations and extracranial carotid-artery stenosis. N Engl J Med 1995;332:286-91.
6. Lussier-Cacan S, Xhignesse M, Piolot A, Selhub J, Davignon J, Genest J Jr. Plasma total homocysteine in healthy subjects: sex-specific relation with biological traits. Am J Clin Nutr 1996;64:587-93.
7. Frosst P, Blom HJ, Milos R, et al. A candidate genetic risk factor for vascular disease: a common mutation in methylenetetrahydrofolate reductase. Nat Genet 1995;10:111-3.
8. Christensen B, Frosst P, Lussier-Cacan S, et al. Correlation of a common mutation in methylenetetrahydrofolate reductase gene with plasma homocysteine in patients with premature coronary artery disease. Arterioscler Thromb Vasc Biol 1997;17:569-73.
9. Hajjar KA. Homocysteine-induced modulation of tissue plasminogen activator binding to its endothelial cell membrane receptor. J Clin Invest 1993;91:2873-9.
10. Rodgers GM, Conn MT. Homocysteine, an atherogenic stimulus, reduces protein C activation by arterial and venous endothelial cells. Blood 1990;75:895-901.

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11. Tsai J-C, Perrella MA, Yoshizumi M, et al. Promotion of vascular smooth muscle cell growth by homocysteine: A link to atherosclerosis. Proc Natl Acad Sci USA 1994;91:6369-73.
12. Tsai J-C, Wang H, Perrella MA, et al. Induction of cyclin A gene expression gene expression by homocysteine in vascular smooth muscle cells. J Clin Invest 1996;97:146-53.
13. International task force for the prevention of coronary artery disease. Coronary artery disease: reducing the risk. Nutr Metab Cardiovasc Dis 1998;8:229.
14. Malinow MR, Bostom AG, Krauss RM. Homocyst(e)ine, diet, and cardiovascular diseases: a statement for healthcare professionals from the Nutrition Committee, American Heart Association. Circulation 1999;99:178-82.
15. Utermann G. The mysteries of lipoprotein(a). Science 1989;246:904-10.
16. Marcovina SM, Albers JJ, Gabel B, Koschinsky ML, Gaur VP. Effect of the number of apolipoprotein(a) kringle 4 domains on immunochemical measurements of lipoprotein(a). Clin Chem 1995;41:246-55.
17. Maher VMG, Brown BG. Lipoprotein (a) and coronary heart disease. Curr Opin Lipidol 1995;6:229-35.
18. Maeda S, Abe A, Seishima M, Makino K, Noma A, Kawade M. Transient changes of serum lipoprotein(a) as an acute phase protein. Atherosclerosis 1989;78:145-50.
19. Stein JH, Rosenson RS. Lipoprotein Lp(a) excess and coronary heart disease. Arch Intern Med 1997;157:1170-6.
20. Schaefer EJ, Lamon-Fava S, Jenner JL, et al. Lipoprotein(a) levels and risk of coronary heart disease in men. The Lipid Research Clinics Coronary Primary Prevention Trial. JAMA 1994;271:999-1003.

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21. Cremer P, Nagel D, Labrot B, et al. Lipoprotein Lp(a) as predictor of myocardial infarction in comparison to fibrinogen, LDL cholesterol and other risk factors: results from the prospective Göttingen Risk Incidence and Prevalence Study (GRIPS). Eur J Clin Invest 1994;24:444-53.
22. Bostom AG, Cupples LA, Jenner JL, et al. Elevated plasma lipoprotein(a) and coronary heart disease in men aged 55 years and younger. A prospective study. JAMA 1996;276:544-8.
23. Bostom AG, Gagnon DR, Cupples LA, et al. A prospective investigation of elevated lipoprotein (a) detected by electrophoresis and cardiovascular disease in women. The Framingham Heart Study. Circulation 1994;90:1688-95.
24. Assmann G, Schulte H, von Eckardstein A. Hypertriglyceridemia and elevated lipoprotein(a) are risk factors for major coronary events in middle-aged men. Am J Cardiol 1996;77:1179-84.
25. Wild SH, Fortmann SP, Marcovina SM. A prospective case-control study of lipoprotein(a) levels and apo(a) size and risk of coronary heart disease in Stanford Five-City Project participants. Arterioscler Thromb Vasc Biol 1997;17:239-45.
26. Jauhiainen M, Koskinen P, Ehnholm C, et al. Lipoprotein (a) and coronary heart disease risk: a nested case-control study of the Helsinki Heart Study participants. Atherosclerosis 1991;89:59-67.
27. Cantin B, Gagnon F, Moorjani S, et al. Is lipoprotein(a) an independent risk factor for ischemic heart disease in men? The Quebec Cardiovascular Study. J Am Coll Cardiol 1998;31:519-33.
28. Smith EB, Cochran S. Factors influencing the accumulation in fibrous plaques of lipid derived from low density lipoprotein. II. Preferential immobilization of lipoprotein (a) (Lp(a)). Atherosclerosis 1990;84:173-81.

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29. Loscalzo J, Weinfeld M, Fless GM, Scanu AM. Lipoprotein(a), fibrin binding, and plasminogen activation. *Arteriosclerosis* 1990;10:240-5.
30. Bottalico LA, Keesler GA, Fless GM, Tabas I. Cholesterol loading of macrophages leads to marked enhancement of native lipoprotein(a) and apoprotein(a) internalization and degradation. *J Biol Chem* 1993;268:8569-73.
31. Nachman RL. Lipoprotein(a): molecular mischief in the microvasculature. *Circulation* 1997;96:2485-7.
32. Poon N, Zhang X, Dunskey KG, Taubman MB, Harpel PC. Apolipoprotein(a) induces monocyte chemotactic activity in human vascular endothelial cells. *Circulation* 1997;96:2514-9.
33. Grainger DJ, Kirschenlohr HL, Metcalfe JC, Weissberg PL, Wade DP, Lawn RM. Proliferation of human smooth muscle cells promoted by lipoprotein(a). *Science* 1993;260:1655-8.
34. Ren S, Man RY, Angel A, Shen GX. Oxidative modification enhances lipoprotein(a)-induced overproduction of plasminogen activator inhibitor-1 in cultured vascular endothelial cells. *Atherosclerosis* 1997;128:1-10.
35. Tsurumi Y, Nagashima H, Ichikawa K, Sumiyoshi T, Hosoda S. Influence of plasma lipoprotein (a) levels on coronary vasomotor response to acetylcholine. *J Am Coll Cardiol* 1995;26:1242-50.
36. Genest JJ Jr, Martin-Munley SS, McNamara JR, et al. Familial lipoprotein disorders in patients with premature coronary artery disease. *Circulation* 1992;85:2025-33.
37. Chiu B, Viira E, Tucker W, Fong IW. *Chlamydia pneumoniae*, cytomegalovirus, and herpes simplex virus in atherosclerosis of the carotid artery. *Circulation* 1997;96:2144-8.
38. Pasceri V, Cammarota G, Patti G, et al. Association of virulent *Helicobacter pylori* strains with ischemic heart disease. *Circulation* 1998;97:1675-9.

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39. Gupta S, Leatham EW, Carrington D, Mendall MA, Kaski JC, Camm AJ. Elevated *Chlamydia pneumoniae* antibodies, cardiovascular events, and azithromycin in male survivors of myocardial infarction. *Circulation* 1997;96:404-7.
40. Ossewaarde JM, Feskens EJ, De Vries A, Vallinga CE, Kromhout D. *Chlamydia pneumoniae* is a risk factor for coronary heart disease in symptom-free elderly men, but *Helicobacter pylori* and cytomegalovirus are not. *Epidemiol Infect* 1998;120:93-9.
41. Gurfinkel E, Bozovich G, Daroca A, Beck E, Mautner B. Randomised trial of roxithromycin in non-Q-wave coronary syndromes: ROXIS Pilot Study. *Lancet* 1997;350:404-7.
42. Ernst E, Resch KL. Fibrinogen as a cardiovascular risk factor: a meta-analysis and review of the literature. *Ann Intern Med* 1993;118:956-63.
43. Thompson SG, Kienast J, Pyke SDM, Haverkate F, van de Loo JCW. Hemostatic factors and the risk of myocardial infarction or sudden death in patients with angina pectoris. European Concerted Action on Thrombosis and Disabilities Angina Pectoris Study Group. *N Engl J Med* 1995;332:635-41.
44. Cairns JA, Lewis HD Jr, Meade TW, Sutton GC, Thérour P. Antithrombotic agents in coronary artery disease. *Chest* 1995;108(4 Suppl):380S-400S.
45. American Diabetes Association. Aspirin therapy in diabetes. *Diabetes Care* 1997;20:1772-3.
46. Junker R, Heinrich J, Schulte H, van de Loo J, Assmann G. Coagulation factor VII and the risk of coronary heart disease in healthy men. *Arterioscler Thromb Vasc Biol* 1997;17:1539-44.
47. Folsom AR, Wu KK, Rosamond WD, Sharrett AR, Chambless LE. Prospective study of hemostatic factors and incidence of coronary heart disease. The Atherosclerosis Risk in Communities (ARIC) Study. *Circulation* 1997;96:1102-8.

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48. Meade TW, Cooper JA, Stirling L, Howarth DJ, Ruddock V, Miller GJ. Factor VIII, ABO blood group and the incidence of ischaemic heart disease. Br J Haematol 1994;88:601-7.
49. Hamsten A, de Faire U, Walldius G, et al. Plasminogen activator inhibitor in plasma: risk factor for recurrent myocardial infarction. Lancet 1987;ii:3-9.

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Section 5: Risk Factors Associated with Lifestyle and Behaviour - Smoking

Andrew Pipe MD

The importance of smoking as a principal, preventable risk factor for cardiovascular diseases (CVD) cannot be overstated. The relationship between smoking and CVD is unequivocal (1,2). Smoking increases cardiovascular mortality by 50% and doubles the incidence of CVD (3). Smoking ranks as the largest preventable cause of ischemic heart disease (4,5). The chemical constituents of tobacco smoke are estimated to exceed 4000, and their effects on the cardiovascular system are multiple (2).

Each year more than 16,000 cardiovascular deaths, many of which are premature (6), occur in Canada as a consequence of smoking. Deaths from ischemic heart disease make up more than half of this number. More than 2000 deaths from stroke occur each year in Canada as a result of smoking (4). Smoking is the most powerful risk factor for atherosclerosis involving the peripheral circulation; the causal association between smoking and atherosclerosis is most marked in the abdominal aorta. Each year about 1000 smoking-attributable deaths occur in Canada as a result of aortic aneurysms (2,7).

SMOKING IN CANADA

Among Canadians, 28% of men and 25% of women smoke regularly. There have been no real changes in the overall prevalence of smoking since 1986 (8). Approximately one-third of the

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Canadian population between the ages of 18 and 44 years smokes regularly; the prevalence of smoking is highest in Atlantic Canada and Quebec, and lowest in Saskatchewan and Ontario. Adolescent smoking, however, has increased in the past few years - an increase that has been attributed to a reduction in tobacco taxes and the greater sensitivity of adolescents to cigarette prices (7,9,10).

SMOKING AND THE PATHOGENESIS OF CVD

Endothelial dysfunction is viewed as the prime initiating factor in the development of atherosclerosis. Nicotine, in an animal model, has been shown to damage the endothelium(11). The constituents of tobacco smoke increase smooth muscle cell proliferation, platelet aggregation and the adherence of platelets to endothelium (6,12,13). Plasma viscosity and levels of fibrinogen and factor VII are also increased by tobacco smoke (14). Levels of plasminogen (which promotes the lysis of thrombi) are reduced in smokers (15). The effects of acetylsalicylic acid on platelet aggregation are reduced as a result of exposure to cigarette smoke (12).

The inhalation of nicotine produces a variety of physiological and hemodynamic effects. Heart rate, blood pressure, cardiac output, myocardial oxygen demand and vasoconstriction all increase. The coronary arteries are particularly sensitive to smoking, and acute vasoconstriction occurs rapidly following exposure to nicotine (16). Carbon monoxide constitutes 3% to 6% of cigarette smoke; its high affinity for hemoglobin reduces the oxygen carrying capacity of the blood and limits oxygen availability, exacerbating myocardial ischemia (17,18).

Cigarette smoking produces changes in the lipoprotein profile and other components of the atherosclerotic process. High density lipoprotein levels fall in association with smoking and rise with smoking cessation (6). Nicotine exposure produces elevations in the levels of free fatty acids and very low density lipoproteins (19). Cigarette smoking among women is also associated with an earlier menopause and altered estrogen metabolism (20).

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SMOKING AND ISCHEMIC HEART DISEASE

Smoking produces an increase in myocardial oxygen demand and a reduction in oxygen availability. Smoking can initiate and accelerate the development of coronary athero-sclerosis, further impairing the delivery of oxygen to the myocardium. Nicotine can sensitize the myocardium, rendering it more irritable and susceptible to the development of arrhythmias, particularly ventricular fibrillation. Not surprisingly, the risk of sudden cardiac death is significantly increased by cigarette smoking (3,21).

A smoker dies three years earlier than a nonsmoker and 10 to 15 years earlier if a smoker is known to be at high risk for coronary disease (22). Sadly, the effectiveness of many commonly prescribed cardiac medications, including nifedipine, propranolol, diltiazem and digoxin, declines in the face of continued smoking (23). The risk of recurrent disease is reduced by 50% within one year among myocardial infarction patients who stop smoking and approaches that of a nonsmoker within two years of smoking cessation (24). It has been known for some time that following coronary angioplasty the rates of restenosis are significantly higher in smokers (25). Continued smoking adversely affects the fate of bypass grafts and is associated with a doubling of the risk of death or nonfatal infarction after a bypass procedure (26).

SMOKING AND CEREBROVASCULAR DISEASE

It has been suggested that between 50% and 55% of all strokes occurring in the United States are attributable to cigarette smoking and that the risk of stroke is 1.5 to 3.0 times that of nonsmokers (7). Women smokers using oral contraceptives are at particular risk and have demonstrated a relative risk for stroke ranging from 3.3 to 21.9 (27). Cigarette smokers have reduced levels of cerebral blood flow; smoking cessation increases brain perfusion (28,29).

SMOKING AND PERIPHERAL VASCULAR DISEASE

Smoking is considered to be the most important risk factor for the development of peripheral vascular disease (3,30). The prognosis of patients with peripheral vascular disease is improved with smoking cessation. Those who continue to smoke are destined to have complication and amputation rates significantly higher than those who were successful in cessation (31,32).

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SECOND-HAND SMOKE

The public health impact of exposure to the tobacco smoke of others is considerable. Passive smoking has been described as the third leading cause (after active smoking and alcohol use) of preventable disease in the United States (33). Those who have never smoked but who have been exposed to environmental tobacco smoke (ETS) have an increased risk of developing CVD. The increase in relative risk is calculated to be between 1.2 and 1.3 (32,34-36). There is evidence to suggest that exposure to ETS accelerates the development of atherosclerosis (37). These findings have implications for the cardiovascular specialist: consideration must be given to exposure to ETS in assessing cardiovascular risk. The avoidance of ETS should be given the same priority as smoking cessation as a means of preventing disease, especially among those with other risk factors (38).

RESEARCH PRIORITIES

Given the magnitude of the cardiovascular and public health consequences of tobacco consumption, it is essential that research efforts designed to address the factors and forces that shape the development of tobacco addiction or that positively influence smoking cessation be accorded priority. It has been suggested (39) that research activities address the following:

risk factors for initiation of smoking;

effectiveness of school-based programs;

restrictions on sales to minors;

roles of health professionals;

sex differences in adolescent smoking.

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Cardiovascular scientists and clinicians may have particular interests and opportunities to study the following:

the delivery of smoking cessation strategies to hospitalized patients;

the use of nicotine replacement therapy (NRT) and other strategies in acute care settings;

the use of harm reduction techniques (ie, long term NRT) in heavily addicted smokers with CVD;

the identification of the predictors of smoking cessation;

the development and application of optimal professional practice strategies in smoking cessation in cardiovascular settings.

SMOKING AND THE CARDIOVASCULAR SPECIALIST

It has been noted that smoking is the most obvious and important risk factor for coronary artery and vascular disease (40). As such, it must become a priority for all physicians involved in the prevention, diagnosis and treatment of cardiovascular illness. Smoking has not received the attention that it merits from cardiovascular specialists. There is good evidence that even brief clinical interventions can be effective in facilitating smoking cessation; cardiovascular clinicians must become familiar with the techniques and approaches used to address tobacco addiction (41). The use of NRT has been shown to be highly effective in facilitating smoking cessation; it has been demonstrated to be at least twice as effective as other measures (42). NRT can be used safely in patients with established CVD (43-45). The increased availability of NRT products in most Canadian provinces means that community pharmacists now have a particular role to play in counselling those who obtain NRT products over the counter. Pharmacists are also in an excellent position to counsel and encourage people attempting smoking cessation with prescription products.

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More recent attempts to treat tobacco addiction using bupropion have been demonstrated to be highly effective and are an entirely new approach to the treatment of nicotine addiction (46).

The area of smoking cessation is, like the management of any other cardiovascular risk factor, within the purview of the cardiovascular specialist, and to fail to address this fundamentally important issue constitutes a significant professional oversight. Smoking cessation interventions should be unambiguous and nonjudgemental, and include the offer of specific assistance or referral, and can be coordinated with the family physician and other health professionals. Smoking cessation initiatives are among the most cost effective of any in clinical medicine (47). Cardiovascular physicians and their professional organizations must take every opportunity to call for and support appropriate public health policies for the control of tobacco (48).

More specifically the following are recommended:

The smoking status (never smoked, former smoker, exposed to ETS) of all patients should be known, quantified (pack-years) and documented (**Level III**).

All smokers should receive at the time of every encounter specific, nonjudgemental, unambiguous advice to stop smoking and to avoid exposure to ETS (**Level III**).

Smoking cessation programs should be considered an essential element of any CVD centre or setting. Such programs should be available to all smokers and their families (**Level III**).

The offer of physician advice and self-help materials to stop smoking should be documented for all smokers hospitalized with CVD (**Level II**).

Smoking cessation clinic, or other community or professional resources should be available for smokers in all communities (**Level III**).

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All cardiovascular physicians should be familiar with the appropriate use of NRT and other therapeutic initiatives (eg, the use of bupropion) demonstrated to be helpful in smoking cessation (**Level III**).

All cardiovascular physicians and their professional organizations should advocate and support comprehensive programs of tobacco control. Such programs should safeguard the air quality of all public spaces, eliminate all forms of tobacco advertising and sponsorship, regulate all aspects of tobacco product manufacture and marketing, mandate appropriate levels of taxation on tobacco products and seek to eliminate the export of tobacco products (and hence tobacco diseases) to other nations (**Level III**).

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REFERENCES

1. McBride PE. The health consequences of smoking. Cardiovascular diseases. Med Clin North Am 1992;76:333-53.
2. Jonas MA, Oates JA, Ockene JK, Hennekens CH. Statement on smoking and cardiovascular disease for health care professionals. American Heart Association. Circulation 1992;86:1664-9.
3. Reducing the Health Consequences of Smoking: 25 Years of Progress. Rockville: US Department of Health and Human Services, 1989.
4. The Health Consequences of Smoking: Cardiovascular disease. A Report of the Surgeon General. Washington: US Department of Health and Human Services, 1983.
5. Forrester JS, Merz NB, Bush TL, et al. Efficacy of risk factor management. In: Fuster VF, Pearson TA, eds. 27th Bethesda Conference: Matching the intensity of risk factor management with the hazard for coronary disease events. J Am Coll Cardiol 1996;27:957-1047.
6. Illing EM, Kaiserman MJ. Mortality attributable to tobacco use in Canada and its regions, 1991. Can J Public Health 1995;86:257-65.
7. The Health Benefits of Smoking Cessation. A report of the Surgeon General. Rockville: US Department of Health and Human Services, 1990.
8. Survey on Smoking in Canada. Ottawa: Health Canada, 1994.
9. Ferrence RG, Garcia JM, Sykora K, Collishaw NE, Farimon L. Effects of Pricing on Cigarette Use Among Teenagers and Adults in Canada, 1980-1989. Toronto: Addiction Research Foundation, 1991.
10. Brown KS, Taylor TE, Madill CL, Cameron R. The Relationship <

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11. Between the Tobacco Tax Decrease and Smoking Among Youth: Results of a Survey in South-Western Ontario [Working Paper Series #14]. Toronto: Ontario Tobacco Research Unit, 1996.
12. Booyse FM, Osikowicz G, Quarfoot AJ. Effects of chronic oral consumption of nicotine on the rabbit aortic endothelium. *Am J Pathol* 1981;102:229-38.
13. Folts JD, Gering SA, Laibly SW, et al. Effects of cigarette smoke and nicotine on platelets and experimental coronary artery thrombosis. In: Diana J, ed. *Tobacco Smoking and Atherosclerosis: Pathogenesis and Cellular Mechanisms*. New York: Plenum Publishing, 1990:339-58.
14. Nowak J, Murray JJ, Oates JA, et al. Biochemical evidence of a chronic abnormality in platelet and vascular function in healthy individuals who smoke cigarettes. *Circulation* 1987;76:6-14.
15. Meade TW, Imeson J, Stirling Y. Effects of changes in smoking and other characteristics on clotting factors and the risk of ischaemic heart disease. *Lancet* 1987;ii:986-8.
16. Belch JJF, McArdle BM, Burns P. The effects of acute smoking on platelet behaviours, fibrinolysis and hemorrheology in habitual smokers. *Thromb Haemost* 1984;51:6-8.
17. Maouad J, Fernandez F, Barillon A, et al. Diffuse or segmental narrowing (spasm) of the coronary arteries during smoking demonstrated on angiography. *Am J Cardiol* 1984;52:354-5.
18. Turner JA, McNichol MW, Sillett RW. Distribution of carboxyhaemoglobin concentrations in smokers and non-smokers. *Thorax* 1986;41:25-7.
19. Anderson EW, Andelman RJ, Strauch JM, et al. Effect of low-level carbon monoxide exposure on onset and duration of angina pectoris. *Ann Intern Med* 1973;79:46-50.
20. Bizzi A, Tacconi MT, Medea A, et al. Some aspects of the effect of nicotine on plasma FFA and tissue triglycerides. *Pharmacology* 1972;7:216-24.

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21. Benowitz NL. Pharmacologic aspects of cigarette smoking and nicotine addiction. N Engl J Med 1988;319:1318-30.
22. Suhonen O, Reunanen A, Knekt P, et al. Risk factors for sudden and non-sudden coronary death. Acta Med Scand 1988;223:19-25.
23. Williams RR, Hopkins PN, Wu LL, et al. Evaluating family history to prevent early coronary heart disease. In: Pearson TA, Criqui MH, Luepker RV, et al, eds. Primer in Preventive Cardiology. Dallas: American Heart Association, 1994:93-106.
24. Deanfield JE, Wright C, Krikler S, et al. Cigarette smoking and the treatment of angina with propranolol, atenolol, and nifedipine. N Engl J Med 1984;310:951-4.
25. Wilhelmsson C, Elmfeldt D, Vedin JA, et al. Smoking and myocardial infarction. Lancet 1975;i:415-9.
26. Galan KM, Deligonul U, Kern MJ, et al. Increased frequency of restenosis in patients continuing to smoke cigarettes after coronary angioplasty. Am J Cardiol 1988;61:260-3.
27. Pasternak RC, Grundy MG, Levy D, et al. Spectrum of risk factors for coronary heart disease. In: Fuster V, Pearson TA, eds. 27th Bethesda Conference. Matching the intensity of risk factor management with the hazard for coronary disease events. J Am Coll Cardiol 1996;27:978-90.
28. Petti DB, Wingred J. Use of oral contraceptives, cigarette smoking, and risk of subarachnoid hemorrhage. Lancet 1978;ii:234-5.
29. Rogers RL, Meyer JS, Shaw TG. Cigarette smoking decreases cerebral blood flow suggesting increased risk for stroke. JAMA 1983;250:2796-800.
30. Rogers RI, Meyer JS, Judd BW, et al. Abstention from cigarette smoking improves cerebral perfusion among elderly chronic smokers. JAMA 1985;253:2970-4.

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31. Criqui MH, Browner D, Fronek A, et al. Peripheral arterial disease in large vessels is epidemiologically distinct from small vessel disease. An analysis of risk factors. *Am J Epidemiol* 1989;129:1110-9.
32. Ameli FM, Stein M, Provan JL, et al. The effect of post operative smoking on femoropopliteal bypass grafts. *Ann Vasc Surg* 1989;3:20-5.
33. Wiseman S, Kenchington G, Dain R, et al. Influence of smoking and plasma factors on patency of femoropopliteal vein grafts. *BMJ* 1989;299:643-6.
34. Glantz SA, Parmley WW. Passive smoking and heart disease: epidemiology, physiology, and biochemistry. *Circulation* 1991;83:1-12.
35. Steenland K, Thun M, Lally C, Heath C. Environmental tobacco smoke and coronary heart disease in the American Cancer Society CPS-II cohort. *Circulation* 1996;94:622-8.
36. Kawachi I, Colditz GA, Speizer FE, et al. A prospective study of passive smoking and coronary heart disease. *Circulation* 1997;95:2374-9.
37. Wells JA. Passive smoking as a cause of heart disease. *J Am Coll Cardiol* 1994;24:546-54.
38. Howard G, Wagenknecht LE, Burke GL, et al. Cigarette smoking and progression of atherosclerosis: the Atherosclerosis Risk in Communities (ARIC) study. *JAMA* 1998;279:119-24.
39. Werner RK. What's so passive about passive smoking? Secondhand smoke as a cause of atherosclerotic disease. *JAMA* 1998;279:157-8.
40. Abernathy T, Pederson L. Priorities for Tobacco Research and Information: Results of Surveys of Researchers and Programmers in Ontario [Working Paper Series #5]. Toronto: Ontario Tobacco Research Unit, 1995.
41. Fineberg HV. Clinical evaluation: how does it influence medical practice? *Bull Cancer (Paris)* 1987;74:333-46.

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42. Fiore MC, Bailey WC, Cohen SJ, et al. Smoking Cessation: Information for Specialists. Clinical Practice Guideline. Quick Reference Guide for Smoking Cessation Specialists, No 18 [AHCPR Pub No. 96-0694]. Rockville: US Department of Health and Human Services, Public Health Service, Agency for Health Care Policy and Research and Centers for Disease Control and Prevention, 1996.
43. Fiore MC, Smith SS, Jorenby DE, Baker TB. The effectiveness of the nicotine patch for smoking cessation: a meta-analysis. JAMA 1994;271:1940-7.
44. Joseph AM, Norman SM, Ferry LH, et al. The safety of transdermal nicotine as an aid to smoking cessation in patients with cardiac disease. N Engl J Med 1996;335:1792-8.
45. Working Group for the Study of Transdermal Nicotine in Patients with Coronary Artery Disease. Nicotine replacement therapy for patients with coronary artery disease. Arch Intern Med 1994;154:989-95.
46. Benowitz NL, Gourlay SG. Cardiovascular toxicity of nicotine: Implications for nicotine replacement therapy. J Am Coll Cardiol 1997;29:1422-31.
47. Hurt RD, Sachs DP, Glover ED, et al. A comparison of sustained-release bupropion and placebo for smoking cessation. N Engl J Med 1997;337:1195-202.
48. Cromwell J, Bartosch WJ, Fiore MC, et al. Cost-effectiveness of the clinical practice recommendations in the AHCPR Guideline for smoking cessation. JAMA 1997;278:1759-66.
49. Pipe AL. Tobacco control: education is not enough. In: Yamamoto C, ed. Multiple Risk Factors in Cardiovascular Disease. Tokyo: Churchill Livingstone Japan, 1994:267-71.

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Section 5: Risk Factors Associated with Lifestyle and Behaviour - Diet and the prevention of cardiovascular diseases

Gilles Paradis MD, J George Fodor MD

Thirty-seven per cent of total mortality in Canada is caused by cardiovascular diseases (CVD), the majority of which is ischemic heart disease (IHD). Forty-six per cent of the Canadian population aged 18 to 74 years have a total cholesterol level above 5.2 mmol/L, and 16% suffer from hypertension (1). Because dietary patterns influence several CVD risk factors including dyslipidemia, hypertension, obesity, type II diabetes and possibly thrombosis, it is essential to assess to what extent dietary measures are efficacious in the prevention and therapy of CVD. We review the evidence linking diet to CVD, with a particular emphasis on dietary factors related to dyslipidemia and hypertension.

DIET, DYSLIPIDEMIA AND CVD

The origins of the 'diet-heart' hypothesis can be traced back to 1913, to the pioneering work of Anitschkow (2). Anitschkow (2) showed that dietary cholesterol may cause arterial lesions in rabbits resembling human atherosclerotic plaques and that this effect is mediated through elevated plasma cholesterol. Subsequent studies of several other animal species, including species that do not develop athero-sclerosis under normal circumstances, have been remarkably consistent in showing that feeding of saturated fatty acids and cholesterol leads to increases in low density lipoprotein (LDL) cholesterol concentrations and to the development of intimal lesions that progress in a manner similar to that of human atherosclerosis from fatty

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streaks to ulcerated plaques (3,4). Studies among primates have also shown regression of atherosclerotic lesions with diet-induced lowering of plasma cholesterol (3,4).

Although animal studies provide crucial information on the pathophysiology of atherosclerosis, their results must be confirmed by human population studies because the lipoprotein profiles and physiology of various animal species may differ substantially from that of humans. The diet-heart hypothesis has been fuelled by three lines of research among humans: ecological studies of diet and CVD among large groups of individuals, within-population epidemiological studies relating diet to serum cholesterol and to the risk of CVD, and experimental studies in humans.

ECOLOGICAL STUDIES

Ecological studies include international comparisons of dietary patterns and CVD occurrence in various countries. The International Atherosclerosis Project (IAP), reported in 1968, found high correlation coefficients between estimated population-wide dietary fat intake and the extent of atherosclerosis among 21,000 autopsies conducted in 15 countries (5). In another study, national dietary data were compared with IHD mortality rates from national vital statistics obtained 20 years after the dietary data were collected (6). High saturated fat consumption was associated with increased IHD risk, whereas high polyunsaturated fat intake was associated with lower IHD death (6).

The major limitation of ecological studies is that it is impossible to know whether the attributes being correlated actually occur in the same individuals, making these investigations very susceptible to bias. To try to alleviate this problem, investigators have studied dietary intakes and CVD among cohorts from several countries.

The most important example of this strategy is the Seven Countries Study, started in the mid-1950s, involving over 12,000 men from 16 different cohorts in seven countries. This landmark study showed a very strong correlation between saturated fat intake and five-year IHD mortality ($r=0.84$), although the relationship with total fat intake was less impressive ($r=0.40$) (7). In fact,

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the cohort from the Island of Crete had both one of the highest total fat intakes (more than 40% of calories) and one of the lowest IHD mortalities. However, the cohort had one of the lowest saturated fat intakes (7% of calories). The strong relationship between saturated fat intake and IHD has recently been shown to extend through 25 years of follow-up of the Seven Countries Study (8).

Another example of ecological studies involves the follow-up of migrant populations. The Ni-Hon-San study compared CVD risk factors and IHD deaths among Japanese men living in Japan, Hawaii and San Francisco (9,10). The comparison of cohorts of individuals of similar ancestry removed the potential confounding effect of genetic factors involved in the diet-CVD relationship. The percentage of calories from saturated fats differed substantially among the cohorts: 7%, 23% and 26% for the cohorts from Japan, Hawaii and San Francisco, respectively. The five-year IHD mortality rates paralleled the dietary fat intake: 1.3, 2.2 and 3.7 per 1000, respectively.

Although the measurement of exposure and outcome (diet and IHD) in the same individuals was an improvement over previous ecological studies, the Seven Countries and Ni-Hon-San studies still did not adequately control for the confounding effects of other major risk factors. For example, the cohorts with the lowest fat intake in the Seven Countries Study were located in the least industrialized countries, and had higher levels of physical activity and less obesity. Similarly, because obesity and alcohol intake varied considerably between the Ni-Hon-San cohorts and because it is likely that migrants may differ importantly from nonmigrants in general health characteristics or lifestyles, it is impossible to infer that the differences in IHD mortality are entirely due to differences in diet.

Although ecological studies suffer from many flaws, they do provide evidence that supports the diet-heart hypothesis, and they offer clues to causation of the important population differences in CVD mortality across various countries (11,12). To establish whether diet is a risk factor at the individual level requires studies within defined populations.

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WITHIN-POPULATION STUDIES

Within-population studies allow direct measurement of diet, other risk factors and the outcome of interest in individuals, and provide an opportunity to adjust for potential confounding variables. However, there are inherent limitations in studying the impact of diet on CVD in homogeneous populations (13). First, interindividual variations in diet in such populations are substantially lower than intra-individual variations, hence decreasing the probability that significant associations can be found at the individual level. Second, because of the efforts and costs involved in obtaining dietary data, many investigations have used simpler but less reliable methods of dietary assessment, such as food frequency questionnaires and single 24 h recalls. These methods are more likely to misclassify dietary exposure and to lead to false negative results. Finally, objective measures of diet are rarely, if ever, used in epidemiological studies. The subjective methods are fraught with methodological problems including recall bias, and under-reporting of certain types of food and of total calories consumed (14).

Given these limitations, it is not surprising that several cohort studies have failed to support an association between dietary fat, saturated fat and dietary cholesterol, and the risk of IHD (15). The most notable studies that fall in this category are the Framingham (16), Tecumseh (17), Evans County (18) and Zutphen (19) studies.

However, several other cohort studies have revealed significant associations between dietary fat and the risk of CVD (20). The Puerto Rico Heart Study included over 8000 men from a rural and an urban cohort followed for six years (21). A significant, positive association between saturated fat intake and IHD was found in the rural but not the urban cohort. The 10-year follow-up report of over 7000 men from the Honolulu Heart Study similarly found significant positive correlations between total fat, saturated fat and dietary cholesterol intakes, and IHD risk (22). The Ireland-Boston Diet-Heart Study followed 1000 men for 20 years. It reported significant positive, although small, correlation coefficients between saturated fats and IHD (23).

A much larger study in Belgium followed over 21,000 men and women for four years. Significant positive correlations were reported between saturated fat intake and IHD ($r=0.69$ for

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men, $r=0.49$ for women), as well as significant negative correlations with polyunsaturated fat consumption ($r=-0.73$ for men, $r=-0.41$ for women) (24). Similarly, Goldbourt et al (25) reported a significant positive correlation between saturated fat intake and IHD in a cohort of 10,000 Israeli civil servants followed for 23 years. Dietary polyunsaturated fat intake was negatively associated with IHD risk. A more recent report from the Atherosclerosis Risk in Communities (ARIC) Study identified significant positive correlations between saturated fat and cholesterol intakes and carotid artery wall thickness as assessed by B mode ultrasound, but only among women (26).

Finally, the Western Electric Study reported significant positive associations between the Keys lipid score, and the dietary cholesterol intake and IHD among 1900 men followed for almost 20 years (27). However, in this study, saturated fat intake was not an independent predictor of IHD.

The associations identified in the previous studies remained statistically significant after adjustment for other CVD risk factors, including, in several cases, serum cholesterol, suggesting that the impact of dietary saturated fats may be mediated through additional causal pathways (13). In addition to cohort studies, several feeding experiments support the relationship between diet and serum cholesterol.

THE INFLUENCE OF DIET ON BLOOD LIPOPROTEIN

Numerous studies conducted under the highly controlled environments of metabolic wards have clearly shown that total blood cholesterol, as well as high density lipoprotein (HDL) and LDL, are influenced by dietary fat and cholesterol. The effects of specific fatty acids have recently been reviewed in detail elsewhere (28), and only a brief overview is presented in this section.

Saturated and polyunsaturated fatty acids: Except for stearic acid, which has little effect on blood cholesterol (29), saturated fats increase total, LDL-and HDL-cholesterol concentrations. Conversely, reducing saturated fat intake can lead to decreases in total, LDL-and HDL-cholesterol (30). However, diets that replace saturated fatty acids with unsaturated fatty acids result primarily in lower LDL cholesterol levels (31).

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Fish and omega-3 fatty acids: Long chain omega-3 fatty acids reduce triglyceride levels and appear to have additional physiological effects, including decreases in platelet aggregation and in blood pressure, which suggest a favourable impact on the pathogenesis of IHD (32,33). Greenland Eskimo (34) and Dutch (35) studies ascertained an inverse association between the consumption of both fish and omega-3 fatty acids and IHD. The amount of omega-3 fatty acids that provides a certain degree of protection is unknown.

A cohort study of Dutch men (35) suggested that there is an inverse relationship between consumption of more than 30 g of fish per day and risk of IHD. Other studies have been unable to reproduce these results (36). The Diet and Rein-farction Trial (DART) randomly assigned more than 2000 myocardial infarction (MI) survivors to fatty fish (two to three times weekly), a low saturated fat diet or a high fibre diet (37). Although the reinfarction rate was not affected, the subjects assigned to fish consumption experienced a 29% reduction in all cause mortality. The relationship between fish consumption and IHD risk is inconsistent. **Monounsaturated fatty acids:** Recent studies have shown that monounsaturated fatty acids lower LDL-cholesterol when substituted for saturated fatty acids (28,31). Whether monounsaturated fatty acids reduce LDL without affecting HDL, as has been claimed, is unclear (20).

Trans fatty acids: The hydrogenation process of vegetable oils results in the transformation of the usual bent configuration of *cis* isomers into the closely packed configuration of *trans* isomers (20). *Trans* fatty acids are saturated, eg, hydrogenation of vegetable oils to produce margarine. The association of *trans* fatty acids with increased risk of IHD was reviewed in 1995, and cohort studies provided evidence that excess intake of *trans* fatty acids can adversely affect cholesterol profiles and lead to increases in the risk of developing IHD (38,39). In a recent prospective cohort study, Hu et al (40) found that in over 80,000 women aged 34 to 59 years, replacement of 2% of energy from trans fat with unhydrogenated, unsaturated fats reduced risk of IHD by 53% (40). Women with low saturated fat and low *trans* fatty acid diets who consumed higher quantities of mono-or polyunsaturated fatty acids had the lowest risk of IHD.

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Dietary cholesterol: Dietary cholesterol appears to be a less potent regulator of blood cholesterol than dietary fatty acids. The lipoprotein response to the interaction of fatty acids and cholesterol consumption is unclear, although increases in dietary cholesterol alone usually result in elevated blood cholesterol concentrations (41). However, there is greater variability in the individual response to dietary cholesterol than to dietary fatty acids.

Table 1 summarizes dietary factors that increase serum LDL-cholesterol concentrations and that may promote atherogenesis.

TABLE 1
Dietary factors that increase serum low density lipoprotein cholesterol concentration

Caloric imbalance (weight gain)
Percentage calories derived from fat
Saturated fatty acids
Unsaturated trans fatty acids
Cholesterol

DIETARY INTERVENTION TRIALS

Although the animal studies, the ecological studies, the metabolic ward studies and the observational cohort studies provide generally consistent and solid evidence supporting dietary intervention to reduce CVD, the most reliable data on the benefits of low fat or low saturated fat intake on CVD must come from large scale, randomized clinical trials of sufficient duration. There are relatively few trials because of the methodological problems such studies encounter, including motivating free-living populations to make and to maintain over long periods of time major changes in their diet, measuring compliance and preventing any control group from making any changes in its diet. Attributing improvement in event rates to a single factor is next to impossible because of the planned and unplanned dietary changes, and other lifestyle changes that often accompany restriction in dietary fat or saturated fat. For example, decreases in total fat intake usually lead to weight loss. Also, diets that replace saturated fats

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with polyunsaturated fats may increase the intake of antioxidants from vegetable oils (15). In addition, it may prove impossible and may be unethical to prevent subjects in the treatment arm of a trial from making unrelated improvements in their lifestyle behaviours and to prevent subjects in the control group from changing their diets following repeated dietary data collection (the 'so-called' Hawthorne effect). Finally, replacing saturated fats with carbohydrates may reduce LDL, but may also increase triglycerides and small dense LDL particles, and reduce HDL leading to increased risk of IHD (42).

Primary prevention trials: The major primary prevention trials are the Finnish Mental Hospital Study and the Los Angeles Veterans Administration Trial, which were both conducted among institutionalized patients and involved replacing high saturated fat intake with high polyunsaturated fat intake. IHD mortality was reduced by 53% in men ($P < 0.002$) and by 34% in women (not significant) at six years in the Finnish study (43). Although total mortality was not affected and the primary end points of MI and sudden death decreased by 20% (not significant) after eight years of follow-up in the Los Angeles trial, the combined end points of MI, IHD death, stroke, ruptured aneurysm and ischemic gangrene were significantly reduced by 34% ($P < 0.001$) (44).

The Minnesota Coronary Survey failed to show any benefits for a high polyunsaturated fat diet, although mean total plasma cholesterol fell 14% during the trial (45). The low baseline cholesterol levels (mean 207 mg %) and young mean age of the study population may have contributed to the negative results. The Oslo trial of diet and smoking intervention provides additional evidence of the benefit of a low fat diet among hypercholesterolemic men. Because the antismoking advice was largely ineffective, a substantial portion of the 45% reduction in IHD incidence ($P = 0.01$, one tail) and the marginally significant 39% reduction in total mortality ($P = 0.055$, one tail) that were observed three and a half years after the end of the trial (the trial lasted five years) can be attributed to the dietary changes and the weight reduction that accompanied the low fat diet (46,47).

Three other multifactorial risk reduction trials involved dietary counselling in addition to other interventions: the Multiple Risk Factor Intervention Trial (48), the Göteborg Primary Prevention

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Trial (49) and the World Health Organization Collaborative Trial (50). Although these trials were unable to affect total mortality or to achieve statistically significant reductions in IHD incidence, the reduction of risk was generally proportional to changes in risk factor levels as measured by logistic regression function (51).

Secondary prevention trials: Several dietary treatment trials among patients with CVD have been conducted since the 1950s. These trials, which have recently been reviewed (15,20), targeted either reduction in event rates or reduction in the progression of atherosclerosis as measured by angiography. Globally, the results from these trials support the use of moderately lower total fat intake and substantially lower saturated fat and *trans* unsaturated fat intakes (52). It seems reasonable to replace saturated fats with polyunsaturated and monounsaturated fats given the effects of carbohydrates on triglycerides, HDL and insulin secretion (42). However, the long term effects of such replacement is controversial (28).

The Lyon Diet Heart Study provides new evidence that a Mediterranean diet exerts substantial benefits in the secondary prevention of CVD (53). Although the number of events was small, a highly significant 76% reduction in CVD mortality and a 73% reduction in new MI were noted among men and women in the experimental group.

Overview of randomized trials: The effect of lipid-lowering diets was reviewed eight years ago by the Toronto Working Group on Cholesterol Policy (54). The review concluded that there were only five properly conducted, randomized trials concerning the possible benefits of lipid-lowering diets. According to the Working Group, not a single trial provided evidence that IHD mortality would be reduced or that life expectancy would be improved. The authors remarked that in the studies, after an initial decline of cholesterol levels by 12% to 14%, there was a slow rise in cholesterol levels, and toward the end of the trials, the cholesterol levels were 3% to 4% below starting points.

Similarly, the 1993 Canadian Task Force on the Periodic Health Examination (55) concluded that no evidence from even one high quality, randomized clinical trial documented that dietary recommendations of the American Heart Association (56), the Canadian Consensus Conference on Cholesterol (57), or the National Cholesterol Education Program's Expert Panel

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(58) would reduce IHD risks, either in the overall population or in any identifiable high risk sub-group.

However, more recent reviews of the evidence provide a more balanced summary that is more consistent with the totality of the scientific evidence (13,15,20,28,31,41,42,52,59-61).

Randomized trials of hypolipidemic drugs for the primary or secondary prevention of CVD provide additional support for the diet-heart hypothesis by confirming the importance of lowering LDL and increasing HDL for the prevention of IHD. A recent meta-analysis of primary and secondary dietary prevention trials concluded that a 10% reduction in total serum cholesterol (0.6 mmol/L) reduces the risk of nonfatal MI by 9% after two years, 14% from years 2 to 5 and 37% after more than five years of follow-up (61). It is likely that the lifelong adherence to a 'prudent' or to a Mediterranean-type diet may achieve much lower IHD rates than what has been observed by trials which, for cost reasons, can rarely last more than five years. The overwhelming evidence for the association between dietary saturated fat and dietary cholesterol intakes and the risk of IHD and CVD is tempered by the paucity of effective dietary interventions in the clinical or outpatient setting. Although the documentation of decreasing population levels of mean serum cholesterol combined with country-wide consumption data at least suggest that changes in dietary patterns at a population level are occurring and probably contribute somewhat to decreasing CVD mortality (62,63), evidence suggests that individual patients experience great difficulties achieving more than a 5% reduction in LDL-cholesterol (64). Brunner et al (59) reviewed 17 randomized, controlled trials of dietary behaviour interventions. Five trials were of nine to 18 months' duration and reported a plasma total cholesterol reduction of -0.22 mmol/L ($P < 0.01$) following dietary counselling. The second study by Tang et al (60) assessed the efficacy of dietary advice to lower blood total cholesterol concentration in free-living subjects in a systematic overview of 19 randomized, controlled trials. The duration of follow-up varied from six weeks to five years. The mean reduction in cholesterol concentration in the longer trials was 4.5%. Except one, all diets were more intensive than the step I diet of the American Heart Association. The authors conclude that prescribed dietary advice about as intensive as the step I diet typically achieves a reduction in blood cholesterol concentration of only about 3% in free-living subjects.

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Mean reduction of 15% in LDL can be achieved with a step II diet, but with wide individual variation in response (65). In a recent study, reductions of total fat and saturated fat from 36% to 27% and 12% to 8% of calories, respectively, was associated with significant decreases in total and LDL-cholesterol; however, further reduction to 22% and 6%, respectively, conferred no additional benefits (66). Similarly, another recent study demonstrated a significant reduction in LDL-cholesterol among high risk men and women only if the participants engaged in aerobic exercise (67) in addition to a step II diet (67). Although genetic and environmental factors play a role in the responsiveness to dietary therapy, the most important factor by far is compliance. There is a pressing need for re-search to increase the effectiveness of dietary counselling.

OTHER DIETARY FACTORS

Alcohol: Evidence from cohort studies confirms that moderate intake of alcohol (not more than two drinks per day) is inversely associated with the risk of developing IHD (68-71), and an excess intake is related to a higher risk of IHD. The most likely mechanism of the protective effect of moderate alcohol consumption is an increase of HDL-cholesterol levels or, in the case of wine consumption, the potent antioxidant effect of flavonoids. Patients who do not drink alcoholic beverages should not be advised to start drinking alcohol.

Antioxidants: Ecological and cohort studies (72-74) report an inverse association between dietary intake of vegetables and fruits, and the risk of developing IHD. It is postulated that the protective effect of fruits and vegetables is due to the presence of antioxidants that prevent LDL oxidation and reduce its atherogenic potential.

Four prospective cohort studies reported that higher intakes of vitamin E provide a certain degree of protection against the development of IHD (72,75-77). Three major randomized clinical trials have assessed the effects of vitamin E. One primary prevention trial conducted among male smokers failed to show any significant impact on acute IHD events (78). In the two other trials involving patients with IHD, vitamin E significantly reduced nonfatal MI, but a nonsignificant increase in fatal IHD was documented (79,80).

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In conclusion, vitamin E supplementation may be beneficial in patients with existing IHD, but the lack of effect on fatal events and insufficient data on primary prevention do not allow the recommendation of treatment with vitamin E supplementation. Several large scale randomized trials are in progress, and their outcome will be known in the coming years.

Fibre: Cohort studies among men have identified an association between dietary fibre intake and IHD. A study of 43,757 American male health professionals aged 40 to 75 years reported an inverse association between fibre intake and MI (81). Another large prospective cohort study of 21,930 male Finnish smokers ascertained that a greater intake of foods rich in fibre significantly reduced the risk of IHD (82). A number of other epidemiological studies also support the association between higher intakes of fibre and lower incidence of IHD.

DIET AND HYPERTENSION

Salt: Epidemiological and experimental studies suggest that habitual ingestion of a diet high in sodium plays a role in the etiology and pathogenesis of hypertension (83,84). The strength of association of salt intake and hypertension between populations has Level II evidence. The evidence of this association within populations is weak. Obviously this relationship is obscured by genetic differences between salt-sensitive and salt-resistant individuals, as well as by methodological problems in the measurement of dietary sodium intake.

The Canadian Panel on Nonpharmacologic Therapy to Prevent and Control Hypertension (85) recommends the following:

Reduction of dietary sodium intake among hypertensive patients, particularly those over the age of 44 years, to a target range of 90 to 130 mmol/day (corresponding to 3 to 7 g of salt per day) (**Level III, Grade D**);

Determination of sodium consumption of hypertensive patients by interview (**Level II, Grade D**);

No prescription of a low salt diet for normotensive individuals because of insufficient evidence that it reduces the incidence of hypertension (**Level II, Grade B**).

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Internationally, there are views that differ from the recommendations of the Canadian Panel. For example, the American Heart Association recommends that the general public consume no more than 6 g of sodium chloride per day. Recently, the debate on the role of sodium in hypertension was renewed in the United States, which may lead to changes in recommendations for dietary intake of sodium in the general population (86).

Potassium, magnesium, calcium and hypertension: This topic was reviewed by the Canadian Panel on Nonpharmacologic Therapy to Prevent and Control Hypertension in 1997 (87). The Panel recommends a dietary intake of 60 mmol or more per day of potassium, magnesium and calcium because they have been shown to be associated with a reduced risk of stroke morbidity (**Level II, Grade D**).

No other evidence was found to justify increased intake of calcium or magnesium for the prevention or treatment of hypertension, or potassium supplementation above the average dietary intake of 60 mmol/day for treatment of hypertension (**Level I, Grade B**).

Other dietary interventions in hypertension: A recent randomized, multicentre study, the Dietary Approaches to Stop Hypertension trial, evaluated the effect of three dietary patterns on blood pressure in 459 adults with mild hypertension over an eight-week period (88). A 'combination diet' rich in fruits, vegetables, and fat-free or low fat dairy products significantly reduced systolic and diastolic blood pressure (**Level II, Grade B**).

CONCLUSIONS AND RECOMMENDATIONS

Taken together, the scientific evidence convincingly supports a causal association between high dietary saturated fat and elevated LDL-cholesterol intakes and increased risk of IHD. Saturated fat (fat from land animals and dairy sources) should be reduced. Saturated fat is not an essential nutrient. Reduction of these fatty acids to less than 8% of energy is a prudent measure. *Trans* fatty acids are not naturally occurring in human food supply and are highly atherogenic. Their intake should be substantially reduced or, better, entirely eliminated. Whether saturated fats should be replaced by mono-or polyunsaturated fats, or by

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carbohydrates is more difficult to ascertain. High carbohydrate diets are associated with the development of insulin resistance, whereas high polyunsaturated fats have been associated with tumour growth in animal models (15,42). Populations that have either a high carbohydrate diet (Asian countries) or a high unsaturated fat diet (Mediterranean countries) have low CVD rates (15).

A summary of Dietary Recommendations for the Canadian Public compiled by the Communications/Supplement Committee of Health Canada lists recommendations of five Canadian organizations addressing the issue of dietary fat. Each organization recommends limiting fat intake to maximally 30% of energy (Appendix, Table 2, pages 13G-16G). The general principles of healthy nutrition, clearly spelled out in the Canada Food Guide, emphasize cereals, breads, other grain products, vegetables (five to 12 servings per day) and fruit (five to 10 servings per day) (89).

RECOMMENDATION

Consume 30% or less of total calories from fat;

Consume no more than 8% to 10% of total calories from saturated fatty acids;

Consume up to 15% of total calories from monounsaturated fatty acids;

Consume less than 300 mg/day of cholesterol (**Level 1, Grade B**).

Refined carbohydrates, eg, refined grains, sugar and potatoes, should be replaced whenever possible with whole grain minimally processed products (**Level II, Grade B**).

The total fibre intake for adults should be 20 to 35 g/day (**Level II, Grade B**).

Data on the benefits of vitamin E, folate and vitamin B6 intake are promising; however, the strength of evidence is not sufficient to allow recommendation for widespread use (**Level I, Grade C**).

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Patients with diagnosed CVD should be advised to adhere to a Mediterranean type of diet (less than 10% of saturated fat, more than 0.6% of alpha-linolenic acid, etc) (**Level I, Grade A**).

Patients with a history of CVD should be advised to consume 150 g of fatty fish two to three times weekly (**Level II, Grade B**).

Patients who drink alcoholic beverages should be advised to restrict their alcohol intake to no more than two drinks per day. Patients who do not drink alcoholic beverages should not be advised to start drinking alcohol (**Level II, Grade A**).

RESEARCH RECOMMENDATIONS

Further research is required to define more precisely the impact of specific fatty acids, *trans* fatty acids, fish and omega-3 fatty acids, fibre, folic acid, vitamin B6 and blood homocysteine levels, salt, iron, selenium and other minerals, over-weight, soy protein and genetic factors affecting dietary response. Further research is also needed to identify more effective dietary interventions for the general population and for patients with CVD.

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REFERENCES

1. Canadians and Heart Health. Reducing the risk. [Cat H39-328/1995E.] Ottawa: Supply and Services Canada, 1995.
2. Anitschkow N. A history of experimentation on arteriosclerosis in animals. In: Blumenthal HT, ed. Coiwdry's Arteriosclerosis, 2nd edn. New York: Macmillan, 1967:21-44 .
3. Nicolosi RJ. Dietary fat saturation effects on low-density lipoprotein concentrations and metabolism in various animal models. Am J Clin Nutr 1997;65(Suppl):1617S-27S.
4. Ross R. The pathogenesis of atherosclerosis: a perspective for the 1990s. Nature 1993;362:801-9.
5. McGill HC, ed. Geographic Pathology of Atherosclerosis. Baltimore: Williams and Wilkins, 1968.
6. Hegsted DM, Ausman LM. Diet, alcohol and coronary heart disease in men. J Nutr 1988;118:1184-9.
7. Keys A. Seven Countries: A Multivariate Analysis of Death and Coronary Heart Disease. Cambridge: Harvard University Press, 1980.
8. Kromhout D, Menotti A, Bloemberg B, et al. Dietary saturated and *trans* fatty acids and cholesterol and 25-year mortality from coronary heart disease: The Seven Countries Study. Prev Med 1995;24:308-15.
9. Kato H, Tillotson J, Nichaman MZ, Rhoads GG, Hamilton HB. Epidemiologic studies of coronary heart disease and stroke in Japanese men living in Japan, Hawaii and California: serum lipids and diet. Am J Epidemiol 1973;97:372-85.
10. Robertson TL, Kato H, Rhoads GG, et al. Epidemiologic studies of coronary heart disease and stroke in Japanese men living in Japan, Hawaii and California. Incidence of

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myocardial infarction and death from coronary heart disease. Am J Cardiol 1977;39:239-43.

11. Blackburn H, Jacobs D. Sources of the diet-heart controversy: confusion over population versus individual correlations. Circulation 1984;70:775-80.
12. Rose G. Sick individuals and sick populations. Int J Epidemiol 1985;14:32-8.
13. Caggiula AW, Mustad VA. Effects of dietary fat and fatty acids on coronary artery disease risk and total and lipoprotein cholesterol concentrations: epidemiologic studies. Am J Clin Nutr 1997;65(Suppl):1597S-610S.
14. Willett WC. Nutritional Epidemiology, 2nd edn. New York: Oxford University Press, 1998.
15. Willett WC, Lenart EB. Dietary factors. In: Manson JE, Ridker PM, Gaziano JM, Hennekens CH, eds. Prevention of Myocardial Infarction. New York: Oxford University Press, 1996:351-86.
16. Dawber TR. The Framingham Study. The Epidemiology of Atherosclerotic Disease. Cambridge: Harvard University Press, 1980.
17. Nichols AB, Ravenscroft C, Lamphiear DE, Ostrander LD Jr. Daily nutritional intake and serum lipid levels. The Tecumseh study. Am J Clin Nutr 1976;29:1384-92.
18. Gordon T, Kagan A, Garcia-Palmieri MR, et al. Diet and its relation to coronary heart disease and death in three populations. Circulation 1981;63:500-15.
19. Kromhout D, de Lezenne Coulander C. Diet, prevalence and 10-year mortality from coronary heart disease in 871 middle-aged men. The Zutphen Study. Am J Epidemiol 1984;119:733-41.
20. Schaefer EJ, Brousseau ME. Diet, lipoproteins, and coronary heart disease. Endocrinol Metab Clin North Am 1998;27:711-32.

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21. Garcia-Palmieri MR, Sorlie P, Tillotson J, Costas R Jr, Cordero E, Rodriguez M. Relationship of dietary intake to subsequent coronary heart disease incidence: the Puerto Rico Heart Health Program. *Am J Clin Nutr* 1980;33:1818-27.
22. McGee DL, Reed DM, Yano K, Kagan A, Tillotson J. Ten-year incidence of coronary heart disease in the Honolulu Heart Program. Relationship to nutrient intake. *Am J Epidemiol* 1984;119:667-76.
23. Kushi LH, Lew RA, Stare FJ, et al. Diet and 20-year mortality from coronary heart disease. The Ireland-Boston Diet-Heart Study. *N Engl J Med* 1985;312:811-8.
24. Joossens JV, Geboers J, Kesteloot H. Nutrition and cardiovascular mortality in Belgium. For the BIRNH Study Group. *Acta Cardiol* 1989;44:157-82.
25. Goldbourt U, Yaari S, Medalie JH. Factors predictive of long-term coronary heart disease mortality among 10,059 male Israeli civil servants and municipal employees. A 23-year mortality follow-up in the Israeli Ischemic Heart Disease Study. *Cardiology* 1993;82:100-21.
26. Tell GS, Evans GW, Folsom AR, Shimakawa T, Carpenter MA, Heiss G. Dietary fat intake and carotid artery wall thickness: the Atherosclerosis Risk in Communities (ARIC) Study. *Am J Epidemiol* 1994;139:979-89.
27. Shekelle RB, Shryock AM, Paul O, et al. Diet serum cholesterol, and death from coronary heart disease. The Western Electric study. *N Engl J Med* 1981;304:65-70.
28. Kris-Etherton PM, Yu S. Individual fatty acid effects on plasma lipids and lipoproteins: human studies. *Am J Clin Nutr* 1997;65 (5 Suppl):1628S-44S.
29. Bonanome A, Grundy SM. Effect of dietary stearic acid on plasma cholesterol and lipoprotein levels. *N Engl J Med* 1988;318:1244-8.
30. Brinton EA, Eisenberg S, Breslow JL. A low-fat diet decreases high density lipoprotein (HDL) cholesterol levels by decreasing HDL apolipoprotein transport rates. *J Clin Invest* 1990;85:144-51.

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31. Mensink RP, Katan MB. Effect of dietary fatty acids on serum lipids and lipoprotein. A meta-analysis of 27 trials. *Arterioscler Thromb* 1990;12:911-9.
32. Harris WS. n-3 fatty acids and serum lipoproteins: human studies. *Am J Clin Nutr* 1997;65(5 Suppl):1645S-54S.
33. Leaf A, Weber PC. Cardiovascular effects of n-3 fatty acids. *N Engl J Med* 1988;318:549-57.
34. von Schacky C. Prophylaxis of atherosclerosis with marine omega-3 fatty acids. A comprehensive strategy. *Ann Intern Med* 1987;107:890-9.
35. Kromhout D, Bosscheiter EB, de Lezenne Coulander C. The inverse relation between fish consumption and 20-year mortality from coronary heart disease. *N Engl J Med* 1985;312:1205-9.
36. Leaf A, Jorgensen MB, Jacobs AK, et al. Do fish oils prevent restenosis after coronary angioplasty? *Circulation* 1994;90:2248-57.
37. Burr ML, Fehily AM, Gilbert JF, et al. Effects of changes in fat, fish, fibre intakes on death and myocardial reinfarction: diet and reinfarction trial. *Lancet* 1989;ii:757-61.
38. *Trans* fatty acids and coronary heart disease risk. Report of the expert panel on *trans* fatty acids and coronary heart disease. *Am J Clin Nutr* 1995;62:655S-708S.
39. Willett WC, Stampfer MJ, Manson JE, et al. Intake of *trans* fatty acids and risk of coronary heart disease among women. *Lancet* 1993;341:581-5.
40. Hu FB, Stampfer MJ, Manson JE, et al. Dietary fat intake and the risk of coronary heart disease in women. *N Engl J Med* 1997;337:1491-9.
41. Hopkins PN. Effects of dietary cholesterol on serum cholesterol: A meta-analysis and review. *Am J Clin Nutr* 1992;55:1060-70.
42. Katam MB, Grundy SM, Willett WC. Should a low-fat, high-carbohydrate diet be recommended for everyone? Beyond low-fat diets. *N Engl J Med* 1997;337:563-6.

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43. Turpeinen O, Karvonen MJ, Pekkarinen M, Miettinen M, Elosuo R, Paavilainen E. Dietary prevention of coronary heart disease: The Finnish Mental Hospital Study. *Int J Epidemiol* 1979;8:99-118.
44. Dayton S, Pearce ML, Hashimoto S, et al. A controlled clinical trial of a diet high in unsaturated fat in preventing complications of atherosclerosis. *Circulation* 1969;40(Suppl II):1-69.
45. Frantz ID Jr, Dawson EA, Ashman PL, et al. Test of effect of lipid lowering by diet on cardiovascular risk. The Minnesota coronary survey. *Arteriosclerosis* 1989;9:129-35.
46. Hjermann I, Velve Byre K, Holme I, Leren P. Effect of diet and smoking intervention on the incidence of coronary heart disease. Report from the Oslo Study Group of a randomised trial in healthy men. *Lancet* 1981;ii:1303-10.
47. Hjermann I, Holme I, Leren P. Oslo Study Diet and Antismoking trial. Results after 102 months. *Am J Med* 1986;80(Suppl 2A):7-11.
48. Multiple Risk Factor Intervention Trial Research Group. Multiple Risk Factor Intervention Trial. Risk factor changes and mortality results. *JAMA* 1982;248:1465-77.
49. Wilhelmsen L, Berglund G, Elmfeldt D, et al. The multifactor primary prevention trial in Göteborg, Sweden. *Eur Heart J* 1986;7:279-88.
50. An interventional controlled trial in the multifactorial prevention of coronary heart disease. *Int J Epidemiol* 1974;3:219-24.
51. Kornitzer M. Changing individual behavior. In: Marmot M, Elliott P, eds. *Coronary Heart Disease Epidemiology. From Aetiology to Public Health*. Oxford: Oxford University Press, 1992:482-94.
52. Gaziano JM, Manson JE. Diet and heart disease. The role of fat, alcohol, and antioxidants. *Cardiol Clin* 1996;14:69-83.

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53. de Lorgeril M, Renaud S, Mamelle N, et al. Mediterranean alpha-linolenic acid-rich diet in secondary prevention of coronary heart disease. Lancet 1994;343:1454-9.
54. The Toronto Working Group on Cholesterol Policy. Asymptomatic hypercholesterolemia: a clinical policy review. J Clin Epidemiol 1990;43:1028-121.
55. The Canadian Task Force on the Periodic Health Examination. The Canadian Guide to Clinical Preventive Health. Ottawa: Minister of Supply & Services Canada, 1994.
56. Dietary guidelines for healthy American adults. A statement for physicians and health professionals by the Nutrition Committee, American Heart Association. Circulation 1986;174:1465A-8A.
57. Canadian Consensus Conference on Cholesterol: final report. Canadian Consensus Conference on the Prevention of Heart and Vascular Disease by Altering Serum Cholesterol and Lipoprotein Risk Factors. CMAJ 1988;139(Suppl II):1-8.
58. Summary of the second report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol In Adults. JAMA 1993;269:3015-23.
59. Brunner E, White I, Thorogood M, Bristow A, Curle D, Marmot M. Can dietary interventions change diet and cardiovascular risk factors? A meta-analysis of randomized controlled trials. Am J Public Health 1997;87:1415-22.
60. Tang JL, Armitage JM, Lancaster T, Silagy CA, Fowler CH, Neil HAW. Systematic review of dietary intervention trials to lower blood cholesterol in free-living subjects. BMJ 1998;316:1213-20.
61. Law MR, Wald NJ, Thompson SG. By how much and how quickly does reduction in serum cholesterol concentration lower risk of ischaemic heart disease? BMJ 1994;308:367-72.

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62. Burke GL, Sprafka JM, Folsom AR, Hahn LD, Luepker RV, Blackburn H. Trends in serum cholesterol levels from 1980 to 1987. The Minnesota Heart Survey. N Engl J Med 1991;324:941-6.
63. Johansson L, Drevon CA, Bjorneboe GE. The Norwegian diet during the last hundred years in relation to coronary heart disease. Eur J Clin Nutr 1996;50:277-83.
64. Hunninghake DB, Stein EA, Dujorne CA, et al. The efficacy of intensive dietary therapy alone or combined with lovastatin in outpatients with hypercholesterolemia. N Engl J Med 1993;328:1213-9.
65. Schaefer EJ, Lamon-Fava, Ausman LM, et al. Individual variability in lipoprotein cholesterol response to National Cholesterol Education Program Step 2 diets. Am J Clin Nutr 1997;65:823-30.
66. Knopp RH, Walden CE, Retzlaff BM, et al. Long-term cholesterol-lowering effects of 4 fat-restricted diets in hypercholesterolemic and combined hyperlipidemic men: The Dietary Alternatives Study. JAMA 1997;278:1509-15.
67. Stefanick ML, Mackey S, Sheehan M, Ellsworth N, Haskell WL, Wood PD. Effects of diet and exercise in men and postmenopausal women with low levels of HDL cholesterol and high levels of LDL cholesterol. N Engl J Med 1998;339:12-20.
68. Moore RD, Pearson TA. Moderate alcohol consumption and coronary artery disease. A review. Medicine (Baltimore) 1986;65:242-67.
69. Stampfer MJ, Colditz GA, Willett WC, Speizer FE, Hennekens CH. A prospective study of moderate alcohol consumption and the risk of coronary heart disease and stroke in women. N Engl J Med 1988;319:267-73.
70. Ellison RC. Cheers! Epidemiology 1990;1:337-9. (Edit)
71. Maclure M. Demonstration of deductive, meta-analysis: ethanol intake and risk of myocardial infarction. Epidemiol Rev 1993;15:328-51.

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72. Rimm EB, Stampfer MJ, Aschario A, Giovannucci E, Colditz GA, Willett WC. Vitamin E consumption and the risk of coronary heart disease in men. *N Engl J Med* 1993;328:1450-6.
73. Hertog MGL, Feskens EJM, Hollman PCH, Katan MB, Kromhout D. Dietary antioxidant flavonoids and risk of coronary heart disease: the Zutphen Elderly Study. *Lancet* 1993;342:1007-11.
74. Verschuren WMM, Jacobs DR, Bloemberg BPM, et al. Serum total cholesterol and long-term coronary heart disease mortality in different cultures. Twenty-five-year follow-up of the seven countries study. *JAMA* 1995;274:131-6.
75. Stampfer MJ, Hennekens CH, Manson JE, Colditz GA, Rosner B, Willett WC. Vitamin E consumption and the risk of coronary disease in women. *N Engl J Med* 1993;328:1444-9.
76. Kushi LH, Folsom AR, Prineas RJ, Mink PJ, Wu Y, Bostick RM. Dietary antioxidant vitamins and death from coronary heart disease in postmenopausal women. *N Engl J Med* 1996;334:1156-62.
77. Knekt P, Reunanen A, Järvinen R, Seppänen R, Heliövaara M, Aromaa A. Antioxidant vitamin intake and coronary mortality in a longitudinal population study. *Am J Epidemiol* 1994;139:1180-90.
78. The effect of vitamin E and beta carotene on the incidence of lung cancer and other cancers in male smokers. The Alpha-Tocopherol, Beta Carotene Cancer Prevention Study Group. *N Engl J Med* 1994;330:1029-35.
79. Rapola JM, Vertama J, Ripatti S, et al. Randomised trial of alpha-tocopherol and beta-carotene supplements on incidence of major coronary events in men with previous myocardial infarction. *Lancet* 1997;349:1715-20.

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80. Stephens NG, Parsons A, Schofield PM, et al. Randomised controlled trial of vitamin E in patients with coronary disease: Cambridge Heart Anti-Oxidant Study. *Lancet* 1996;347:781-6.
81. Rimm EB, Ascherio A, Giovannucci E, Spiegelman D, Stampfer MJ, Willett WC. Vegetable, fruit and cereal fiber intake and risk of coronary heart disease among men. *JAMA* 1996;275:447-51.
82. Pietinen P, Rimm EB, Korhonen P, et al. Intake of dietary fiber and risk of coronary heart disease in a cohort of Finnish men. The Alpha-Tocopherol, Beta-Carotene Cancer Prevention Study. *Circulation* 1996;94:2720-7.
83. Freis ED. Salt, volume and the prevention of hypertension. *Circulation* 1976;53:589-95.
84. Intersalt: an international study of electrolyte excretion and blood pressure. Results for 24 hour urinary sodium and potassium. Intersalt Cooperative Research Group. *BMJ* 1988;297:319-28.
85. Fodor JG, Whitmore B, Leenen F, Larochelle P. Lifestyle modifications to prevent and control hypertension. 5. Recommendations on dietary salt. Canadian Hypertension Society, Canadian Coalition for High Blood Pressure Prevention and Control, Laboratory Centre for Disease Control at Health Canada, Heart and Stroke Foundation of Canada. *CMAJ* 1999;160(9 Suppl):S29-34.
86. Graudal NA, Galloe AM, Garred P. Effects of sodium restriction on blood pressure, renin, aldosterone, catecholamines, cholesterol, and triglyceride: a meta-analysis. *JAMA* 1998;279:1383-91.
87. Burgess E, Lewanczuk R, Bolli P, et al. Lifestyle modifications to prevent and control hypertension. 6. Recommendations on potassium, magnesium and calcium. Canadian Hypertension Society, Canadian Coalition for High Blood Pressure Prevention and Control, Laboratory Centre for Disease Control at Health Canada, Heart and Stroke Foundation of Canada. *CMAJ* 1999;160(9 Suppl):S35-45.

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88. Appel LJ, Moore TJ, Obarzanek E, et al. A clinical trial of the effects of dietary patterns on blood pressure. DASH Collaborative Research Group. N Engl J Med 1997;336:1117-24.
89. Health Canada. Canada's Food Guide to Healthy Eating. Ottawa: Minister of Supply and Services Canada, 1992.

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CANADIAN CARDIOVASCULAR SOCIETY 1998 CONSENSUS CONFERENCE ON THE PREVENTION OF CARDIOVASCULAR DISEASES: THE ROLE OF THE CARDIOVASCULAR SPECIALIST

Section 5: Risk Factors Associated with Lifestyle and Behaviour - Physical inactivity

Claude Bouchard PhD

Habitual physical activity encompasses information on leisure physical activity, exercise, sports, occupational work and personal chores. The concept of habitual physical activity is an integrator of the daily amount of energy expended for activity. Leisure time physical activity is of particular interest because the adult has typically about 3 to 4 h of discretionary time/day after completion of work, travelling, domestic chores and personal hygiene.

A number of surveys conducted over the past two decades have shown that the profile of the participation in leisure-time physical activity among Canadians is characterized by several rather consistent features (1-4). Briefly, the level of participation in various types of activities decreases during the school years, more so in girls than in boys, with the lowest levels being reached during the last years of high school. Among young adults and middle-aged individuals, about one-third are totally sedentary, one third are occasionally engaging in some forms of physical activity and only about one-third are physically active regularly or fairly regularly. After 65 years of age, men tend to be more active than women. Participation rates are highest in Western Canada and lowest in the Atlantic Provinces. There is a strong seasonal effect on the participation rates of Canadians, with peak rates being attained in the summer months and the highest levels of sedentarism being observed during winter.

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PHYSICAL ACTIVITY AND CARDIOVASCULAR DISEASES

More than 12 studies have evaluated the association between levels of physical activity or cardiorespiratory fitness and total cardiovascular disease (CVD) outcomes, generally CVD mortality (5). In the aggregate, these studies demonstrate that a low level of cardiorespiratory fitness or a sedentary lifestyle is accompanied by a higher risk of CVD mortality (5). In one of these studies, data were available on men and women, and the same relationship was observed in each sex (6). A substantial decrease in the risk is observed at moderate levels of physical activity or cardiorespiratory fitness, but more benefits appear to be derived from higher levels of physical activity or fitness (5,7).

More than 40 studies published since 1953 have examined the relationship between physical activity level or cardiorespiratory fitness and risk of fatal and nonfatal ischemic heart disease (IHD) (5). Taken together, they indicate that a sedentary lifestyle or a low level of habitual physical activity increases the risk of IHD mortality. Those active in sports or other physical activities during their leisure time have a lower rate of fatal and nonfatal IHD. The effect is graded in the sense that the risk decreases progressively with the increase in the level of habitual physical activity or in cardiorespiratory fitness (5). The volume of activity necessary to induce some of these apparent benefits is not overwhelmingly high because the risk diminishes rapidly when comparing low with moderate weekly energy expended in physical activity (7-10). Even though moderate levels of habitual physical activity have an important effect, higher levels reduce the risk even more. For both level of habitual physical activity and level of cardiorespiratory fitness, the effects on IHD events or mortality are significant and graded even after adjustment for a variety of common risk factors, such as body mass index, blood pressure, smoking, blood cholesterol and parental history of IHD.

A meta-analysis of the studies dealing with level of physical activity and IHD concluded that the overall relative risk was about 1.8 for sedentary compared with the most active persons (11). Evidence also suggests that regular physical activity may be helpful in preventing recurrent events in patients with myocardial infarction (12,13).

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In the case of stroke, the evidence is more controversial

(5). There is some epidemiological evidence suggesting that the risk of cerebrovascular accidents is less in active individuals (14), but other studies are negative (5). Only one study made the distinction between ischemic and hemorrhagic stroke (15).

COMMON EFFECTS OF REGULAR PHYSICAL ACTIVITY ON RISK FACTORS

Mechanisms that may account for the influences of regular physical activity on the proneness to CVD include attenuation of other common risk factors, antithrombotic effects, increased myocardial vascularity and function, and improved metabolic environment (16-19).

Cardiac muscle: Favourable changes in the heart muscle, cardiac blood vessels, coronary blood flow and myocardial metabolic characteristics have been described (20-23). Common adaptive responses include an increase in heart size and left ventricular mass, augmented blood volume, increase in stroke volume at rest and during exercise, higher maximal cardiac output, and decrease in heart rate at rest and for a given submaximal power output. Animal research and some observations in human subjects show that with regular exercise the size of existing cardiac vessels can be increased, that capillary density is augmented even in the presence of cardiac hypertrophy, that coronary blood flow capacity can be improved and that neurohumoral control over the myocardial vascular bed is improved (20-23). Regular endurance exercise leads to an increase in maximal oxygen uptake due to an enhanced ability to increase stroke volume and to widen the total body arteriovenous oxygen difference.

Body weight and body fat: Being overweight or obese augments the risk of CVDs. Because physical activity accounts, on average, for only about 25% of the daily energy expended in sedentary individuals, a slight increase in habitual physical activity is unlikely to have a substantial impact on total daily energy expenditure and, thus, on energy balance. However, with a more substantial energy expenditure resulting from a higher level of habitual physical activity, greater influences are likely to be seen on energy balance and, thus, on body fat content (24), as well as on amount of abdominal fat and the size of the visceral fat depot, which are correlated with undesirable alterations in glucose, lipid and lipoprotein levels, and insulin metabolism (25).

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Insulin metabolism: Regular physical activity improves glucose tolerance and may result in improved sensitivity of liver, skeletal muscle and adipose tissues to insulin action, a decrease in the basal level of plasma glucose in hyperglycemic subjects, decrease in fasting insulin levels, reduction of the insulin response to a glucose load and increase in glucose disposal rates (26-28).

Blood pressure: Many epidemiological studies have reported an inverse relationship between level of habitual physical activity and resting blood pressure. Intervention studies have shown that regular physical activity in patients with essential hypertension can reduce systolic and diastolic blood pressures by a mean of approximately 10 mmHg (29). Regular physical activity is associated with a mean reduction of systolic and diastolic blood pressure of 3 mmHg in subjects with a normal pressure and of about 6 mmHg in borderline hypertensives. Data suggest that being regularly active at moderate intensity is sufficient to induce these effects. A review of the prospective studies relating level of physical activity or cardiorespiratory fitness to the future risk of hypertension concluded that physical inactivity and low fitness level are associated with a 30% to 52% risk of developing hypertension over the years compared with more active or fit men and women (5.)

Lipid and lipoprotein metabolism: Regular physical activity lowers plasma triglyceride levels in subjects with initially high levels but has little impact on those with normal concentrations (30). On average, regular physical activity increases high density lipoprotein (HDL) cholesterol, particularly the cholesterol content of the HDL2 subfraction, and may also increase apolipoprotein A-I. Among subjects with elevated cholesterol levels, regular physical activity is occasionally associated with decreases in total cholesterol and LDL-cholesterol as well as in apolipoprotein B. An increase in lipoprotein lipase activity with regular exercise may contribute to the augmentation of the HDL-cholesterol level, particularly the HDL2 subfraction. In addition, the reduction in hepatic lipase activity may be one of the mechanisms favouring the high levels of HDL2-cholesterol observed in active individuals (16,31).

In acute response to physical activity, fat is oxidized in progressively increasing amounts as the total energy expenditure increases, so that lipids may contribute to as much as 90% of the oxidative metabolism in prolonged bouts of moderate intensity exercise. The absolute mass of

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the skeletal muscle mitochondria increases with training, resulting in an increased capacity to oxidize fats. Regular exercise increases the activity of both skeletal muscle and adipose tissue lipo-protein lipase, thereby facilitating the use of circulating triglycerides as a fuel source in trained muscles and promoting the clearance of circulating triglycerides, even at rest.

Coagulation and hemostatic factors: Blood coagulation, fibrinolysis and platelet aggregation are involved with stages of atherosclerosis and CVD. A number of studies suggest that regular physical activity has small but favourable influences on hemostatic factors: it decreases plasma fibrinogen concentration, increases fibrinolytic activity, diminishes antifibrinolytic activity and inhibits platelet aggregability (32).

RECOMMENDED LEVEL OF PHYSICAL ACTIVITY

One important issue is that of the intensity and volume of physical activity needed to bring about these beneficial effects. Many authors have reported that a moderate volume of physical activity is sufficient to produce benefits (6,7,10,16,33) and that the effect is graded (6,8,9). Important and favourable metabolic changes are observed with programs of walking and other low to moderate intensity, long duration exercise sessions that do not necessarily cause an increase in maximal oxygen intake. Given the consistency of the evidence, the recommendation of the Centers for Disease Control and Prevention and the American College of Sports Medicine (7) and of the Surgeon General of the United States (5) to advise people of all ages to include a minimum of 30 mins of physical activity of moderate intensity on most days, and preferably all days, of the week, is particularly appropriate. Health benefits are also likely to be accrued by daily, low intensity physical activity of longer duration (eg, 45 to 60 mins). Higher energy expenditure from leisure-time physical activity or from exercise at higher intensities are, however, likely to generate even more health benefits.

Figure 1 depicts schematically the relationship between amount of energy expended per week and predicted health benefits. For a middle-aged man, 30 mins of daily physical activity at moderate intensity translates into an additional weekly energy expenditure of about 1000 to 1200 kcal. This is a level of habitual physical activity associated with substantial health benefits. Lower levels of weekly energy expenditure associated with added physical activity carry lesser but nonetheless important health benefits.

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If physical inactivity is an important risk factor for IHD, it is interesting to compare it with other known risk factors. In a large study, the association between physical inactivity and IHD was estimated to be similar to that for hypercholesterolemia, hypertension and cigarette smoking (34). Because physical inactivity is so prevalent in the Canadian population, a sedentary lifestyle thus constitutes a very important risk factor.

RECOMMENDATIONS

All adults should be physically active at a moderate intensity level and for a minimum of 30 mins/day, preferably every day (**Level II, Grade A**).

All children and adolescents should be physically active at moderate to high intensity levels on most days, preferably every day, for a minimum of 20 mins/day.

RESEARCH

Improve understanding of the determinants of a physically active lifestyle.

Develop and evaluate innovative methods to promote regular physical activity in the Canadian population, particularly among hard to reach subgroups such as low socioeconomic status populations and ethnic minorities.

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REFERENCES

1. Stephens T, Craig CL. Fitness and activity measurement in the 1981 Canada Fitness Survey. In: Drury T, ed. National Center for Health Statistics. Assessing Physical Fitness and Physical Activity in Population-Based Surveys. DHHS pub no (PHS) 89-1253. Hyattsville: Public Health Service, 1989.
2. Stephens T, Craig CL. The Well-Being of Canadians: Highlights of the 1988 Campbell's Survey. Ottawa: Canadian Fitness and Life-style Research Institute, 1990.
3. Stephens T, Craig CL, Ferris BF. Adult physical activity in Canada: Findings from the Canada Fitness Survey I. Can J Public Health 1986;77:285-90.
4. Stephens T, Caspersen CJ. The demography of physical activity. In: Bouchard C, Shephard RJ, Stephens T, eds. Physical Activity, Fitness, and Health. International Proceedings and Consensus Statement. Champaign: Human Kinetics, 1994:204-13.
5. Physical Activity and Health: A report of the Surgeon General. Atlanta: US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, 1996.
6. Blair SN, Kohl HW, Paffenbarger RS Jr, Clark DG, Cooper KH, Gibbons LW. Physical fitness and all-cause mortality - A prospective study of healthy men and women. JAMA 1989;262:2395-401.
7. Pate RR, Pratt M, Blair SN, et al. Physical activity and public health: A recommendation from the Centers for Disease Control and Prevention and the American College of Sports Medicine. JAMA 1995;273:402-7.
8. Paffenbarger R, Hyde RT, Wing AL. Physical activity and physical fitness as determinants of health and longevity. In: Bouchard C, Shephard RJ, Stephens T, Sutton JR, McPherson BD, eds. Exercise, Fitness and Health: A Consensus of Current Knowledge. Champaign: Human Kinetics, 1990:33-48.

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9. Blair SN, Kampert JB, Kohl HW III, et al. Influences of cardiorespiratory fitness and other precursors on cardiovascular disease and all-cause mortality in men and women. JAMA 1996;276:205-10.
10. Haskell WL. Health consequences of physical activity: understanding and challenges regarding dose-response. Med Sci Sports Exerc 1994;26:649-60.
11. Berlin JA, Colditz GA. A meta-analysis of physical activity in the prevention of coronary heart disease. Am J Epidemiol 1990;132:612-28.
12. O'Connor G, Buring J, Yusuf S, et al. An overview of randomized trials of rehabilitation with exercise after myocardial infarction. Circulation 1989;80:234-44.
13. Oldridge N, Guyatt G, Fischer M, Rimm A. Cardiac rehabilitation after myocardial infarction. JAMA 1988;260:945-50.
14. Kohl HW, LaPorte RE, Blair SN. Physical activity and cancer. An epidemiological perspective. Sports Med 1988;6:222-37.
15. Abbott RD, Rodriguez BL, Burchfiel CM, Curb JD. Physical activity in older middle-aged men and reduced risk of stroke: the Honolulu Heart Program. Am J Epidemiol 1994;139:881-93.
16. Leon AS. Physical activity and risk of ischemic heart disease - an update 1990. In: Oja P, Telama R, eds. Sport for All. Amsterdam: Elsevier, 1991:251-64.
17. Leon AS. Physical Activity and Cardiovascular Health. A National Consensus. Champaign: Human Kinetics, 1997.
18. Morris CK, Froelicher VF. Cardiovascular benefits of physical activity. Herz 1991;16:222-36.
19. Fletcher GF, Balady G, Blair SN, et al. Statement on exercise: benefits and recommendations for physical activity programs for all Americans. Circulation 1996;94:857-62.

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20. Saltin B. Cardiovascular and pulmonary adaptation to physical activity. In: Bouchard C, Shephard RJ, Stephens T, Sutton JR, McPherson B, eds. Exercise, Fitness, and Health. A Consensus of Current Knowledge. Champaign, IL: Human Kinetics Publishers, 1990:187-204.
21. Mitchell JH, Raven PB. Cardiovascular adaptation to physical activity. In: Bouchard C, Shephard RJ, Stephens T, eds. Physical Activity, Fitness, and Health. International Proceedings and Consensus Statement. Champaign: Human Kinetics, 1994:286-301.
22. Laughlin MH, McAllister RM, Delp MD. Physical activity and the microcirculation in cardiac and skeletal muscle. In: Bouchard C, Shephard RJ, Stephens T, eds. Physical Activity, Fitness, and Health. International Proceedings and Consensus Statement. Champaign: Human Kinetics, 1994:302-19.
23. Laughlin MH, Oltman CL, Muller JM, Myers PR, Parker JL. Adaptation of coronary circulation to exercise training. In: Fletcher GF, ed. Cardiovascular Response to Exercise. New York: Futura Publishing Company, 1994:175-205.
24. Bouchard C, Després JP, Tremblay A. Exercise and obesity. Obes Res 1993;1:133-47.
25. Després JP, Moorjani S, Lupien PJ, Tremblay A, Nadeau A, Bouchard C. Regional distribution of body fat, plasma lipoproteins and cardiovascular disease. Arteriosclerosis 1990;10:497-511.
26. Gudat U, Berger M, Lefèbvre PJ. Physical activity, fitness, and non-insulin-dependent (type II) diabetes mellitus. In: Bouchard C, Shephard RJ, Stephens T, eds. Physical Activity, Fitness, and Health. International Proceedings and Consensus Statement. Champaign: Human Kinetics, 1994:669-83.
27. Sutton JR, Farrell PA, Harber VJ. Hormonal adaptation to physical activity. In: Bouchard C, Shephard RJ, Stephens T, Sutton JR, McPherson B, eds. Exercise, Fitness, and Health. A Consensus of Current Knowledge. Champaign: Human Kinetics, 1990:217-58.

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28. Richter EA, Sutton JR. Hormonal adaptation to physical activity. In: Bouchard C, Shephard RJ, Stephens T, eds. Physical Activity, Fitness, and Health. International Proceedings and Consensus Statement. Champaign: Human Kinetics, 1994:331-42.
29. Fagard RH, Tipton CM. Physical activity, fitness, and hypertension. In: Bouchard C, Shephard RJ, Stephens T, eds. Physical Activity, Fitness, and Health. International Proceedings and Consensus Statement. Champaign: Human Kinetics, 1994:633-55.
30. Stefanick ML, Wood PD. Physical activity, lipid and lipoprotein metabolism, and lipid transport. In: Bouchard C, Shephard RJ, Stephens T, eds. Physical Activity, Fitness, and Health. International Proceedings and Consensus Statement. Champaign: Human Kinetics, 1994:417-31.
31. Durstine JL, Haskell WL. Effects of exercise training on plasma lipids and lipoproteins. Exerc Sport Sci Rev 1994;22:477-521.
32. Rauramaa R, Salonen JT. Physical activity, fibrinolysis, and platelet aggregability. In: Bouchard C, Shephard RJ, Stephens T, eds. Physical Activity, Fitness, and Health. International Proceedings and Consensus Statement. Champaign: Human Kinetics, 1994:471-9.
33. Shaper AG, Wannamethee G. Physical activity and ischaemic heart disease in middle-age British men. Br Heart J 1991;66:384-94.
34. The pooling project research group. Relationship of blood pressure, serum cholesterol, smoking habit, relative weight and ECG abnormalities to incidence of major coronary events: final report of the Pooling Project. J Chronic Dis 1978;31:201-306.

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CANADIAN CARDIOVASCULAR SOCIETY 1998 CONSENSUS CONFERENCE ON THE PREVENTION OF CARDIOVASCULAR DISEASES: THE ROLE OF THE CARDIOVASCULAR SPECIALIST

Section 5: Risk Factors Associated with Lifestyle and Behaviour - Psychosocial risks and cardiovascular diseases

Nancy Frasere-Smith PhD, François Lespérance MD

There is considerable epidemiological evidence supporting the role of psychosocial factors as risks for cardiovascular diseases (CVD), particularly for ischemic heart disease (IHD). However, in contrast to other modifiable risks such as hypercholesterolemia and hypertension, it is too soon to suggest clear guidelines for the evaluation and treatment of psychosocial factors. Although the evidence that psychosocial factors contribute to the development of CVD is strong, it is indirect. For example, even though depression is an important predictor of mortality after myocardial infarction (MI) (1), it is premature to conclude that the relationship is causal. Nonetheless, among the variety of psychosocial factors that have been studied, the evidence is clearly stronger for some than for others. These factors need to become the focus of increased research efforts.

This consensus report summarizes the results of studies of risks for the initial development of CVD as well as the prognosis of patients with established disease. Only prospective epidemiological research is included. Retrospective and cross-sectional studies have been excluded. Finally, because of the large variety of similar and overlapping terms used in epidemiological studies of psychosocial risks, these terms are grouped according to the major clinical concepts involved. For example, the studies on depression are combined with those on hopelessness and vital exhaustion.

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STRENGTH OF EVIDENCE FOR PSYCHOSOCIAL RISK FACTORS

In the absence of clinical trial results, the strength of causal inferences about risks for CVD and the strength of the clinical recommendations that can be made about risk modification can be judged on the basis of three other types of evidence: the degree to which there are data to support a plausible biological explanation for the risk factor; the statistical strength of the observed association between the factor and ensuing CVD events (eg, the strength of prospective associations); and the evidence that observed changes in the risk factor influence the subsequent course of the disease (2). Table 1 lists the major prospective epidemiological studies that have evaluated the role of psychosocial factors in CVD, primarily IHD. The evidence is most convincing for the risk associated with depression. However, the risk does not seem to be limited to major depression as it is defined in psychiatry, and includes elevated levels of depressive symptoms as well as the related concepts of hopelessness and vital exhaustion. Depression-related increases in cardiovascular risk have been documented in initially healthy samples as well as in patients with existing IHD. In addition, although less strong than the evidence for depression, the data also support risks associated with anxiety, particularly phobic anxiety, and psychological distress, as well as low social support. It is important to note that these factors are more likely to be inter-related than the individual studies suggest. For example, depressed patients tend to be anxious and to feel unsupported by their friends and families.

Current evidence indicates that the degree of risk associated with depression, and to a somewhat lesser degree with anxiety and low social support, is as great as that associated with more traditional risk factors and is largely independent of them. For example, after control for disease severity, measures of depression or hopelessness have been associated with relative risks between 1.5 and 2 for fatal IHD or MI over periods ranging from six to 27 years in community samples of initially healthy individuals (3,4). The risk also appears to be linear, with patients who report more symptoms of depression being at higher risk. The depression-related risk of cardiac mortality over six to 18 months in post-MI patients has been observed to be even higher, with relative risks in the range from 3 to 6 after control for measures of disease severity (1,5).

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Although early research implicated type A personality in the development of coronary artery disease, subsequent studies did not support the association, and some studies in post-MI patients even suggested a positive prognostic impact. More recent attempts focusing on anger or hostility as the most crucial aspect of type A have yielded conflicting results (6). The evidence pertaining to life stress in general and to stress at work is also equivocal.

TABLE 1

Epidemiological evidence for psychosocial risk factors in cardiovascular diseases (CVD)

Risk factor	Prospective evidence for development of CVD	Prospective evidence for prognosis in established CVD
Depression/hopelessness/vital exhaustion	+ Appels and Mulder (19) + Anda et al (3) + Aromaa et al (20) + Everson et al (21) + Barefoot and Schroll (4) + Pratt et al (22) + Hippisley-Cox et al (23) + Everson et al (24) + Ford et al (25)	Ischemic heart disease: + Kennedy et al (26) + Carney et al (27) 0 Berkman et al (28) + Aromaa et al (20) 0 Oxman et al (29) + Kop et al (30) Barefoot et al (31) Postmyocardial infarction: 0 Ruberman et al (32) 0 Jenkinson et al (33) + Ahern et al (34) + Ladwig et al (5) + Frasure-Smith et al (1,35) Poststroke: + Morris et al (36)
Anxiety/worry/distress	+ Haines et al (37) + Kawachi et al (38) + Kawachi et al (39) + Kubzansky et al (40)	Ischemic heart disease: + Allison et al (41) Postmyocardial infarction: + Wiklund et al (42) + Follick et al (43) 0 Ahern et al (34) + Frasure-Smith (44) + Frasure-Smith et al (45) + Moser and Dracup (46)
Absence of social support/isolation	+ Berkman and Syme (47) + House et al (48)	Ischemic heart disease: + Orth-Gomér et al (50)

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	+ Orth-Gomér and Johnson (49) + Orth-Gomér et al (50) + Kaplan et al (51)	+ Williams et al (52) + Oxman et al (29) Postmyocardial infarction: + Ruberman et al (32) 0 Jenkinson et al (33) + Case et al (53) + Berkman et al (28) 0 Frasure-Smith et al (45)
Type A personality	+ Rosenman et al (54) + Haynes and Feinleib (55) + Eaker et al (56) 0 Shekelle et al (Sample at high risk for coronary artery disease) (57)	Postmyocardial infarction: 0 Ruberman et al (32) 0 Case et al (53) 0 Shekelle et al (57) - Ragland and Brand (58) - Barefoot et al (59) - Ahern et al (34)
Anger/hostility	+ Barefoot et al (60) + Shekelle et al (61) + Barefoot et al (59) + Everson et al (62) + Kawachi et al (63) 0 McCranie et al (64) 0 Leon et al (65) 0 Hearn et al (66) 0 Maruta et al (67)	Cardiopathie ischémique : + Hecker et al ⁶⁸
Life stress	+ Rosengren (69) 0 Rosengren (69) 0 Moor et al (70)	Postmyocardial infarction: + Ruberman et al (32) + Tennant et al (71)
Job strain	+ Karasek et al (72) + Karasek et al (73) + Falk et al (74) 0 Reed et al (75) 0 Hlatky et al (76)	Ischemic heart disease: 0 Hlatky et al (76)

+ Positive relationship; 0 No relationship; - Inverse relationship

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POTENTIAL MECHANISMS LINKING PSYCHOSOCIAL FACTORS AND CARDIAC EVENTS

There are data indicating that depression and low social support can influence behaviourally alterable cardiac risks such as smoking, exercise and diet, as well as patients' tendencies to comply with recommended medications or to respond to symptoms by seeking treatment rapidly (7). The impact of anxiety on these behaviours is less clear. However, biologically plausible mechanisms of action for psychosocial factors have also been suggested (8,9). Musselman et al (10) recently reviewed the psychophysiological and neurobiological research on links between depression and CVD, and concluded that depression is associated with chronic disturbances in autonomic balance and platelet aggregation. It is suspected that the chronic increases in neuroadrenergic tone that have been documented in depressed patients lower the arrhythmic threshold. Recent research also indicates that depression is associated with increased or more easily inducible platelet aggregation. Transitory emotional states such as anxiety and anger can also provoke sudden changes in heart rate, peripheral vascular tone and probably coronary vascular tone. This can induce ischemia and lower the arrhythmic threshold. In addition, the release of adrenalin that accompanies fear or anxiety can stimulate platelet aggregation via alpha-adrenergic pathways. The hypothetical mechanisms to explain the impact of low social support are not as clear cut and focus on what is known as the stress-buffering model

(11). This model postulates that social support is beneficial primarily for individuals under stress, and suggests that social support may act to attenuate emotional and/or physiological responses to environmental stresses.

RANDOMIZED TRIALS OF PSYCHOSOCIAL INTERVENTIONS

Over the past 20 years, many psychosocial interventions have been evaluated for patients with CVD. However, most of the work has involved treatment studies with no comparison groups and small, poorly controlled trials. Further, there has been a wide variation in the effectiveness of the programs in altering psychological factors and few replications of successful approaches. The primary objective has rarely been to improve cardiovascular prognosis.

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Linden et al (12) recently completed a meta-analysis of 23 randomized studies of psychosocial programs for patients with established IHD and concluded that the programs were more effective than standard care in reducing anxiety and/or depression, influenced some biological risk factors, and reduced mortality and morbidity. This level of optimism may be premature. Only 15 of the studies had psychological end points, and 12 reported mortality and/or morbidity data. In fact, the majority of the patients came from only two studies, and most of the data were collected before the widespread use of thrombolysis, early revascularization and acetylsalicylic acid. However, in 1996 and 1997, three randomized trials with much larger samples of post-MI patients were published: Jones and West (13) (n=2328) Taylor et al (14) (n=585) and Frasure-Smith et al (15) (n=1376). All three involved multifactorial case management-type approaches administered by nurses or health visitors. None demonstrated a reduction in the symptom levels of depression or anxiety. Two had no effect on prognosis (13,14), and one showed no impact on men but showed marginally significant evidence of a negative impact in women (15).

In conclusion, the value of psychosocial approaches in secondary prevention of CVD is unclear, at least partially because many of the interventions tested have not been successful in reducing the psychosocial risks themselves. Thus, it is hypothesized that a more specific intervention, such as cognitive therapy for depression, which is more likely to alter psychological symptoms, may have a positive impact on cardiac prognosis. This hypothesis is under study in the multisite Enhancing Recovery in Coronary Heart Disease (ENRICH) trial (16) sponsored by the National Heart, Lung, and Blood Institute in the United States. Although the strength of the epidemiological evidence suggests that it is a promising area of research, there have been no studies of the impact of psychopharmacological treatment on cardiovascular outcomes.

The limited number of clinical trials of interventions to change psychosocial risks is somewhat surprising but understandable for several reasons. First, intervention strategies for many psychosocial factors are unclear. What can and should be done for people who live alone, report few friends or have infrequent social contacts? Isolation can result from personal choice as well as the vicissitudes of life, and it is hard to imagine how friendships can be artificially

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created. Second, there is the question of treatment duration. The efficacy of pharmacological and psychotherapeutic treatments for relief of symptoms of depression and anxiety has been demonstrated primarily in the short term. In contrast, the benefits of cardiac risk modification are usually only measurable in the long term. Thus, to demonstrate that changes in psychological factors result in changes in CVD, it would be necessary, for example, to demonstrate that an intervention is capable of substantially reducing psychological symptoms over several years. Third, it is not clear what level of risk needs to be modified. Should we focus on major depression or treat more minor forms of symptomatology, including anxiety, as well? Should we intervene with patients who have a history of depression in order to prevent recurrences? Answering these questions would require a substantial re-search effort with adequate financial support, which has so far not been available. It is unclear how long it will be before clear psychosocial treatment recommendations for prevention of CVD can be made.

CONCLUSION: PATIENTS WITH PSYCHOSOCIAL RISKS NEED CAREFUL MEDICAL MANAGEMENT AND MONITORING

The bottom line for clinicians is that psychosocial factors including depression, anxiety and low social support probably constitute important risks for CVD. Successful treatment of these risks has the potential for improving prognosis and slowing or preventing disease, both by influencing compliance with modification of other cardiovascular risks and by altering physiological responses. However, clear data on intervention strategies are lacking. Because of this, it is possible to question whether psychosocial factors really influence cardiovascular prognosis. However, there is no doubt that depression and anxiety affect patients' quality of life, and day to day social and role functioning. Until we have results from clinical trials specifically targeting cardiac patients, treatment of depression and anxiety should be based on the treatment of patients without CVD (17,18). It is important to assess the degree to which symptoms are persistent or severe enough to justify treatment. In addition, the patient must feel that there is little chance for getting better on his or her own without some form treatment. Some patients may prefer a prescription for antidepressants or anxiolytics, while others prefer psychotherapy, but most benefit from combined treatment. Although it is unclear whether this approach can improve cardiovascular prognosis, it is likely to improve patients' quality of life.

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RECOMMENDATIONS

Patients with symptoms of depression or anxiety, or lacking social support should have a careful psychological assessment and be offered appropriate treatment if required to improve their quality of life (**Level III, Grade C**).

RESEARCH

Identify the pathophysiological mechanisms by which psychosocial factors affect CVD risk.

Conduct cohort studies to determine whether the risks associated with depression, anxiety and lack of social support are independent of each other.

Assess the impact of modification of psychosocial risk factors on CVD.

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REFERENCES

1. Frasure-Smith N, Lespérance F, Talajic M. Depression and 18-month prognosis after myocardial infarction. *Circulation* 1995;91:999-1005.
2. Pasternak RC, Grundy SM, Levy D, Thompson PD. Task force 3. Spectrum of risk factors for coronary heart disease. *J Am Coll Cardiol* 1996;27:978-90.
3. Anda R, Williamson D, Jones D, et al. Depressed affect, hopelessness, and the risk of ischemic heart disease in a cohort of U.S. adults. *Epidemiology* 1993;4:285-94.
4. Barefoot JC, Schroll M. Symptoms of depression, acute myocardial infarction, and total mortality in a community sample. *Circulation* 1996;93:1976-80.
5. Ladwig KH, Kieser M, König M, Breithardt G, Borggrefe M. Affective disorders and survival after acute myocardial infarction: Results from the post-infarction late potential study. *Eur Heart J* 1991;12:959-64.
6. Allan R, Scheidt S. Stress, anger, and psychosocial factors for coronary heart disease. In: Manson JE, Ridker PM, Gaziano JM, Hennekens CH, eds. *Prevention of Myocardial Infarction*. New York: Oxford University Press, 1996:274-307.
7. Carney RM, Freedland KE, Eisen SA, Rich MW, Jaffe AS. Major depression and medication adherence in elderly patients with coronary artery disease. *Health Psychol* 1995;14:88-90.
8. Kamarck T, Jennings JR. Biobehavioral factors in sudden cardiac death. *Psychol Bull* 1991;109:42-75.
9. Appels A. Depression and coronary heart disease: Observations and questions. *J Psychosom Res* 1997;43:443-52.
10. Musselman DL, Evans DL, Nemeroff CB. The relationship of depression to cardiovascular disease: Epidemiology, biology and treatment. *Arch Gen Psychiatry* 1998;55:580-92.

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11. Cohen S, Wills TA. Stress, social support, and the buffering hypothesis. Psychol Bull 1985; 98:310-357.
12. Linden W, Stossel C, Maurice J. Psychosocial interventions for patients with coronary artery disease - A meta-analysis. Arch Intern Med 1996;156:745-52.
13. Jones DA, West RR. Psychological rehabilitation after myocardial infarction: multicenter randomised controlled trial. BMJ 1996;313:1517-21.
14. Taylor CB, Miller NH, Smith PM, DeBusk RF. The effect of a home-based, case-managed, multifactorial risk-reduction program on reducing psychological distress in patients with cardiovascular disease. J Cardiopulm Rehabil 1997;17:157-62.
15. Frasure-Smith N, Lespérance F, Prince RH, et al. Randomised trial of home-based psychological nursing intervention for patients recovering from myocardial infarction. Lancet 1997;350:473-9.
16. Enhancing Recovery in Coronary Heart Disease (ENRICHD) Patients. RFP NHLBI-HC-94-28. Bethesda: National Heart, Lung, and Blood Institute, 1994.
17. Klerman GL. Mood disorders. In: Treatments of Psychiatric Disorders: A Task Force Report of the American Psychiatric Association. Washington: American Psychiatric Association, 1989:1725-2006.
18. Orne MT, Frankel FH. Anxiety disorders. In: Treatments of Psychiatric Disorders: A Task Force Report of the American Psychiatric Association. Washington: American Psychiatric Association, 1989:2007-94.
19. Appels A, Mulder P. Excess fatigue as a precursor of myocardial infarction. Eur Heart J 1988;9:758-64.
20. Aromaa A, Raitasalo R, Reunanen A, et al. Depression and cardiovascular diseases. Acta Psychiatr Scand Suppl 1994;377:77-82.

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21. Everson SA, Goldberg DE, Kaplan GA, et al. Hopelessness and risk of mortality and incidence of myocardial infarction and cancer. *Psychosom Med* 1996;58:113-21.
22. Pratt LA, Ford DE, Crum RM, Armenian HK, Gallo JJ, Eaton WW. Depression, psychotropic medication, and risk of myocardial infarction. Prospective data from the Baltimore ECA Follow-up. *Circulation* 1996;94:3123-9.
23. Hippisley-Cox J, Fielding K, Pringle M. Depression as a risk factor for ischemic heart disease in men: population based case-control study. *BMJ* 1998;316:1714-9.
24. Everson SA, Roberts RE, Goldberg DE, Kaplan GA. Depressive symptoms and increased risk of stroke mortality over a 29-year period. *Arch Intern Med* 1998;158:1133-8.
25. Ford DE, Mead LA, Chang PP, Cooper-Patrick L, Wang N-Y, Klag MJ. Depression is a risk factor for coronary artery disease in men. *Arch Intern Med* 1998;158:1422-6.
26. Kennedy GJ, Hofer MA, Cohen D, Shindledecker R, Fisher JD. Significance of depression and cognitive impairment in patients undergoing programmed stimulation of cardiac arrhythmias. *Psychosom Med* 1987;49:410-21.
27. Carney RM, Rich MW, Freedland KE, et al. Major depressive disorder predicts cardiac events in patients with coronary artery disease. *Psychosom Med* 1988;50:627-33.
28. Berkman LF, Leo-Summers L, Horwitz RI. Emotional support and survival after myocardial infarction: a prospective, population-based study of the elderly. *Ann Intern Med* 1992;117:1003-9.
29. Oxman TE, Freeman DH Jr, Manheimer ED. Lack of social participation or religious strength and comfort as risk factors for death after cardiac surgery in the elderly. *Psychosom Med* 1995;57:5-15.
30. Kop WJ, Appels A, Mendes de Leon C, De Swart HB, Bar FW. Vital exhaustion predicts new coronary events after successful coronary angioplasty. *Psychosom Med* 1994;56:281-7.

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· knowledge translation, including dissemination of research and encouragement of best practices· professional development, and leadership in health policy.

31. Barefoot JC, Helms MJ, Mark DB, et al. Depression and long-term mortality risk in patients with coronary artery disease. *Am J Cardiol* 1996;78:613-7.
32. Ruberman W, Weinblatt E, Goldberg JD, Chaudhary BS. Psychosocial influences on mortality after myocardial infarction. *N Engl J Med* 1984;311:552-9.
33. Jenkinson CM, Madeley RJ, Mitchell JRA, Turner ID. The influence of psychosocial factors on survival after myocardial infarction. *Public Health* 1993;107:305-17.
34. Ahern DK, Gorkin L, Anderson JL, et al. Biobehavioral variables and mortality or cardiac arrest in the Cardiac Arrhythmia Pilot Study (CAPS). *Am J Cardiol* 1990;66:59-62.
35. Frasure-Smith N, Lespérance F, Talajic M. Depression following myocardial infarction: Impact on 6-month survival. *JAMA* 1993;270:1819-25.
36. Morris PLP, Robinson RG, Andrzejewski P, Samuels J, Price TR. Association of depression with 10-year poststroke mortality. *Am J Psychiatry* 1993;150:124-9.
37. Haines AP, Imeson JD, Meade TW. Phobic anxiety and ischaemic heart disease. *BMJ* 1987;295:297-9.
38. Kawachi I, Colditz GA, Ascherio A, et al. Prospective study of phobic anxiety and risk of coronary heart disease in men. *Circulation* 1994;89:1992-7.
39. Kawachi I, Sparrow D, Vokonas PS, Weiss ST. Symptoms of anxiety and risk of coronary heart disease: The Normative Aging Study. *Circulation* 1994;90:2225-9.
40. Kubzansky LD, Kawachi I, Spiro III A, Weiss ST, Vokonas PS, Sparrow D. Is worrying bad for your heart? A prospective study of worry and coronary heart disease in the Normative Aging Study. *Circulation* 1997;95:818-24.
41. Allison TG, Williams DE, Miller TD, et al. Medical and economic costs of psychologic distress in patients with coronary artery disease. *Mayo Clin Proc* 1995;70:734-42.

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42. Wiklund I, Oden A, Sanne H, Ulvenstam G, Wilhelmsson C, Wilhelmsen L. Prognostic importance of somatic and psychosocial variables after a first myocardial infarction. *Am J Epidemiol* 1988;128:786-95.
43. Follick MJ, Gorkin L, Capone RJ, et al. Psychological distress as predictor of ventricular arrhythmias in a post-myocardial infarction population. *Am Heart J* 1988;116:32-6.
44. Frasure-Smith N. In-hospital symptoms of psychological stress as predictors of long-term outcome after acute myocardial infarction in men. *Am J Cardiol* 1991;67:121-7.
45. Frasure-Smith N, Lespérance F, Talajic M. The impact of negative emotions on prognosis following myocardial infarction: Is it more than depression? *Health Psychol* 1995;14:388-98.
46. Moser DK, Dracup K. Is anxiety early after myocardial infarction associated with subsequent ischemic and arrhythmic events? *Psychosom Med* 1996;58:395-401.
47. Berkman LF, Syme SL. Social networks, host resistance, and mortality: A nine-year follow-up study of Alameda county residents. *Am J Epidemiol* 1979;109:186-204.
48. House JS, Robbins C, Metzner HL. The association of social relationships and activities with mortality: Prospective evidence from the Tecumseh community health study. *Am J Epidemiol* 1982;116:123-40.
49. Orth-Gomér K, Johnson JV. Social network interaction and mortality: A six year follow-up study of a random sample of the Swedish population. *J Chronic Dis* 1987;40:949-57.
50. Orth-Gomér K, Undén A, Edwards M. Social isolation and mortality in ischemic heart disease: A 10-year follow-up study of 150 middle-aged men. *Acta Med Scand* 1988;224:205-15.
51. Kaplan GA, Salonen JT, Cohen RD, Brand RJ, Syme SL, Puska P. Social connections and mortality from all causes and from cardiovascular disease: Prospective evidence from eastern Finland. *Am J Epidemiol* 1988;128:370-80.

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52. Williams RB, Barefoot JC, Califf RM, et al. Prognostic importance of social and economic resources among medically treated patients with angiographically documented coronary artery disease. JAMA 1992;267:520-4.
53. Case RB, Moss AJ, Case N, McDermott M, Eberly sincerely. Living alone after myocardial infarction: impact on prognosis. JAMA 1992;267:515-9.
54. Rosenman RH, Brand RJ, Jenkins D, Friedman M, Straus R, Wurm M. Coronary heart disease in Western collaborative group study. Final follow-up experience of 8 1/2 years. JAMA 1975;233:872-7.
55. Haynes SG, Feinleib M. Type A behavior and the incidence of coronary heart disease in the Framingham heart study. Adv Cardiol 1982;29:85-94.
56. Eaker ED, Abbott RD, Kannel WB. Frequency of uncomplicated angina pectoris in type A compared with type B persons (the Framingham study). Am J Cardiol 1989;63:1042-5.
57. Shekelle RB, Hulley SB, Neaton JD, et al. The MRFIT behavior pattern study II. type A behavior and incidence of coronary heart disease. Am J Epidemiol 1985;122:559-70.
58. Ragland DR, Brand RJ. Type A behavior and mortality from coronary heart disease. N Engl J Med 1988;318:65-9.
59. Barefoot JC, Peterson BL, Harrell FE Jr, et al. Type A behavior and survival: a follow-up study of 1,467 patients with coronary artery disease. Am J Cardiol 1989;64:427-32.
60. Barefoot JC, Dahlstrom WG, Williams RB. Hostility, CHD incidence, and total mortality : A 25-year follow-up study of 255 physicians. Psychosom Med 1983;45:59-64.
61. Shekelle RB, Gale M, Ostfeld AM, Paul O. Hostility, risk or coronary heart disease, and mortality. Psychosom Med 1983;45:109-14.

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62. Everson SA, Kauhanen J, Kaplan GA, et al. Hostility and increased risk of mortality and acute myocardial infarction: The mediating role of behavioral risk factors. *Am J Epidemiol* 1997;146:142-52.
63. Kawachi I, Sparrow D, Spiro A III, Vokonas P, Weiss ST. A prospective study of anger and coronary heart disease. The normative aging study. *Circulation* 1996;94:2090-5.
64. McCranie EW, Watkins LO, Brandsma JM, Sisson BD. Hostility, coronary heart disease (CHD) incidence and total mortality: Lack of association in a 25-year follow-up study of 478 physicians. *J Behav Med* 1986;9:119-25.
65. Leon GR, Finn SE, Murray D, Bailey JM. Inability to predict cardiovascular disease from hostility scores or MMPI items related to Type A behavior. *J Consul Clin Psychol* 1988;56:597-600.
66. Hearn MD, Murray DM, Luepker RV. Hostility, coronary heart disease, and total mortality: A 33-year follow-up study of University students. *J Behav Med* 1989;12:105-21.
67. Maruta T, Hamberger ME, Jennings CA, et al. Keeping hostility in perspective: Coronary heart disease and the Hostility Scale on the Minnesota Multiphasic Personality Inventory. *Mayo Clin Proc* 1993;68:109-14.
68. Hecker MH, Chesney M, Black GW, Farutsch N. Coronary-prone behaviors in the Western Collaborative Group Study. *Psychosom Med* 1988;50:153-64.
69. Rosengren A, Tibblin G, Wilhelmsen L. Self-perceived psychological stress and incidence of coronary artery disease in middle-aged men. *Am J Cardiol* 1991;68:1171-5.
70. Moor L, Meyer F, Peruse M, Cantin B, Dagenais GR. Psychological stress and incidence of ischemic heart disease. *Can J Cardiol* 1997;14(Suppl B):317B. (Abst)
71. Tennant CC, Palmer KJ, Langeluddecke PM, Jones MP, Nelson G. Life event stress and myocardial infarction: A prospective study. *Eur Heart J* 1994;15:472-8.

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72. Karasek R, Baker D, Marxer F, Ahlbom A, Theorell T. Job decision latitude, job demands, and cardiovascular disease: a prospective study of Swedish men. *Am J Public Health* 1981;71:694-705.
73. Karasek RA, Schwartz JE, Schnall PL, Pieper CF, Michela JL. Job characteristics in relation to the prevalence of myocardial infarction in the US Health Examination Survey (HES) and the Health and Nutrition Examination Study (HANES). *Public Health* 1988;78:910-8.
74. Falk A, Hanson BS, Isacsson SO, Ostergren PO. Job strain and mortality in elderly men: social network, support, and influence as buffers. *Am J Public Health* 1992;82:1136-9.
75. Reed DM, Lacroix AZ, Karasek RA, Miller D, MacLean CA. Occupational strain and the incidence of coronary heart disease. *Am J Epidemiol* 1989;129:495-502.
76. Hlatky MA, Lam LC, Lee KL, et al. Job strain and the prevalence and outcome of coronary artery disease. *Circulation* 1995;92:327-33.

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Section 5: Risk Factors Associated with Lifestyle and Behaviour - Socioeconomic factors and social support

Robert D Reid PhD

There is a strong association between the cardiovascular health of a population and measurements such as level of income and education, type of work and degree of social support (1-11). In general, the higher one's socioeconomic status (SES) and the greater one's social support, the better one's cardiovascular health (2). Because the study of SES does not lend itself to randomized clinical trials, the evidence for an association between SES and cardiovascular diseases (CVD) must be inferred from cross-sectional, prospective and retrospective cohort studies.

SES AND CARDIOVASCULAR MORBIDITY AND MORTALITY

In the famous Whitehall Study (3), death rates from ischemic heart disease (IHD) for men in the lowest employment grade in the British civil service were compared with those in the top (administrative) grade. At follow-up, the seven and a half-year IHD rate was 4.0 times higher in the lowest than in the top grade. The social class difference was only partly explained by adjustment for known coronary risk factors (Table 1).

While several studies in the United States and Europe have confirmed a graded, inverse relation between SES and long term risk of IHD, CVD and all-cause mortality (4,5,12,13), Canadian studies (7,14,15) have yielded somewhat inconsistent effects of SES. In the Quebec

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Cardiovascular Study (14,15), education levels were not significantly associated with total or IHD mortality, and there was no relationship between years of schooling and the incidence of first IHD. In the Saskatchewan Heart Health Survey, CVD (angina, infarct, stroke and claudication) were more prevalent among those with less education and lower income and among those who were employed as unskilled workers (7). The strongest correlates of CVD were the levels of household income and education.

It appears that the disparity in cardiovascular health between people of low and high SES is increasing (16). In British men, between the early 1970s and early 1980s, IHD mortality rates declined by 15% in men in nonmanual occupations and increased by 1% in those in manual occupations (17).

Evidence suggests that low SES in childhood may have an independent effect on risk of CVD (relative risk of 1.3 to 1.9), particularly IHD, in adulthood (8,12,18-23). In these studies, adjustment for a wide range of risk factors caused little reduction in the association of childhood social class with mortality from all causes and from CVD. However, some studies have found no relationship (24,25). Lower SES in childhood is associated with higher levels of hostility, depression and hopelessness; greater tobacco consumption and alcohol abuse; less leisure time physical activity; obesity and a less nutritious diet in adulthood (26).

SES AND CARDIOVASCULAR RISK FACTORS

Biological, behavioural, psychological and social risk factors for IHD are differentially distributed by SES in men and women (4,27-33). There is an inverse relationship between SES and hypertension, smoking, total cholesterol level, body mass index, excess alcohol use, sedentary living and diabetes. Other social status differences in biological risk factors are a lower ratio of high to low density lipoproteins, central obesity and higher fibrinogen concentrations, which are more frequent in low SES (34). Blood lipid profiles collected during the Whitehall II Study indicate that high density lipo-protein cholesterol concentrations rise incrementally with social status in both sexes (35). Concurrence of risk factors has been shown

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to be higher in less educated groups, and concurrence of risk factors can have a synergistic effect on the risk for CVD (31).

In Canada, education level is strongly linked to risk factor prevalence (33). Canadians with 11 years or less of education are more likely to have at least one of the major risk factors for CVD than men with more than 11 years of education (76% versus 59%). The prevalence of all risk factors surveyed in the Canadian Provincial Heart Health Surveys is higher among less educated Canadians than among their more educated counterparts. In particular, smoking and a sedentary lifestyle are more prevalent in Canadians with less formal education.

Risk factors contribute to, but do not fully explain, health inequalities among SES groups (36). In most studies, adjustment for conventional biological and behavioural cardiovascular risk factors (such as blood pressure, serum cholesterol level, smoking status and level of leisure time physical activity) attenuates but does not eliminate the relationship between SES and cardiovascular mortality. One recent study (32) found that the relation between SES and cardiovascular mortality could be eliminated by simultaneous adjustment for age and a wide array of biological, behavioural, psychological and social risk factors. However, the relation between SES and acute myocardial infarction remained elevated even after adjustment for these factors.

It appears that persons from all SES categories are modifying their risk for CVD, although those who are less educated continue to show a disproportionately high prevalence of CVD risk factors (37,38). Public health campaigns have been less effective in reaching at-risk individuals with low educational attainment, even though interest in risk modification is high across all SES groups (39).

POSSIBLE MECHANISMS LINKING SOCIOECONOMIC FACTORS AND CVD

The fact that there are socioeconomic gradients in IHD that cannot be accounted for by differences in known coronary risk factors suggests that there are other pathways involved in the mediation of socioeconomic inequalities in IHD risk (35). The indirect effect of psychosocial

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circumstances may include increased exposure to behavioural risks resulting from psychosocial stress (such as stress-related smoking, drinking or eating for comfort). The direct effects of low SES are likely to centre on the physiological effects of chronic mental and emotional stress (40). Several stressors have been identified as contributors to psychosocial adversity including financial strain, job insecurity, low control and monotony at work, stressful life events and poor social networks, low self esteem and fatalism (36). Chronic stresses associated with social position may modify neuroendocrine and physiological functioning. For example, the metabolic syndrome of central obesity, glucose intolerance, insulin resistance, lipoprotein disturbances and reduced fibrinolysis may mediate effects of these stresses on IHD (41).

SOCIAL NETWORKS AND CVD

Extensive social networks may offer protection from CVD. In the Alameda County Study (42,43), men and women who lacked social ties were at increased risk for IHD, cerebrovascular and circulatory disease, and cancer. The mortality rate for men, but not women, was inversely related to the level of social connectedness in the North Karelia study (44). Kawachi et al (45) found that socially isolated men in the Health Professionals Follow-up Study were at increased risk for CVD mortality (relative risk 1.9).

Several prospective studies have shown that social ties predict survival after acute myocardial infarction (46-50). In these studies, patients who lacked social support, lived alone or had not been married had an increased mortality risk following myocardial infarction. Recently, Ickovics (51) found that higher social class was also associated with improved functional recovery after myocardial infarction, even after controlling for clinical, demographic and psychosocial factors known to influence outcome.

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RECOMMENDATIONS

Data on SES (education, employment status, type of work) and degree of social support should be collected to help form the best estimates of patients' risk of future disease and prognosis.

Clinicians should continue to focus on the behavioural, psychosocial and biological risk factors that mediate much of the relationship between SES and CVD.

If intervention materials are being used, these materials should consider the literacy needs of people with less formal education.

Support should be provided to policy initiatives that attempt to create greater income equality through jobs and growth, thereby improving social cohesion (52) and reducing social division (53). In turn, better integration into a network of social relations is known to benefit health: socially isolated people die at two to three times the rate of well connected people (42,45).

Support should be provided to policy initiatives that promote healthy child development, particularly among families of low SES.

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RESEARCH GAPS

There is a need to clarify why biological, behavioural, psychological and social risk factors are differently distributed by SES.

The interactions between clinical and psychosocial characteristics in cardiovascular mortality and recovery need to be clarified.

There is a need to identify as-yet unknown factors that allow an individual to stay healthy despite the increased risk associated with low social class.

There is a need to examine how most effectively to alter or modify social networks and support to improve cardiovascular health outcomes.

There is a need to explore further the nonmedical determinants of cardiovascular health.

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REFERENCES

1. Susser M, Watson W, Hopper K. Sociology in Medicine, 3rd edn. New York: Oxford University Press, 1985.
2. Kaplan GA, Keil JE. Socioeconomic factors and cardiovascular disease: a review of the literature. Circulation 1993;88:1973-98.
3. Rose G, Marmot MG. Social class and coronary heart disease. Br Heart J 1981;45:13-9.
4. Liu K, Cedres LB, Stamler J. Relationship of education to major risk factors and death from coronary heart disease, cardiovascular diseases, and all causes. Circulation 1982;66:1308-14.
5. Siegal D, Kuller L, Lazarus NB, et al. Predictors of cardiovascular events and mortality in the Systolic Hypertension in the Elderly Program pilot project. Am J Epidemiol 1987;126:385-99.
6. Salonen JT. Socioeconomic status and risk of cancer, cerebral stroke and death due to coronary heart disease and any disease: a longitudinal study in eastern Finland. J Epidemiol Commun Med 1982;36:294-7.
7. Reeder BA, Liu L, Horlick L. Sociodemographic variation in the prevalence of cardiovascular disease in Saskatchewan: results from the Saskatchewan Heart Health Survey. Can J Cardiol 1996;12:271-7.
8. Gillum RF, Paffenbarger RF. Chronic disease in former college students XVII. Sociocultural mobility as a precursor of coronary heart disease and hypertension. Am J Epidemiol 1978;108:289-98.
9. Marmot MG. Socio-economic factors in cardiovascular disease. J Hypertens 1996;14:S201-5.
10. Millar WJ, Wigle DT. Socioeconomic disparities in risk factors for cardiovascular disease. Can Med Assoc J 1986;134:127-32.

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11. Pocock SJ, Shaper AG, Copok DG. Social class differences in ischemic heart disease in British men. *Lancet* 1987;ii:197-201.
12. Notkola V, Punsar S, Karvonen JM, Haapakaski J. Socio-economic conditions in childhood in morbidity and mortality caused by coronary heart disease in rural Finland. *Soc Sci Med* 1985;21:517-23.
13. Lynch J, Kaplan GA, Salonen R, Cohen RD, Salonen JT. Socioeconomic status and carotid atherosclerosis. *Circulation* 1995;92:1786-92.
14. Dagenais GR, Robitaille NM, Lupien PJ, et al. First coronary heart disease event rates in relation to major risk factors: Quebec Cardiovascular Study. *Can J Cardiol* 1990;6:274-80.
15. Dagenais GR, Ahmed Z, Robitaille NM, et al. Total and coronary heart disease mortality in relation to major risk factors: Quebec Cardiovascular Study. *Can J Cardiol* 1990;6:59-65.
16. Pell S, Fayerweather WE. Trends in the incidence of myocardial infarction and in associated morbidity and mortality in a large employed sample. *N Engl J Med* 1985;312:1005-11.
17. Marmot MG, McDowell ME. Mortality decline and widening social inequalities. *Lancet* 1986;ii:274-6.
18. Burr ML, Sweetman PM. Family size and paternal unemployment in relation to myocardial infarction. *J Epidemiol Commun Health* 1980;34:93-5.
19. Gliksman MD, Kawachi I, Hunter D, et al. Childhood socioeconomic status and risk of cardiovascular disease in middle-aged women: a prospective study. *J Epidemiol Commun Health* 1995;49:10-5.
20. Kaplan GA, Salonen JT. Socioeconomic conditions in childhood and ischemic heart disease during middle age. *BMJ* 1990;301:1121-3.

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21. Vagero D, Leon D. Effect of social class in childhood and adulthood on adult mortality. Lancet 1994;343:1224-5.
22. Wannamethee SG, Whincup PH, Shaper G, Walker M. Influence of father's social class on cardiovascular disease in middle-aged men. Lancet 1996;348:1259-63.
23. Smith GD, Hart C, Blane D, Gillis C, Hawthorne V. Lifetime socioeconomic position and mortality: prospective observational study. BMJ 1997;314:547-52.
24. Hasle H. Association between living conditions in childhood and myocardial infarction. BMJ 1990;300:512-3.
25. Lynch JW, Kaplan GA, Cohen RD, et al. Childhood and adult socioeconomic status as predictors of mortality in Finland. Lancet 1994;343:524-7.
26. Lynch JW, Kaplan GA, Salonen JT. Why do poor people behave poorly? Variations in adult health behaviours and psycho-social characteristics by stages of socio-economic life course. Soc Sci Med 1997;44:809-19.
27. Matthews KA, Kelsey SF, Meilahn EN, Kuller LH, Wing RR. Educational attainment and behavioral and biological risk factors for coronary heart disease in middle-aged women. Am J Epidemiol 1989;129:1132-44.
28. Jacobsen BK, Thelle DS. Risk factors for coronary heart disease and level of education. Am J Epidemiol 1988;127:923-32.
29. Reyenes JF, Lasater TM, Feldman H, Assaf AR, Carleton RA. Education and risk factors for coronary heart disease: results from a New England Community. Am J Prev Med 1993;9:365-71.
30. Luepker RV, Rosmamond WD, Murphy R, et al. Socioeconomic status and coronary heart disease risk factors trends: the Minnesota Heart Survey. Circulation 1993;88:2172-9.

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31. Hoeymans N, Smit HA, Verkleij H, Krohout D. Cardiovascular risk factors in relation to educational level in 36,000 men and women in the Netherlands. *Eur Heart J* 1996;17:518-25.
32. Lynch JW, Kaplan GA, Cohen RD, Tuomilehto J, Salonen JT. Do cardiovascular risk factors explain the relation between socioeconomic status, risk of all-cause mortality, cardiovascular mortality, and acute myocardial infarction? *Am J Epidemiol* 1996;144:934-42.
33. Joffres MR, MacLean DR, O'Connor BA, Petrasovits A, Satchenko S, eds. *Canadians and Heart Health: Reducing the Risk*. Ottawa: Health Canada, 1995.
34. Brunner E. The social and biological basis of cardiovascular disease in office workers. In: Brunner E, Blane D, Wilkinson RG, eds. *Health and Social Organization*. London: Routledge, 1996.
35. Brunner EJ, Marmot MG, White IR, et al. Gender and employment grade differences in blood cholesterol, apolipoproteins and haemostatic factors in the Whitehall II study. *Atherosclerosis* 1993;102:195-207.
36. Brunner E. Stress and the biology of inequality. *BMJ* 1997;314:1472-6.
37. Winkleby MA, Flora JA, Kraemer HC. A community-based heart disease intervention: predictors of change. *Am J Public Health* 1994;84:767-72.
38. Winkleby MA, Jatulus D, Frant E, Fortmann SP. Socioeconomic status and health: how education, income, and occupation contribute to risk factors for cardiovascular disease. *Am J Public Health* 1992;82:816-20.
39. Davis SK, Winkleby MA, Farquhar JW. Increasing disparity in knowledge of cardiovascular disease risk factors and risk reduction strategies by socio-economic status: implications for policy makers. *Am J Preventive Med* 1995;11:318-23.
40. Wilkinson RG. Health inequalities: relative or absolute material standards. *BMJ* 1997;314:591-5.

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41. Bjorntorp P. Visceral fat accumulation: the missing link between psychosocial factors and cardiovascular disease. *J Int Med* 1991;230:195-201.
42. Berkman LF, Syme SL. Social networks, host resistance and mortality: a nine-year follow-up of Alameda County residents. *Am J Epidemiol* 1979;109:186-204.
43. Berkman LF. The role of social relations in health promotion. *Psychosom Res* 1995;57:245-54.
44. Kaplan JR, Salonen JT, Cohen RD, et al. Social connections and mortality from all causes and cardiovascular disease: prospective evidence from Eastern Finland. *Am J Epidemiol* 1988;128:370-80.
45. Kawachi I, Colditz GA, Ascherio A, et al. A prospective study of social networks in relation to total mortality and cardiovascular disease in men in the U.S. *J Epidemiol Commun Health* 1996;50:245-51.
46. Berkman LF, Leo-Summers L, Horwitz RI. Emotional support and survival after myocardial infarction: a prospective population-based sample of the elderly. *Ann Intern Med* 1992;117:1003-9.
47. Case RB, Moss AJ, Case N, McDermott M, Eberly S. Living alone after myocardial infarction. Impact on prognosis. *JAMA* 1992;267:515-9.
48. Ruberman W, Weinblatt E, Goldberg JD, Chauhary BS. Psychosocial influences on mortality after myocardial infarction. *N Engl J Med* 1984;13:641-54.
49. Williams RB, Barefoot JC, Califf RM, et al. Prognostic importance of social and economic resources among medically treated patients with angiographically documented coronary artery disease. *JAMA* 1992;267:520-4.
50. Vogt TM, Mullooly JP, Ernst D, Pope CR, Hollis JF. Social networks as predictors of ischemic heart disease, cancer, stroke and hypertension: incidence, survival, mortality. *J Clin Epidemiol* 1992;45:659-66.

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51. Ickovics JF. Functional recovery after myocardial infarction in men: The independent effects of social class. *Ann Intern Med* 1997;127:518-25.
52. Kawachi I, Kennedy BP. Health and social cohesion: why care about income inequality. *BMJ* 1997;314:1037-40.
53. Wilkinson RG. *Unhealthy Societies: The Afflictions of Inequality*. London: Routledge, 1996.

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Section 6: Risk factors for stroke - Image

Stephen Phillips MD

Stroke is a generic term for a syndrome - recognized clinically as the sudden onset of a focal disturbance of central nervous system function - that may be caused by three distinct pathological entities: cerebral infarction, intracerebral hemorrhage and subarachnoid hemorrhage (1). This paper focuses on cerebral infarction, which accounts for about 80% of all strokes. The first part concerns atherosclerosis risk factors as they relate to stroke; the second part deals with selected stroke-specific risk factors.

CLASSIC RISK FACTORS

Hypertension: Hypertension is the most important modifiable risk factor for cerebral infarction and intracerebral hemorrhage (2). Hypertension increases the risk of ischemic stroke at age 50 years by a factor of five (3). Randomized trials have shown that antihypertensive treatment reduces the frequency of first stroke by about 40%.

Diabetes mellitus: Diabetes approximately doubles the risk of ischemic stroke (3).

Smoking: Smoking is a risk factor for cerebral infarction and for subarachnoid hemorrhage (4). Nicotine replacement therapy facilitates smoking cessation (5). Long term abstinence, however, is difficult to achieve, and may require a combination of behavioural and pharmacological approaches.

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Hyperlipidemia: The role of hyperlipidemia in the pathogenesis of stroke has been difficult to establish. This is probably because atherothromboembolism is only one of several pathophysiological mechanisms that can produce a stroke syndrome. Studying stroke in the aggregate may mask an association with serum cholesterol if the association is confined to one particular subtype of stroke or if the associations with different stroke subtypes are in opposite directions. For example, some epidemiological studies have shown a J-shaped association between stroke and serum cholesterol concentrations - the incidence of ischemic stroke increasing with increasing cholesterol levels, but lower cholesterol levels being associated with a higher incidence of intracerebral hemorrhage (6). On the other hand, a large review of prospective cohort studies found no association between serum cholesterol levels and stroke (7).

Randomized trials of lipid-lowering treatment have not shown an effect on the *primary* prevention of stroke (8-10). Nor are there any published large trials of the effects of lipid-lowering treatment specifically in stroke patients. Meta-analyses of trials of lipid-lowering treatment in patients with coronary artery disease, however, have shown statistically significant and clinically important reductions in the incidence of fatal and nonfatal stroke (8-10). The estimated relative risk reduction of about 25% is similar to that produced by antiplatelet therapy in this population of patients.

Indirect (between studies rather than within studies) comparisons suggest that stroke is reduced by treatment with hepatic hydroxymethylglutaryl coenzyme A (HMG CoA) reductase inhibitors ('statins') but not by dietary intervention or by treatment with resins or fibrates (10). It is not clear whether this is because cholesterol lowering has to be quite substantial before an effect is seen, or because statins work in other ways such as by stabilizing atherosclerotic plaques or by improving the function of vascular endothelial cells (11). Trials with HMG CoA reductase inhibitors also showed reductions in coronary artery disease mortality and all-cause mortality (10).

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Stroke patients frequently have ischemic heart disease and are at high risk of coronary events. Evidence suggests that stroke patients under the age of 75 years who have elevated serum cholesterol levels should be considered for treatment with a statin drug (**Level I, Grade B**). Older patients may also benefit from treatment, but they were not included in the published trials.

Alcohol: Observational studies have shown a J-shaped relationship between alcohol intake and stroke. Occasional to light alcohol consumption is protective, whereas heavy alcohol use (five or more drinks/day) is an independent risk factor for ischemic stroke (12). How alcohol protects against stroke is unknown. Heavy alcohol intake aggravates hypertension and may induce emboligenic cardiac problems such as atrial fibrillation (AF) and congestive cardiomyopathy. Alcohol may also have prothrombotic effects on platelet function and hemostatic mechanisms. Controlled alcohol intake is an important component of stroke prevention.

Diet: The links between diet and stroke are obscure. Nutrition counselling for patients who have had a stroke or transient ischemic attack (TIA) usually focuses on optimizing blood glucose control (in diabetic patients), and on reducing saturated fat intake and increasing the intake of vegetables, fruit and dietary fibre, in accordance with the recommendations given in the chapter on diet.

Exercise: Leisure time physical activity is associated with a decreased risk of ischemic stroke (13). It is not known whether a program of increased physical activity after a stroke or TIA protects against recurrent vascular events. In the absence of contraindications, patients who have had a stroke or TIA may exercise in accordance with the recommendations given in the chapter on physical activity.

Oral contraceptives: An association between use of oral contraceptives and cerebral infarction was established in case-control and cohort studies during the 1960s and 1970s (14) when oral contraceptive formulations typically contained 80 or 100 µg of estrogen. Most strokes in these studies occurred in women older than 35 years who had other risk factors. Data concerning hemorrhagic stroke have been more controversial.

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Recent case-control studies have shown that the risk of ischemic stroke among healthy women of childbearing age is not increased by the use of low dose estrogen (less than 50 µg) oral contraceptive preparations (15,16). The relative risk of stroke is increased among oral contraceptive users who smoke or who are hypertensive, but the absolute risk of stroke for these individuals is very low (15,17,18). Concerns persist about a possible increase in the risk of intracerebral hemorrhage and subarachnoid hemorrhage among women aged 35 years or more (15,18).

The decision to prescribe an oral contraceptive requires consideration of the other risks and benefits of oral contraception, as well as those associated with the use of other methods of birth control. In general, however, the use of low dose estrogen oral contraceptive preparations should be confined to women under the age of 35 years who do not smoke and do not have hypertension (**Level II, Grade A**).

Hormone replacement therapy: Observational studies have shown no consistent relationship between stroke and hormone replacement therapy (HRT) in postmenopausal women (19-21). There was no statistically significant effect of HRT on the frequency of stroke and TIA in a large randomized trial of conjugated equine estrogens plus medroxyprogesterone acetate versus placebo in postmenopausal women who were younger than 80 years with coronary artery disease (and an intact uterus) followed for an average of four years (22). HRT is not recommended for prevention of stroke in postmenopausal women (**Level I, Grade D**).

STROKE-SPECIFIC RISK FACTORS

Atrial fibrillation: AF is an important risk factor for cerebral infarction. AF secondary to rheumatic heart disease, fortunately now uncommon, is associated with about an 18-fold increase in the risk of stroke (23). Nonrheumatic AF, present in almost 10% of the population 65 years of age or older (24), increases the risk by a factor of five (3,25,26).

Prevention of stroke in patients with nonrheumatic AF has been examined in several clinical trials (27-29). Warfarin, at a dose sufficient to produce an international normalized ratio in the

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range 2.0 to 3.0, is recommended for the prevention of stroke in patients who have intermittent or persistent AF and a history of hypertension, poor left ventricular function (moderate to severe left ventricular dys-function on echocardiography or recent congestive heart failure), rheumatic mitral valve disease or a thromboembolic event (including a TIA or nondisabling stroke in the previous few weeks) (30,31) (**Level I, Grade A**).

Acetylsalicylic acid (ASA) at a dose of 325 mg daily is recommended for patients who decline warfarin, who are not candidates for anticoagulation or who are younger than 65 years with no other vascular disease risk factors (**Level I, Grade A**) (30,31).

Carotid occlusive disease: In this section, percentage reductions in the luminal diameter of the internal carotid artery refer to measurements taken from a cerebral angiogram by the method used in the North American Symptomatic Carotid Endarterectomy Trial (NASCET) (32).

Among patients who experience a carotid territory TIA or nondisabling stroke, have angiographic evidence of severe (70% or more) ipsilateral carotid stenosis, and are treated with antithrombotic drugs and risk factor modification, the risk of major stroke or death over the subsequent two years is almost 20% (32,33). This risk is lower with lesser degrees of carotid stenosis. If the carotid stenosis is moderately severe, the two-year risk of major stroke or death is less than 10% (34,35). For mild carotid stenosis, the risk is less than 5% (33,36). Carotid stenosis in patients who have never had a stroke or TIA is associated with about a 2% average annual risk of ipsilateral ischemic stroke (37). The gradient of risk associated with varying degrees of carotid stenosis in asymptomatic patients is less clear than in symptomatic patients. Patients with asymptomatic carotid stenosis do not seem to benefit from treatment with ASA (38).

Successful carotid endarterectomy - performed within six months of carotid territory TIA or nondisabling stroke in patients with angiographic evidence of severe (70% or more) ipsilateral carotid stenosis - reduces the risk of major stroke or death over the subsequent two years by more than 50% (32,33). Endarterectomy is only modestly beneficial in patients with moderately severe symptomatic carotid stenosis (34,35). In patients who have mild carotid stenosis, the

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risk of surgical complications outweighs any long term benefit from the operation (33,35). The role of endarterectomy in patients with asymptomatic carotid stenosis is unclear (37,39-42).

Carotid endarterectomy is recommended for patients with symptomatic, surgically accessible internal carotid artery stenosis of 70% to 99%, provided that, first, there is no worse distal, ipsilateral, carotid system disease; second, the patient is in stable medical condition; and third, the rate of major surgical complications (stroke and death) among patients of the treating surgeon is less than 6% (**Level I, Grade A**) (39).

Carotid endarterectomy is not recommended for patients with symptomatic internal carotid artery stenosis of less than 50% (**Level I, Grade D**) (33,35,36).

Table 1

Factors that influence the risk of carotid stenosis, carotid endarterectomy and stroke

Factors associated with an increased risk of stroke without endarterectomy
<ul style="list-style-type: none"> • Nature of ischemic event (stroke > transient ischemic attack > none) • Localization of ischemic event (hemisphere > retina) • Severity of internal carotid artery stenosis
Factors associated with an increased risk of stroke or death from endarterectomy
<p>Demographic factors</p> <ul style="list-style-type: none"> • Female sex <p>Age 75 years or more</p> <ul style="list-style-type: none"> • Elevated blood pressure • Diabetes • Peripheral vascular disease • History of congestive heart failure <p>Neurological factors</p> <ul style="list-style-type: none"> • Left carotid disease • Cerebral infarct visible on computed tomography or magnetic resonance scan

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Angiographic factors

- Ipsilateral carotid siphon stenosis
- Ipsilateral external carotid artery stenosis
- Contralateral carotid occlusion

Surgical factors

- Endarterectomy performed in combination with coronary artery bypass

The data do not allow the formulation of firm recommendations for carotid endarterectomy in patients who have moderately severe symptomatic carotid stenosis or for patients who have asymptomatic carotid stenosis.

In the NASCET (35), patients with symptomatic moderate (50% to 69%) carotid stenosis treated surgically had a five-year ipsilateral stroke risk of 15.7%; for patients treated medically the risk was 22.2% ($P=0.045$). In other words, 15 patients would need to be treated by endarterectomy to prevent one ipsilateral stroke at five years (which is about double the figure for patients with symptomatic, 70% to 99% stenosis). Benefit was greatest among men, patients with recent stroke (rather than TIA) as the qualifying event and patients with hemispheric (rather than retinal) symptoms. Data from the trial also indicated that no net benefit accrues from endarterectomy for symptomatic, moderately severe carotid stenosis if the perioperative risk of disabling stroke and death exceeds 2%.

A systematic review (41) of the randomized trials of carotid endarterectomy for asymptomatic carotid stenosis of 50% or more showed that about 50 patients would have to undergo surgery to prevent one ipsilateral stroke over three years. The Canadian Stroke Consortium does not recommend screening and endarterectomy for asymptomatic carotid stenosis (42). The Canadian Neurosurgical Society considers asymptomatic carotid stenosis of more than 60% to be an “uncertain indication” for endarterectomy (39). The Asymptomatic Carotid Surgery Trial (43,44) (in progress) is anticipated to help clarify the role of endarterectomy in this patient population. Additional studies are required to determine the role of the operation in patients with carotid stenosis who require major surgery below the neck.

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Patients may be expected to benefit from endarterectomy if they are at high risk of stroke over two to three years when treated medically *and* if they are at low risk of perioperative stroke. Various factors influence these risks (Table 1) (34,35,45,46). The decision to operate on a particular patient requires that the risks and benefits be carefully weighed. Data from about 10,000 patients in trials and large observational studies are being used to derive mathematical models that will help clinicians select patients most likely to benefit from surgery (47).

The role of carotid angioplasty and stenting in the management of carotid artery disease is unclear. One small randomized trial (48) showed no benefit of carotid angioplasty over endarterectomy. Another trial (49) of carotid angioplasty and stenting versus carotid endarterectomy was stopped prematurely because five of the seven patients who underwent angioplasty had a stroke. More trials are required.

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REFERENCES

1. Whisnant JP, Basford JR, Bernstein EF, et al. Classification of cerebrovascular diseases III. Special report from the National Institute of Neurological Disorders and Stroke. Stroke 1990;21:637-76.
2. Phillips SJ, Whisnant JP, on behalf of the National High Blood Pressure Education Program. Hypertension and the brain. Arch Intern Med 1992;152:938-45.
3. Whisnant JP, Wiebers DO, O'Fallon WM, Sicks JD, Frye RL. A population-based model of risk factors for ischemic stroke. Neurology 1996;47:1420-8.
4. Donnan GA, You R, Thrift A, McNeill JJ. Smoking as a risk factor for stroke. Cerebrovasc Dis 1993;3:129-138.
5. Silagy C, Mant D, Fowler G, Lodge M. Meta-analysis on efficacy of nicotine replacement therapies in smoking cessation. Lancet 1994;343:139-42.
6. Neaton JD, Blackburn H, Jacobs D, et al. Serum cholesterol level and mortality findings for men screened in the Multiple Risk Factor Intervention Trial. Arch Intern Med 1992;152:1490-500.
7. Cholesterol, diastolic blood pressure, and stroke: 13,000 strokes in 450,000 people in 45 prospective cohorts. Prospective studies collaboration. Lancet 1995;346:1647-53.
8. Crouse JR III, Byington RP, Hoen HM, Furberg CD. Reductase inhibitor monotherapy and stroke prevention. Arch Intern Med 1997;157:1305-10.
9. Hebert PR, Gaziano JM, Chan KS, Hennekens CH. Cholesterol lowering with statin drugs, risk of stroke, and total mortality. An overview of randomized trials. JAMA 1997;278:313-21.
10. Bucher HC, Griffith LE, Guyatt GH. Effect of HMGcoA reductase inhibitors on stroke. A meta-analysis of randomized, controlled trials. Ann Intern Med 1998;128:89-95.

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11. Endres M, Laufs U, Huang Z, et al. Stroke protection by 3-hydroxy-3-methylglutaryl (HMG)-CoA reductase inhibitors mediated by endothelial nitric oxide synthase. *Proc Natl Acad Sci USA* 1998;95:8880-5.
12. Sacco RL, Elkind M, Boden-Albala B, et al. The protective effect of moderate alcohol consumption on ischemic stroke. *JAMA* 1999;281:53-60.
13. Sacco RL, Gan R, Boden-Albala B, et al. Leisure-time physical activity and ischemic stroke risk. The Northern Manhattan Stroke Study. *Stroke* 1998;29:380-7.
14. Longstreth WT, Swanson PD. Oral contraceptives and stroke. *Stroke* 1984;15:747-50.
15. Petitti DB, Sidney S, Bernstein A, Wolf S, Quesenberry C, Ziel HK. Stroke in users of low-dose oral contraceptives. *N Engl J Med* 1996;335:8-15.
16. Schwartz SM, Siscovick DS, Longstreth WT, et al. Use of low-dose oral contraceptives and stroke in young women. *Ann Intern Med* 1997;127:596-603.
17. WHO Collaborative Study of Cardiovascular Disease and Steroid Hormone Contraception. Ischaemic stroke and combined oral contraceptives: results of an international, multicentre, case-control study. *Lancet* 1996;348:498-505.
18. WHO Collaborative Study of Cardiovascular Disease and Steroid Hormone Contraception. Haemorrhagic stroke, overall stroke risk, and combined oral contraceptives: results of an international, multicentre, case-control study. *Lancet* 1996;348:505-10.
19. Grady D, Rubin SM, Petitti DB, et al. Hormone therapy to prevent disease and prolong life in postmenopausal women. *Ann Intern Med* 1992;117:1016-37.
20. Paganini-Hill A. Estrogen replacement therapy and stroke. *Prog Cardiovasc Dis* 1995;38:223-42.
21. Pedersen AT, Lidegaard Ø, Kreiner S, Ottesen B. Hormone replacement therapy and risk of non-fatal stroke. *Lancet* 1997;350:1277-83.

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22. Hulley S, Grady D, Bush T, et al, for the Heart and Estrogen/progestin Replacement Study (HERS) Research Group. Randomized trial of estrogen plus progestin for secondary prevention of coronary heart disease in postmenopausal women. JAMA 1998;280:605-13.
23. Wolf PA, Dawber TR, Thomas E Jr, Kannel WB. Epidemiologic assessment of chronic atrial fibrillation and risk of stroke: The Framingham Study. Neurology 1978;28:973-7.
24. Phillips SJ, Whisnant JP, O'Fallon WM, Frye RL. The prevalence of cardiovascular disease and diabetes mellitus in Rochester, Minnesota. Mayo Clin Proc 1990;65:344-59.
25. Cairns JA, Connolly SJ. Nonrheumatic atrial fibrillation: Risk of stroke and role of antithrombotic therapy. Circulation 1991;84:469-81.
26. Laupacis A, Cuddy TE. Prognosis of individuals with atrial fibrillation. Can J Cardiol 1996;12(Suppl A)14A-6A.
27. Atrial Fibrillation Investigators. Risk factors for stroke and efficacy of antithrombotic therapy in atrial fibrillation. Analysis of pooled data from five randomized controlled trials. Arch Intern Med 1994;154:1449-57.
28. European Atrial Fibrillation Trial Study Group. Secondary prevention in nonrheumatic atrial fibrillation after transient ischaemic attack or minor stroke. Lancet 1993;342:1255-62.
29. European Atrial Fibrillation Trial Study Group. Optimal oral anticoagulant therapy in patients with nonrheumatic atrial fibrillation and recent cerebral ischaemia. N Engl J Med 1995;333:5-10.
30. Laupacis A, Albers G, Dalen J, Dunn MI, Jacobson AK, Singer DE. Antithrombotic therapy in atrial fibrillation. Chest 1998;114:579S-89S.
31. Connolly SJ, Turpie AGG. Antithrombotic therapy in atrial fibrillation. Can J Cardiol 1996;12(Suppl A)17A-20A.

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32. North American Symptomatic Carotid Endarterectomy Trial Collaborators. Beneficial effect of carotid endarterectomy in symptomatic patients with high-grade carotid stenosis. N Engl J Med 1991;325:445-53.
33. European Carotid Surgery Trialists' Collaborative Group. MRC European Carotid Surgery Trial: interim results for symptomatic patients with severe (70-90%) or with mild (0-29%) carotid stenosis. Lancet 1991;337:1235-43.
34. European Carotid Surgery Trialists' Collaborative Group. Randomised trial of endarterectomy for recently symptomatic carotid stenosis: final results of the MRC European Carotid Surgery Trial (ECST). Lancet 1998;351:1379-87.
35. Barnett HJM, Taylor DW, Eliasziw M, et al, for the North American Symptomatic Carotid Endarterectomy Trial Collaborators. Benefits of carotid endarterectomy in patients with symptomatic moderate or severe stenosis. N Engl J Med 1998;339:1415-25.
36. European Carotid Surgery Trialists' Collaborative Group. Endarterectomy for moderate symptomatic stenosis: interim results from the MRC European Carotid Surgery Trial. Lancet 1996;347:1591-3.
37. Warlow C. Surgical treatment of asymptomatic carotid stenosis. Cerebrovasc Dis 1996;6(Suppl 1):7-14.
38. Côté R, Battista RN, Abrahamowicz M, Langlois Y, Bourgue F, Mackey A, and the Asymptomatic Cervical Bruit Study Group. Lack of effect of aspirin in asymptomatic patients with carotid bruits and substantial carotid narrowing. Ann Intern Med 1995;123:649-65.
39. Findlay JM, Tucker WS, Ferguson GG, Holness RO, Wallace MC, Wong JH. Guidelines for the use of carotid endarterectomy: current recommendations from the Canadian Neurosurgical Society. Can Med Assoc J 1997;157:653-9.

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40. Barnett HJM, Eliasziw M, Meldrum HE, Taylor DW. Do the facts and figures warrant a 10-fold increase in the performance of carotid endarterectomy on asymptomatic patients? *Neurology* 1996;46:603-8.
41. Benavente O, Moher D, Pham B. Carotid endarterectomy for asymptomatic carotid stenosis: a meta-analysis. *BMJ* 1998;317:1477-80.
42. Perry JR, Szalai JP, Norris JW, for the Canadian Stroke Consortium. Consensus against both carotid endarterectomy and routine screening for asymptomatic carotid artery stenosis. *Arch Neurol* 1997;54:25-8.
43. Halliday AW. The Asymptomatic Carotid Surgery Trial (ACST): Rationale and design. *Eur J Vasc Surg* 1994;8:703-10.
44. Chaturvedi S, Halliday A. Is another clinical trial warranted regarding endarterectomy for asymptomatic carotid stenosis? *Cerebrovasc Dis* 1998;8:210-3.
45. Rothwell PM, Slattery J, Warlow CP. Clinical and angiographic predictors of stroke and death from carotid endarterectomy: systematic review. *BMJ* 1997;315:1571-7.
46. Goldstein LB, Samsa GP, Matchar DB, Oddone EZ. Multicentre review of preoperative risk factors for endarterectomy for asymptomatic carotid stenosis. *Stroke* 1998;29:750-3.
47. Warlow C. Carotid endarterectomy for asymptomatic carotid stenosis. *BMJ* 1998;317:468.
48. Brown MM for the CAVATAS investigators. Results of the Carotid and Vertebral Artery Transluminal Angioplasty Study (CAVATAS). *Cerebrovasc Dis* 1998;8(Suppl 4):21. (Abst)
49. Naylor AR, Bolia A, Abbott RJ, et al. Randomized study of carotid angioplasty and stenting versus carotid endarterectomy: A stopped trial. *J Vasc Surg* 1998;28:326-34.

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Section 7: Risk Factors for Peripheral Arterial Disease - Peripheral Arterial Disease

Stefan A Carter MD

Peripheral arterial disease (PAD) is a common disorder usually due to atherosclerotic changes in the arteries supplying particularly the lower extremities. Patients with clinical or subclinical PAD must be included in any preventive strategy for cardiovascular diseases (CVD). The reasons are not simply the effects on the limbs but, of importance, that recent data demonstrate that patients with PAD have a profoundly increased risk of cardiovascular ischemic events and mortality. Simple, noninvasive measurements of ankle pressure provide a powerful tool for detecting and quantifying the severity of the arterial obstruction and may allow assignment of the degree of risks.

PREVALENCE AND RISKS OF CARDIOVASCULAR EVENTS AND MORTALITY

Intermittent claudication and asymptomatic disease: Intermittent claudication is the common presentation. The presence of PAD in patients who complain of exercise-related leg pain can usually be established by history and physical examination. Questionnaires can be used in epidemiological studies (1,2). The prevalence of intermittent claudication is estimated to increase from 1% below the age of 50 years to 3% to 10% between the ages of 60 and 70 years, and over 10% in older patients (3-5). However, the prevalence of PAD based on the

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symptoms grossly underestimates the existence of the disease. The prevalence based on the finding of decreased ankle to brachial blood pressure ratio or index (ABI) is at least three times higher (6,7). This indicates that symptomatic PAD is but a tip of the iceberg, with a large proportion of patients with silent atherosclerosis who can be identified by measuring ABI.

Measurement of ABI provides an easy and reliable method that lends itself to wide use. Although simple, taking measurements requires care in order to obtain reliable results. ABI correlates well with angiographic findings, and has high sensitivity and specificity (8,9). One limitation is 'incompressibility' of the tibial arteries, which may preclude reliable measurements. This phenomenon occurs in about 15% of diabetic patients referred to vascular laboratories and in a smaller percentage of patients with renal disease, on corticosteroid therapy, following cardiac transplantation and in some whose age approaches or exceeds 80 years (10). If falsely high pressures are suspected, patients may be referred to vascular laboratories for more sophisticated tests. Screening may also be carried out by such laboratories.

It is well appreciated that patients with PAD have a high incidence of clinical or subclinical disease of the arteries supplying the heart and the brain, and that patients with ischemic heart disease (IHD) and cerebrovascular disease often have PAD. Although there is little reliable information on the degree of overlap between arterial disease in the three territories, relevant studies suggest that, among patients with symptomatic atherosclerosis in one or more territories, nearly 15% have PAD without manifestations in the cardiac or cerebral circulation (11). Because asymptomatic PAD is about three times as common as symptomatic disease, a large cohort with silent atherosclerosis can be identified and targeted for appropriate preventive interventions.

Recent studies demonstrate that patients with symptomatic and asymptomatic PAD who present with an abnormal ABI are at excessive risk of total and cardiovascular mortality. The risk of cardiovascular mortality is increased about five times in asymptomatic patients who only have a low ABI and more than 10 times in the presence of symptomatic PAD (12). Also, several studies indicate that the risks increase with the severity of the obstruction as

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determined by the values of ABI (5,12,13). The increased risks of total and cardiovascular mortality are present after controlling for age, sex, smoking, blood pressure, and cholesterol, triglyceride and fasting plasma glucose levels. Numerous reports indicate that, in patients with claudication, abnormal ABI is associated with an odds ratio for total mortality of near 3.0, whereas the presence of IHD, increase in age of 10 years, male sex, smoking, diabetes and hypertension are associated with ratios between 1.0 and 2.0. Thus, ABI is a powerful predictor of total and cardiovascular mortality, and measurements of ABI need to be incorporated into screening programs.

Critical limb ischemia: Critical limb ischemia (CLI) denotes severe, usually multilevel, arterial obstruction associated with breakdown of the skin (ulcer or gangrene) or pain in the foot at rest. There is little direct information on the incidence of CLI. Estimates suggest that it is in the order of 500/million people/year (14).

The risks for development of CLI are the same as those for the progression of atherosclerosis and its complications. Smoking and diabetes are the most important. The prevalence of gangrene is 20 to 30 times higher in diabetic than in nondiabetic patients, and the percentage of amputees with diabetes varies between 25% and 50% (15,16).

Prognosis of patients with CLI is comparable with that of virulent malignancies. The rates of major amputation and mortality are reported to vary between 10% and 20%/year (17), but in some studies, especially in patients with advanced disease in whom arterial reconstruction cannot be carried out, yearly mortality and amputation rates may approach 50% (18).

It is not clear why patients with PAD have such excessive risks. PAD may be a marker of extensive, generalized athero-sclerosis or of increased tendency to sudden thrombotic events. Also, there is evidence that underperfusion or lack of perfusion leads to events in the microcirculation of the limbs with arterial disease (17,19) and results in changes in remote vascular beds (20). These effects of ischemia have been shown in patients with CLI and after intermittent ischemia associated with claudication.

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MANAGEMENT

Modification of risk factors: Smoking and diabetes, and to a lesser extent hypertension and dyslipidemia, are associated with increased risk of developing intermittent claudication and of progression of PAD (21-23). Although evidence in the case of PAD is less extensive than in the case of IHD and CVD, modification of the risk factors for atherosclerosis has a beneficial effect on prognosis. Stopping smoking was reported to increase the chance of improvement in ankle pressure and the walking distance in intermittent claudication (24), and to improve the late patency after arterial reconstruction (25). Improvement in plasma lipid levels appears to have a beneficial effect on atherosclerotic lesions assessed by angiography, and on the development and progression of PAD (26-28). Similarly, good control of diabetes and treatment of hypertension may have beneficial effects (26,29).

Walking exercise programs: Walking exercise is the accepted primary treatment of intermittent claudication. Many studies demonstrated that walking programs resulted in significant improvement in the walking ability as assessed by treadmill walking, walking impairment questionnaires, and social functioning and well being questionnaires (30-32). Timing of free walking showed that over 80% of patients were able to walk continuously more than 2 km without significant discomfort after participating for three months in a program of walking 1 h three times a week (30). Although intermittent ischemia induced by claudication induces reperfusion injury in the ischemic muscles, early work suggests that exercise attenuates this response (33). Remarkably, exercise training was reported to result in walking ability and quality of life as good as or better than that provided by percutaneous transluminal angioplasty (34,35).

Antithrombotic therapy: The US Physicians' Health Study showed that low dose acetylsalicylic acid (ASA) reduced the risk for peripheral arterial surgery in apparently healthy men, an example of primary prevention of PAD (36). Individual studies, as well as meta-analyses, show that antiplatelet drugs such as ASA, ticlopidine or clopidogrel have beneficial effects on the progression and regression of stenotic lesions, and reduce strokes, myocardial infarction and the limb events (26,37-39). Both direct and indirect evidence indicates that antiplatelet therapy reduces cardiovascular mortality in patients with PAD.

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Oral anticoagulants: Oral anticoagulants, such as warfarin, may have beneficial effects in patients with PAD after arterial reconstruction, and in those with vascular thrombosis and hypercoagulable states (26).

Other drugs: Although pentoxifylline showed statistically significant improvements in treadmill walking, this and similar drugs have an effect that is too small to recommend their routine use (40,41). Their effects are inferior to the excellent results of the walking programs. They may be tried in individual patients who are not motivated to participate in or do not respond well to exercise programs.

Newer drugs such as cilostazol and gene therapy are being tested and may have beneficial effects (42,43). At present, there is insufficient evidence to recommend their use.

Review of randomized, double-blind, multicentre trials of intravenous infusions of EDTA in patients with PAD showed no significant effects on walking distance or ABI. Thus, there is no scientific basis for the use of chelation therapy in the treatment of PAD (44). Quality-of-life effects of chelation are being assessed in a controlled trial. Frequent infusions of EDTA may produce severe hypocalcemia and therefore may be dangerous.

Transcutaneous angioplasty and arterial reconstruction:

Transcutaneous angioplasty and arterial reconstruction can eliminate arterial obstruction. While highly effective in relieving intermittent claudication, they are recommended only in selected patients. This is because exercise therapy is highly effective, the invasive treatment has not been proven to improve prognosis of the patients, reocclusion occurs in a significant percentage over time, and there are significant perioperative risks and costs. In limbs with severe CLI, arterial reconstruction, if technically feasible, is the treatment of choice.

Other forms of physical therapy: Limited walking (eg, walking across a room) and intermittent venous compression decrease venous pressure and increase arteriovenous pressure gradient. These events result in large increases in blood flow, increase transcutaneous oxygen tension and may assist with healing of skin ulcers (45-48). Symptoms of intermittent claudication may

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also be improved by the use of such devices. More definitive studies are needed to determine the value and the role of such therapy.

RECOMMENDATIONS

Measurements of ABI need to be incorporated into screening programs for prevention of atherosclerotic CVD to identify cohorts with increased risk of cardiovascular events and mortality in the population above 40 to 50 years of age.

Patients with symptoms of PAD and asymptomatic patients with abnormal ABI (0.90 to 0.95 or less) should be assessed for the presence of risk factors for atherosclerosis (**Level I, Grade A**).

Any other cardiovascular risk factors that may be present need to be vigorously modified.

Patients with symptomatic or asymptomatic PAD should be placed on antiplatelet therapy in the absence of specific contraindications (**Level I, Grade A**).

Patients with intermittent claudication should be treated with ongoing walking exercise programs. While supervised programs may give superior results, home-based programs and walking in shopping malls during inclement weather are also of benefit (**Level II, Grade B**).

Foot care must be promoted vigorously for all patients with PAD and in elderly patients with and without diabetes by physicians and in community-wide programs to prevent development of skin lesions.

Programs for management of skin lesions with early referral to vascular specialists should be promoted to decrease the incidence of amputations.

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RESEARCH RECOMMENDATIONS

Patients with symptomatic and asymptomatic PAD should be included in studies of primary and secondary prevention, and of therapies aimed at ameliorating atherosclerosis and its complications.

Studies are needed to determine the degree of overlap in the coexistence of PAD, IHD and cerebrovascular disease, and to determine the outcomes in subgroups with one or more of these manifestations.

The cost effectiveness of various interventions needs to be studied in patients with PAD.

The effects of arterial reconstruction and of transcutaneous angioplasty on long term cardiovascular morbidity and mortality in patients with PAD need to be assessed.

Studies are needed to determine noninvasive vascular tests or their combinations that best predict the outcome to the limb and life of patients with PAD.

More studies are needed to determine the effects of limited walking, intermittent venous compression and other physical therapies in patients with PAD.

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REFERENCES

1. Rose GA, McCartney P, Reid DD. Self-administration of a questionnaire on chest pain and intermittent claudication. Br J Prev Soc Med 1977;31:42-8.
2. Regensteiner JG, Steiner JF, Panzer RJ, Hiatt WR. Evaluation of walking impairment by questionnaire in patients with peripheral arterial disease. J Vasc Med Biol 1990;2:142-56.
3. Schroll M, Munch O. Estimation of peripheral arteriosclerotic disease by ankle blood pressure measurements in a population study of 60-year-old men and women. J Chronic Dis 1981;34:261-9.
4. Fowkes FGR. Epidemiology of atherosclerotic arterial disease in the lower limbs. Eur J Vasc Surg 1988;2:283-91.
5. Vogt MT, Cauley JA, Newman AB, Kuller LH, Hulley SB. Decreased ankle/arm blood pressure index and mortality in elderly women. JAMA 1993;270:465-9.
6. Criqui MH, Fronek A, Barrett-Connor E, et al. The prevalence of peripheral arterial disease in a defined population. Circulation 1985;71:510-5.
7. Stoffers HE, Rinkens PE, Kester AD, Kaiser V, Knottnerus JA. The prevalence of asymptomatic and unrecognized peripheral arterial occlusive disease. Int J Epidemiol 1996;25:282-90.
8. Carter SA. Clinical measurement of systolic pressures in limbs with arterial occlusive disease. JAMA 1969;207:1869-74.
9. Yao ST. New techniques of objective arterial evaluation. Arch Surg 1973;106:600-4.
10. Carter SA. Role of pressure measurements. In: Bernstein EF, ed. Vascular Diagnosis. St Louis: Mosby Publishers, 1993:471-80.

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11. Aronow WS, Ahn C. Prevalence of coexistence of coronary artery disease, peripheral arterial disease, and atherothrombotic brain infarction in men and women 62 years of age. *Am J Cardiol* 1994;74:64-5.
12. Criqui MH, Langer RD, Fronek A, et al. Mortality over a period of 10 years in patients with peripheral arterial disease. *N Engl J Med* 1992;326:381-6.
13. O’Riordain DS, O’Donnell JA. Realistic expectations for the patient with intermittent claudication. *Br J Surg* 1991;78:861-3.
14. The Vascular Surgical Society of Great Britain and Ireland. Critical limb ischaemia: management and outcome. Report of a national survey. *Eur J Vasc Endovasc Surg* 1995;10:108-13.
15. Amputation Statistics for England, Wales and Northern Ireland. London: Department of Health and Social Security, 1986.
16. Porter JM, Baur GM, Taylor LM. Lower-extremity amputations for ischaemia. *Arch Surg* 1981;116:89-92.
17. European Working Group on Critical Leg Ischemia. Second European consensus document on chronic critical leg ischemia. *Circulation* 1991;84(Suppl IV):IV1-IV26.
18. Belch JJF, Diehm C, Söhngen M, Söhngen W. Critical limb ischaemia: a case against consensus II. *Int Angiol* 1995;14:353-6.
19. Lowe GDO, Rumley A, Tooke JE. Clinical pathophysiology of arterial disease. In: Tooke JE, Lowe GDO, eds. *A Textbook of Vascular Medicine*. Oxford: Oxford University Press, 1996:43-59.
20. Green MA, Shearman CP. Reperfusion injury in peripheral vascular disease. *Vasc Med Rev* 1994;5:97-106.

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21. Dagenais GR, Maurice S, Robitaille N-M, Gingras S, Lupien PJ. Intermittent claudication in Quebec men from 1974-1986: the Quebec cardiovascular study. Clin Invest Med 1991;14:93-100.
22. Cantin B, Moorjani S, Dagenais GR, Lupien PJ. Lipoprotein(a) distribution in a French Canadian population and its relation to intermittent claudication (The Quebec Cardiovascular Study). Am J Cardiol 1995;75:1224-8.
23. Murabito JM, D'Agostino RB, Silbershatz H, Wilson PWF. Intermittent claudication: A risk profile from the Framingham Heart Study. Circulation 1997;96:44-9.
24. Quick C, Cotton L. The measured effect of stopping smoking on intermittent claudication. Br J Surg 1982;69(Suppl):S24-6.
25. A report of the Surgeon General: The Health consequences of smoking: Cardiovascular disease. Rockville: US Department of Health and Human Services, Public Health Service, Office on Smoking and Health, 1983.
26. Carter SA. Life style modification and drug therapy in peripheral atherosclerosis. In: Strandness DE, Didisheim P, Clowes AW, Watson JT, eds. Vascular Diseases - Current Research and Clinical Applications. Orlando: Gruene & Stratton 1987:105-17.
27. Buchwald H, Bourdages HR, Campos CT, Nguyen P, Williams SE, Boen JR. Impact of cholesterol reduction on peripheral arterial disease in the program on the surgical control of the hyperlipidemias (POSCH). Surgery 1996;120:672-9.
28. Hirsch AT, Treat-Jacobson D, Lando HA, Hatsukami DK. The role of tobacco cessation, antiplatelet and lipid-lowering therapies in the treatment of peripheral arterial disease. Vasc Med 1997;2:243-51.
29. Orchard TJ, Strandness DE, Cavanagh PR, et al. Assessment of peripheral vascular disease in diabetes. Report and recommendations of an international workshop. Circulation 1993;88:819-28.

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30. Carter SA, Hamel ER, Paterson JM, Snow CJ, Mymmin D. Walking ability and ankle systolic pressures: Observations in patients with intermittent claudication in a short-term walking exercise program. J Vasc Surg 1989;10:642-9.
31. Hiatt WR, Regensteiner JG, Hargarten ME, Wolfe EE, Brass EP. Benefit of exercise conditioning for patients with peripheral arterial diseases. Circulation 1990;81:602-9.
32. Gardner AW, Poehlman ET. Exercise rehabilitation programs for the treatment of claudication pain. A meta-analysis. JAMA 1995;274:975-80.
33. Tisi PV, Shearman CP. The evidence for exercise-induced inflammation and intermittent claudication: Should we encourage patients to stop walking? Eur J Vasc Endovasc Surg 1998;15:7-17.
34. Perkins JMT, Collin J, Creasy TS, Fletcher EWL, Morris PJ. Exercise training versus angioplasty for stable claudication. Long and medium term results of a prospective, randomized trial. Eur J Vasc Endovasc Surg 1996;11:409-13.
35. Whyman MR, Fowkes FGR, Kerracher EMG, et al. Is intermittent claudication improved by percutaneous transluminal angioplasty? A randomized controlled trial. J Vasc Surg 1997;26:551-7.
36. Goldhaber SZ, Manson JE, Stampfer MJ, et al. Low-dose aspirin and subsequent peripheral arterial surgery in the physicians' health study. Lancet 1992;340:143-5.
37. Jackson MR, Clagett GP. Antithrombotic therapy in peripheral arterial occlusive disease. Chest 1998;114(Suppl):666S-82S.
38. Janzon L, Bergqvist D, Boberg J, et al. Prevention of myocardial infarction and stroke in patients with intermittent claudication; effects of ticlopidine. Results from STIMS, the Swedish ticlopidine multicentre study. J Int Med 1990;227:301-8.
39. CAPRIE Steering Committee. A randomized, blinded trial of clopidogrel versus aspirin in patients at risk of ischaemic events (CAPRIE). Lancet 1996;348:1329-39.

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40. Porter JM, Cutler BS, Lee BY, et al. Pentoxifylline efficacy in the treatment of intermittent claudication. Multicenter controlled double-blind trial with objective assessment of chronic occlusive arterial disease patients. Am Heart J 1982;104:66-72.
41. Lindgarde F, Jelnes R, Bjorkman H, et al. Scandinavian Study Group: Conservative drug treatment in patients with moderately severe chronic occlusive peripheral arterial disease. Circulation 1989;80:1549-56.
42. Dawson DL, Cutler BS, Meissner MH, Strandness DE. Cilostazol has beneficial effects in treatment of intermittent claudication. Results from a multicentre, randomized, prospective, double-blind trial. Circulation 1998;98:678-86.
43. Baumgartner I, Pieczek A, Manor O, et al. Constitutive expression of phVEGF165 after intramuscular gene transfer promotes collateral vessel development in patients with critical limb ischemia. Circulation 1998;97:1114-23.
44. Ernst E. Chelation therapy for peripheral arterial occlusive disease. Circulation 1997;96:1031-3.
45. Foley WT. Treatment of gangrene of the feet and legs by walking. Circulation 1957;15:689-700.
46. Gaskell P, Parrott JCW. The effect of a mechanical venous pump on the circulation of the feet in the presence of arterial obstruction. Surg Gynecol Obstet 1978;146:583-92.
47. Abu-Own A, Cheadle T, Scurr JH, Smith PDC. Effects of intermittent pneumatic compression of the foot on the microcirculatory function in arterial disease. Eur J Vasc Surg 1993;7:488-92.
48. Carter SA. Effects of ambulation on foot oxygen tension in limbs with peripheral atherosclerosis. Clin Physiol 1996;16:199-208.

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Section 8: Cardiac rehabilitation programs

Andrew Ignaszewski MD, Scott A Lear PhD

Cardiac rehabilitation, as defined by the World Health Organization, is “the sum of activity required to ensure cardiac patients the best possible physical, mental and social conditions so that they may, by their own effort, regain as normal a place as possible in the community, and lead an active life” (World Health Organization, 1964).

Cardiac rehabilitation programs (CRP) have developed significantly since they were introduced in the 1960s, when a patient recovering from an uncomplicated myocardial infarction (MI) was confined to bed rest for up to eight weeks. Such programs were initiated to help patients recuperate from MI and/or coronary artery bypass graft surgery (CABG). CRP use multifactorial risk factor reduction strategies, which include management of physical inactivity, diet, lipids, weight, hypertension, stress and smoking, along with vocational counselling. Research shows that most cardiac populations can benefit significantly from CRP (1-5). These programs decrease cardiovascular and total mortality between 20% and 25% (**Level II, Grade B**) (1,2), reduce morbidity (**Level II, Grade B**) (6) and are cost effective (**Level II, Grade B**) (7) - less than \$12,000 per quality-adjusted life year (7,8).

CRP may involve physicians, registered nurses, exercise specialists, dietitians, kinesiologists, physiotherapists, occupational therapists, physical educators with an exercise physiology

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background, pharmacists, paramedics, vocational counsellors, social workers, psychologists and psychiatrists, and provide an ideal complement to care from the attending physician. Guidelines for CRP are essential to provide a cooperative framework with which to optimize the health and well-being of cardiac participants and their families.

TABLE 1
Impact of cardiac rehabilitation programs on cardiovascular end points and risk factors

Characteristic	Level	Grade of evidence	References
Increased exercise tolerance	I	A	15,16
Increased strength	II	B	17
Promotion of exercise habits	II	B	18
Decreased symptoms (angina, heart failure)	II	B	19,20
Smoking cessation and relapse prevention	II	B	15,20
Improved lipid profile	II	B	6,21
Decreased body weight	II	B	6
Improved blood pressure	II	B	22
Improved psychological well-being	I	A	23,24
Improved social adjustment and functioning	II	B	25
Facilitated return to work	III	C	26
Regression of coronary atherosclerosis	II	B	6,21
Coronary collateral formation	III	C	27
Improvement in ejection fraction	III	C	3
Improved skeletal muscle function	II	B	26
Decreased myocardial ischemia	II	B	28,29

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Effects of ventricular arrhythmias	III	C	28
Improvement in functional capacity and symptoms (congestive heart failure)	I	A	4,30
Improvement in functional capacity and symptoms (cardiac transplantation)	I	A	5
Benefit in the elderly	II	B	31

GOALS OF CARDIAC REHABILITATION

CRP should be designed to guide participants toward the following goals:

Restoration of optimal physiological, psychological and vocational status;

Reduction of risk of death and reinfarction.

RATIONALE FOR CARDIAC REHABILITATION

Cardiovascular disease (CVD) mortality has declined steadily since the 1960s. It has been suggested that with every 20% decline in mortality from CVD there is a 6% increase in prevalence of the disease; thus, more people are living with CVD as a chronic condition (9).

Table 1 outlines recommendations for the use of CRP in modifying numerous cardiovascular end points and risk factors based on existing evidence.

TARGET POPULATIONS

Multifactorial CRP can benefit (Table 1) patients with the following:

Ischemic heart disease (post-MI, CABG, percutaneous transluminal coronary angioplasty [PTCA]/stent, stable angina);

Other heart conditions (compensated heart failure, controlled dysrhythmias, automatic implanted cardioverter-defibrillator/pacemaker, postvalve replacement,

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cardiomyopathy, myocardial aneurysm resection, pre-and post-heart transplant, congenital heart defects);

Other chronic diseases that may benefit from a medically supervised program (eg, stroke and other peripheral vascular diseases);

High risk of developing CVD.

STRATIFICATION

Candidates for CRP need to be stratified according to risk on program entry to ensure safety and maximal benefit (10).

Low risk patients:

No significant left ventricular dysfunction (ejection fraction 50% or greater);

No resting or exercise-induced myocardial ischemia manifested as angina and/or ST segment depression;

No resting or exercise-induced complex arrhythmias;

Uncomplicated MI, CABG, PTCA or atherectomy;

Functional capacity more than six metabolic equivalents on graded exercise stress test, three or more weeks after the clinical event.

Intermediate risk patients:

Mild to moderately depressed left ventricular function (ejection fraction 31% to 49%).

Functional capacity less than five to six metabolic equivalents, three or more weeks after the clinical event;

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Failure to comply with exercise intensity prescription;

Exercise-induced myocardial ischemia (1 to 2 mm

ST segment depression) or reversible ischemic defects (echocardiography or nuclear imaging).

High risk patients:

Severely depressed left ventricular function (ejection fraction 30% or less);

Complex ventricular arrhythmias at rest, appearing or increasing with exercise;

Decrease in systolic blood pressure of more than

25 mmHg during exercise or failure to rise with increasing exercise workloads;

Survivor of sudden cardiac death;

MI complicated by congestive heart failure, cardiogenic shock and/or complex ventricular arrhythmias;

Severe coronary artery disease and marked exercise-induced myocardial ischemia (more than 2 mm ST segment depression during exercise).

STRUCTURE OF CARDIAC REHABILITATION AND PREVENTION PROGRAMS

Traditionally, CRP have been classified into four phases, phase I to IV, representing a progression from the hospital (phase I) to a medically supervised outpatient program (phases II and III) to a community or home-based setting (phase IV). Due to changes in hospital and health care practices, and the need to accommodate patients at various stages of disease risk, the need for phase designation becomes inappropriate. CRP can be more appropriately

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distinguished as inpatient, outpatient or community/home-based programs. Participation within these programs is determined by appropriate risk stratification in order to maximize health care resources and patient benefit. Irrespective of the program, there should be regular communication, in the form of progress reports, between the program staff and the patient's attending physician.

Inpatient program: Formerly referred to as phase I, the inpatient program consists of low level activities that gradually progress throughout the hospital stay to prevent deconditioning. The patient should be able to walk approximately 100 m and climb one flight of stairs without symptoms before discharge. Education and counselling regarding healthy lifestyle modification (diet, exercise, smoking cessation, medication use and stress management) should begin, and patients should be referred to a local outpatient program. Due to the decreased duration of hospital stays, intervention at this stage may be limited; however, this is an ideal time at which to begin patient rehabilitation and prevention.

Outpatient program: Formerly referred to as phases II and III, the outpatient program is ideal for the patients who have recently been discharged from hospital or those who are at moderate to high risk and would benefit from close medical supervision. These programs last from eight to 16 weeks and combine physician-supervised and electrocardiogram-(ECG) monitored exercise sessions with cardiovascular risk factor reduction interventions using a case management model. A staff to patient ratio of 1:5 during the exercise sessions is recommended. Staff should consist of a registered nurse, an exercise specialist and an exercise leader. Other staff required are a medical director, a program director and a dietitian, with additional support from a pharmacist, psychologist or social worker, physiotherapist and occupational therapist. Full assessment including history, physical examinations, blood tests and exercise stress test, plus stratification by the medical director, is a minimal requirement before program participation. Each person should have an individualized exercise prescription based on results of the entry exercise stress test. Exercise intensity should begin at 60% of heart rate (HR) reserve ($\text{resting HR} + 0.6 \times [\text{maximum HR} - \text{resting HR}]$) and progress to 75% to 85% under the guidance of the exercise staff. For patients with ischemia and/or arrhythmias,

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the target HR should be in the 10 to 15 beat/min range, 10 beats below the HR of onset. Dietary intervention should consist of promotion of the American Heart Association step I diet (11). A smoking cessation and stress management program should be available to those who require it. Interim progress reviews are recommended to optimize patient management. Before exit, each patient should complete another full assessment that includes a review of patient progress. It is appropriate for patients who are at moderate or low risk to continue to a community/home-based program.

Community/home-based program: Formerly referred to as phase IV, these CRP are appropriate for patients at low to moderate risk. They allow for continued improvement of functional capacity and risk factor profile under a less supervised environment, commonly conducted within community recreation centres, consisting of the same interventions as those in the outpatient programs. The staffing ratio for these programs can be 1:15 and include a registered nurse and an exercise leader. Liaison with a local outpatient program is beneficial but not required. These programs should also have a medical and program director and dietitian, and may include other health care support. Risk assessment should be completed before participation and on graduation. Patients should be at low risk and capable of performing a self-directed risk factor management program before exiting.

For patients at low risk and at the maintenance stage, only minimal supervision may be required. At this point, patients may safely continue their individualized programs in either community centres or in a home-based setting under the guidance of their family physician.

MONITORING

There is no evidence with which to define ECG monitoring guidelines (Level III, Grade C). However, numerous organizations have suggested guidelines based on expert consensus (12-14). For outpatient programs, monitoring all patients until they are at low risk as defined earlier is advisable. Monitoring should also be available in community-based programs for intermittent assessments.

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OUTCOMES

Outcome measures provide an objective assessment of patient progress and program efficacy, and can be included in the entrance and exit assessments of the program or during any of the review assessments. These facets, outlined in Table 1, can be incorporated into assessments along with patient reports, health utilization, lifestyle behaviour and medication adherence, education and program satisfaction.

CRP IN CANADA

Numerous cities across Canada have CRP, and new programs are being established regularly. Further information regarding location and referral to existing programs can be obtained from the Canadian Association of Cardiac Rehabilitation.

RECOMMENDATIONS

1. Access to integrated publicly funded and networked CRP should be available to all patients with CVD or those identified to be at high or moderate risk of CVD.
2. There should be a coordinated data management network for publicly funded CRP that are cost efficient by virtue of rationalized programs functioning with an appropriate critical mass of patients.

FUTURE RESEARCH

Research is still needed to answer a number of questions and to improve care of cardiac patients in the following areas:

1. Evaluation of CRP in specific populations (ethnic and socioeconomic);
2. Benefits and safety of resistance training in all populations;
3. Return to work rates and vocational rehabilitation;
4. Evaluation of cost effectiveness and cost outcomes with comparisons of various CRP models;

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5. Safety and efficacy of supervised CRP versus unsupervised, with and without ECG monitoring;
6. Development of valid psychosocial measures to ascertain improvement in psychological functioning and quality of life;
7. Evaluation of different behavioural techniques for promoting lifestyle change in large populations.

MONITORING

There is no evidence with which to define ECG monitoring guidelines (**Level III, Grade C**).

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REFERENCES

1. O'Connor GT, Buring JE, Yusuf S, et al. An overview of randomized trials of rehabilitation with exercise after myocardial infarction. *Circulation* 1989;80:234-44.
2. Oldridge NB, Guyatt GH, Fischer ME, Rimm AA. Cardiac rehabilitation after myocardial infarction: combined experience of randomized clinical trials. *JAMA* 1988;260:945-50.
3. Lee AP, Ice R, Blessey R, Sanmarco ME. Long-term effects of physical training on coronary patients with impaired ventricular function. *Circulation* 1979;60:1519-26.
4. Coats AJ, Adamopoulos S, Meyer TE, Conway J, Sleight P. Effects of physical training in chronic heart failure. *Lancet* 1990;335:63-6.
5. Kobashigawa JA, Leaf DA, Lee MD, et al. A controlled trial of exercise rehabilitation after heart transplantation. *N Engl J Med* 1999;340:272-7.
6. Haskell WL, Alderman EL, Fair JM, et al. Effects of intensive multiple risk factor reduction on coronary atherosclerosis and clinical cardiac events in men and women with coronary artery disease: The Stanford Coronary Risk Intervention Project (SCRIP). *Circulation* 1994;89:975-90.
7. Oldridge N, Furlong W, Feeny D, et al. Economic evaluation of cardiac rehabilitation soon after acute myocardial infarction. *Am J Cardiol* 1993;72:154-61.
8. Ades PA, Huang D, Weaver SO. Cardiac rehabilitation participation predicts lower rehospitalization costs. *Am Heart J* 1992;123:916-21.
9. Fryes RL, Higgins MW, Beller GA, et al. Major demographic and epidemiologic trends affecting adult cardiology. *J Am Coll Cardiol* 1988;12:840-6.
10. American Association of Cardiovascular and Pulmonary Rehabilitation. Guidelines for Cardiac Rehabilitation Programs, 2nd edn. Champaign: Human Kinetics Books, 1995:155.

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11. National Cholesterol Education Program. Second Report of the Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel II). *Circulation* 1994;89:1333-445.
12. American College of Sports Medicine, Preventative and Rehabilitative Exercise Committee. Guidelines for Exercise Testing and Prescription, 4th edn. Philadelphia: Lea & Febiger, 1991:314.
13. Fletcher GF, Balady G, Froelicher VF, Hartley LH, Haskell WL, Pollock ML. American Heart Association. Exercise standards: A statement for health professionals from the American Heart Association. *Circulation* 1995;91:580-615.
14. Parmley WW. Position report on cardiac rehabilitation: recommendations of the American College of Cardiology on cardiovascular rehabilitation. *J Am Coll Cardiol* 1986;7:451-3.
15. DeBusk RF, Houston Miller N, Superko HR, et al. A case-management system for coronary risk factor modification after acute myocardial infarction. *Ann Intern Med* 1994;120:721-9.
16. Froelicher V, Jensen D, Genter F, et al. A randomized trial of exercise training in patients with coronary heart disease. *JAMA* 1984;252:1291-7.
17. McCartney N, McKelvie RS, Haslam DR, Jones NL. Usefulness of weightlifting training in improving strength and maximal power output in coronary artery disease. *Am J Cardiol* 1991;67:939-45.
18. Hambrecht R, Niebauer J, Marburger C, et al. Various intensities of leisure time physical activity in patients with coronary artery disease: effects on cardiorespiratory fitness and progression of coronary atherosclerotic lesions. *J Am Coll Cardiol* 1993;22:468-77.
19. Ornish D, Brown SE, Scherwitz LW, et al. Can lifestyle changes reverse coronary heart disease? The Lifestyle Heart Trial. *Lancet* 1990;336:129-33.

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20. Engblom E, Hietanen EK, Hamalainen H, Kallio V, Inberg M, Knuts LR. Exercise habits and physical performance during comprehensive rehabilitation after coronary artery bypass surgery. *Eur Heart J* 1992;13:1053-9.
21. Schuler G, Hambrecht R, Schlierf G, et al. Regular physical exercise and low-fat diet: effects of progression of coronary artery disease. *Circulation* 1992;86:1-11.
22. Hamalainen H, Luurila OJ, Kallio V, Arstila M, Hakkila J. Long-term reduction in sudden deaths after a multifactorial intervention programme in patients with myocardial infarction: 10-year results of a controlled investigation. *Eur Heart J* 1989;10:55-62.
23. Gulanick M. Is phase 2 cardiac rehabilitation necessary for early recovery of patients with cardiac disease? A randomized, controlled study. *Heart Lung* 1991;20:9-15.
24. Oldridge NB, Guyatt G, Jones N, et al. Effects on quality of life with comprehensive rehabilitation after acute myocardial infarction. *Am J Cardiol* 1991;67:1084-9.
25. Bar FW, Hoppener P, Diederiks J, et al. Cardiac rehabilitation contributes to the restoration of leisure and social activities after myocardial infarction. *J Cardiopulm Rehabil* 1992;12:117-25.
26. Cardiac Rehabilitation. Clinical guide number 17. Rockville: Agency for Health Care Policy and Research, 1995.
27. Kennedy CC, Spiekerman RE, Lindsay MI Jr, Manken HT, Frye RL, McCallister BD. One-year graduated exercise program for men with angina pectoris: evaluation by physiologic studies and coronary arteriography. *Mayo Clin Proc* 1976;51:231-6.
28. DeBusk RF, Houston N, Haskell W, Fry F, Parker M. Exercise training soon after myocardial infarction. *Am J Cardiol* 1979;44:1223-9.
29. Todd IC, Ballatyne D. Effect of exercise training on the total ischaemic burden: an assessment by 24 hour ambulatory electrocardiographic monitoring. *Br Heart J* 1992;68:560-6.

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30. Giannuzzi P, Tavazzi L, Temporelli PL, et al. Long-term physical training and left ventricular remodeling after anterior myocardial infarction: results of the Exercise in Anterior Myocardial Infarction (EAMI) trial. J Am Coll Cardiol 1993;22:1821-9.
31. Ades PA, Waldmann ML, Gillespie C. A controlled trial of exercise training in older coronary patients. J Gerontol 1995;50A:M7-11.

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Section 9: Cost Effectiveness of Preventing Cardiovascular Diseases

Steven A Grover MD

Cardiovascular diseases (CVD) accounted for \$7.3 billion or 17% of the direct total costs of illness in Canada in 1995 (1). Given the increasing demands placed on constrained health care resources, cost effectiveness analysis can be used to compare the value of a specific health intervention with other potential alternatives. Health care spending can then be targeted toward those diagnostic and therapeutic interventions that provide the greatest benefits at the lowest cost.

The cost effectiveness ratio is defined as the difference in the cost between two interventions divided by the difference in effectiveness (2). Effectiveness is usually defined as years of life saved or quality-adjusted life years (QALY) saved.

$$\text{Cost effectiveness} = \frac{\text{Cost}_2 - \text{Cost}_1}{\text{QUALY}_2 - \text{QUALY}_1}$$

The perspective of these analyses determines which costs will be considered, such as those borne by the patient, a third party payer (ie, corporation, health insurer, health maintenance organization, hospital or government) or society as a whole. Whenever possible, the societal perspective is preferred because it facilitates comparisons between different cost effectiveness analyses. Discounting is commonly incorporated into cost effectiveness analyses to recognize the differential impact of costs and benefits that are realized immediately versus those that

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occur in the future. Accordingly, both costs and benefits are generally discounted at a rate of 3% to 5% annually.

To be considered cost effective, an intervention must first be demonstrated to be effective. Accordingly, there is no substitute for randomized clinical trial data that conclusively demonstrates the effectiveness of a specific intervention. Unfortunately, the duration of most clinical trials rarely exceeds five years, and most CVD interventions, once prescribed, must be followed for the remainder of the patient's life. Cost effectiveness analyses are, therefore, often based on disease simulation models that incorporate the results of clinical trials and extrapolate the costs and benefits over the entire duration of anticipated treatment (3). Wherever possible, such disease simulation models should be validated to ensure the credibility of the final conclusions.

MEASURING HEALTH BENEFITS

Cost effectiveness analyses traditionally focus on changes in life expectancy. However, CVD interventions may also significantly reduce the morbidity associated with disease and enhance the patient's overall quality of life (4). Increasingly, QALY are used as one means of capturing the reduction in mortality and disability associated with a specific intervention. However, such analyses must also consider the quality of life associated with the intervention itself, and even small changes associated with long term interventions, such as weight reduction, dietary restriction or hypertension therapy, must be carefully considered (5-10).

MEASURING COSTS

Cost effectiveness analyses focus primarily on direct medical costs. These include the costs of diagnosing and treating CVD, and any complications associated with the therapy. However, the economic burden of CVD includes not only direct health care costs but also indirect costs, such as lost productivity and wages, and social security and disability payments associated with chronic disease. Indirect costs, while difficult to measure, may have a major impact on the cost effectiveness ratios associated with disease prevention.

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THE COST EFFECTIVENESS OF SPECIFIC INTERVENTIONS TO PREVENT CVD

To date, cost effectiveness analyses have focused primarily on modifiable risk factors for which there is consistent evidence of efficacy from randomized clinical trials (3). These interventions include the treatment of hypertension and hyperlipidemia, exercise training and cardiac rehabilitation. Despite the absence of large randomized trials, cigarette smoking has also been evaluated, given the epidemiological evidence that it is a strong and consistent risk factor that can be completely eliminated two to four years after smoking cessation. Acetylsalicylic acid, oral anticoagulant and beta-blocker use have also been analyzed, as well as use of medical technology including revascularization procedures, exercise stress testing and hospitalization in a coronary care unit.

COST EFFECTIVENESS AND RISK STRATIFICATION

The cost effectiveness of preventing CVD for a specific individual is extremely sensitive to that individual's absolute risk of developing the disease over time. Accordingly, cost effectiveness ratios surrounding secondary prevention among individuals who have already developed the disease tend to be lower than estimates for primary prevention among those who may never develop the disease (3). In primary prevention, individuals with multiple risk factors have a higher absolute risk of developing the disease. Cost effectiveness ratios of disease prevention are also more attractive in this group than in low risk individuals with one isolated risk factor.

THE COST EFFECTIVENESS OF SPECIFIC THERAPIES

Although there is no clear consensus at what point a cost effectiveness ratio becomes economically attractive, ratios below \$20,000/year of life saved are considered to be very competitive. Those between \$20,000 and \$50,000/year of life saved are considered acceptable compared with currently supported treatments, such as renal dialysis for end-stage kidney failure. Those between \$50,000 and \$100,000/year of life saved are considered less attractive, and those over \$100,000/year of life saved are considered unaffordable.

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The treatment of hyperlipidemia has been extensively studied in randomized clinical trials, with the effectiveness of both primary and secondary prevention clearly demonstrating a reduction in both cardiac events and the costs associated with treating CVD. Among individuals with known CVD, the cost effectiveness of secondary prevention appears very attractive (3). For instance, economic analyses of the Scandinavian Simvastatin Survival Study (4S) demonstrate that lipid modification markedly reduces the use of hospital services, thereby offsetting most of the costs associated with prescribing statin therapy (11). Some simulation models suggest that secondary prevention of hyperlipidemia may actually save lives and money in the United States (3). In a more recently completed Canadian analysis, the long term cost effectiveness of statin therapy in secondary prevention appears to be very competitive, with cost effectiveness ratios ranging from \$5,000 to \$10,000/year of life saved (12). If the reduction in cerebrovascular events that has recently been demonstrated in two secondary prevention trials is also considered, the cost effectiveness of statin therapy is even more attractive (12).

In primary prevention, the cost effectiveness of lipid therapy is highly dependent on the absolute risk of the individual patient. Among high risk men with multiple risk factors, cost effectiveness ratios are often below \$50,000/year of life saved and may even approach \$20,000/year of life saved when changes in both low density lipoprotein and high density lipoprotein cholesterol are considered (13). Primary prevention appears to be less cost effective among women than men because of the lower absolute risk of CVD in women, all other things being equal (14). Nonetheless, middle-aged high risk women appear to be one subgroup in which lipid intervention may be attractive.

HYPERTENSION

The treatment of hypertension has consistently been shown to reduce the risk of stroke. The impact of treatment on the risk of coronary events is more modest. Nonetheless, the treatment of moderate to severe hypertension appears to be cost effective (15,16). The cost effectiveness of treating mild hypertension is more sensitive to the cost of medication. Lower-cost medications, such as generic diuretics and beta-blockers, are particularly cost effective (17).

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SMOKING CESSATION

Epidemiological data indicate that the increase in life expectancy associated with smoking cessation appears to range from two to five years. Given the relatively small cost associated with smoking intervention, the associated cost effectiveness of ratios appear to be extremely attractive (18-21). However, these ratios are quite sensitive to the long term compliance associated with smoking cessation therapies.

FITNESS TRAINING AND CARDIAC REHABILITATION

The cost effectiveness of cardiac rehabilitation including exercise is based primarily on estimates of two overview analyses of randomized clinical trials (22-24). Oldridge and colleagues (25) have also completed an economic analysis of a randomized trial of cardiac rehabilitation after myocardial infarction. Even though mortality and morbidity were similar at one year in the control and intervention groups, quality of life improvements associated with cardiac rehabilitation resulted in cost effectiveness ratios of \$10,000/QALY gained (25). Despite the paucity of clinical trial data demonstrating reductions in cardiovascular mortality and morbidity associated with fitness training, substantial data demonstrate a reduction in systolic and diastolic blood pressure and low density lipoprotein cholesterol, and a significant increase in high density lipoprotein cholesterol associated with fitness training among previously sedentary individuals. Accordingly, the positive impact of fitness training on multiple risk factors suggests that fitness training holds great promise as a cost effective intervention. Again, as with smoking cessation, long term compliance is an essential determinant of the long term cost effectiveness of this strategy.

CONCLUSIONS

A number of important determinants remain to be evaluated in assessing the long term cost effectiveness of CVD prevention, including long term compliance. Population data suggest that the compliance demonstrated in randomized clinical trials overestimates the reality among patients receiving care in a community setting (26). Indirect costs associated with CVD must also be carefully considered, particularly in primary prevention among young individuals who

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still have many years of productivity in the labour force. Ensuring that such individuals remain productive will result in major economic gains.

Finally, the impact of specific interventions on an individual's quality of life must be further evaluated. While exercise training in cardiac rehabilitation has clearly been shown to result in improvements in quality of life, a number of studies suggest that use of some antihypertensive agents and the labelling of hypertension or hyperlipidemia may be associated with reductions in quality of life. Clearly, interventions that can enhance quality of life and reduce the clinical and economic impact of CVD will prove to be the most cost effective.

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REFERENCES

1. Heart Disease and Stroke in Canada. Ottawa: Heart and Stroke Foundation of Canada, 1997.
2. Canadian Coordinating Office for Health Technology Assessment. Guidelines for Economic Evaluation of Pharmaceuticals: Canada, 2nd edn. Ottawa: Canadian Coordinating Office for Health Technology Assessment, 1997.
3. Goldman L, Garber AM, Grover SA, Hlatky MA. 27th Bethesda Conference: matching the intensity of risk factor management with the hazard for coronary disease events. Task Force 6. Cost effectiveness of assessment and management of risk factors. J Am Coll Cardiol 1996;27:1020-30.
4. Drummond MF, Heyse J, Cook J, McGuire A. Selection of end points in economic evaluations of coronary-heart-disease interventions. Med Decis Making 1993;13:184-90.
5. Charlson ME, Alderman M, Melcher L. Absenteeism and labelling in hypertensive subjects. Prevention of an adverse impact in those at high risk. Am J Med 1982;73:165-70.
6. Haynes RB, Sackett DL, Taylor DW, Gibson ES, Johnson AL. Increased absenteeism from work after detection and labeling of hypertensive patients. N Engl J Med 1978;299:741-4.
7. Havas S, Reisman J, Hsu L, Koumjian L. Does cholesterol screening result in negative labeling effect? Results of the Massachusetts Model Systems for Blood Cholesterol Screening Project. Arch Intern Med 1991;151:113-9.
8. Irvine MJ, Logan AG. Is knowing your cholesterol number harmful? J Clin Epidemiol 1994;47:131-45.
9. Jachuck SJ, Brierley H, Jachuck S, Willcox PM. The effect of hypotensive drugs on the quality of life. J R Coll Gen Pract 1982;32:103-5.

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10. Brett AS. Psychologic effects of the diagnosis and treatment of hypercholesterolemia: Lessons from case studies. *Am J Med* 1991;91:642-7.
11. Pedersen TR, Kjekshus J, Berg K, et al. Cholesterol lowering and the use of healthcare resources. Results of the Scandinavian Simvastatin Survival Study. *Circulation* 1996;93:1796-802.
12. Grover SA, Coupal L, Paquet S, Zowall H. Cost-effectiveness of 3-hydroxy-3-methylglutaryl-coenzyme A reductase inhibitors in the secondary prevention of cardiovascular disease: forecasting the incremental benefits of preventing coronary and cerebrovascular events. *Arch Intern Med* 1999;159:593-600.
13. Grover SA, Abrahamowicz M, Joseph L, Brewer C, Coupal L, Suissa S. The benefits of treating hyperlipidemia to prevent coronary heart disease. Estimating changes in life expectancy and morbidity. *JAMA* 1992;267:816-22.
14. Hamilton VH, Racicot FE, Zowall H, Coupal L, Grover SA. The cost-effectiveness of HMG-CoA reductase inhibitors to prevent coronary heart disease. Estimating the benefits of raising HDL-C. *JAMA* 1995;273:1032-8.
15. Littenberg B, Garber AM, Sox HC Jr. Screening for hypertension. *Ann Intern Med* 1990;112:192-202.
16. Weinstein MC, Stason WB. Hypertension: A Policy Perspective. Cambridge: Harvard University Press, 1976.
17. Edelson JT, Weinstein MC, Tosteson ANA, Williams L, Lee TH, Goldman L. Long-term cost-effectiveness of various initial monotherapies for mild to moderate hypertension. *JAMA* 1990;263:407-13.
18. Cummings SR, Rubin SM, Oster G. The cost-effectiveness of counseling smokers to quit. *JAMA* 1989;261:75-9.
19. Oster G, Huse DM, Delea TE, Colditz GA. Cost-effectiveness of nicotine gum as an adjunct to physician's advice against cigarette smoking. *JAMA* 1986;256:1315-8.

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20. Tsevat J. Impact and cost-effectiveness of smoking interventions. Am J Med 1992;93(1A):43S-7S.
21. Krumholz HM, Cohen BJ, Tsevat J, Pasternak RC, Weinstein MC. Cost-effectiveness of a smoking cessation program after myocardial infarction. J Am Coll Cardiol 1993;22:1697-702.
22. Oldridge NB, Guyatt GH, Fischer ME, Rimm AA. Cardiac rehabilitation after myocardial infarction. Combined experience of randomized clinical trials. JAMA 1988;260:945-50.
23. O'Connor GT, Buring JE, Yusuf S, et al. An overview of randomized trials of rehabilitation with exercise after myocardial infarction. Circulation 1989;80:234-44.
24. Berlin JA, Colditz GA. A meta-analysis of physical activity in the prevention of coronary heart disease. Am J Epidemiol 1990;132:612-28.
25. Oldridge N, Furlong W, Feeny D, et al. Economic evaluation of cardiac rehabilitation soon after acute myocardial infarction. Am J Cardiol 1993;72:154-61.
26. Avorn J, Monette J, Lacour A, et al. Persistence of use of lipid-lowering medications: A cross-national study. JAMA 1998;279:1458-62.

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CANADIAN CARDIOVASCULAR SOCIETY 1998 CONSENSUS CONFERENCE ON THE PREVENTION OF CARDIOVASCULAR DISEASES: THE ROLE OF THE CARDIOVASCULAR SPECIALIST

Section 10: Partnerships in cardiovascular disease prevention

Elinor Wilson PhD

In 1992, in Victoria, Canada, a landmark event occurred. Heart health professionals from around the globe came together and forged the Victoria Declaration (1). This call to action highlighted a preferred future for a world free of the devastating effects of cardiovascular diseases (CVD). The Declaration stated:

... the Advisory Board of the International Conference on Heart Health calls upon health, media, education and social science professionals, and their associations, the scientific research community ... [in] adopting new policies, making regulatory changes and implementing health promotion and disease prevention programs directed at entire populations. (1)

The Declaration also delineated a key role for health professional associations:

For health professional associations, there are two urgent tasks: to develop evaluation and treatment guidelines for CVD prevention; and to keep governments and funding agencies informed about priority areas for research in health promotion and disease prevention and control. There is also a role for such associations to play as advocates for strong public health policy. (1)

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In 1995, the Catalonia Declaration Advisory Board articulated the role of cardiovascular scientists (2):

Thus the community of scientists, whether from universities, research organizations, or local professional associations, constitutes a major asset to citizens' groups. As citizens' groups mobilize the community, they can base their course of action on the know-how, endorsement, and collaboration of health professionals with expertise in this area. (2)

In 1998, the same group, this time in Singapore, "forged the will for heart health in the next millennium" (3). It called upon organizations such as professional associations to "recognize the expanding epidemic of cardiovascular disease and to step forward as leaders in promoting heart health" (3). The Singapore Declaration went further and defined specific activities for professional associations to undertake to fulfil their role and responsibility. These activities are that

governments, professional societies and health care systems join to develop policies for the identification of persons at high risk for CVD and for their cost effective treatment;

health care systems integrate and evaluate behavioural, pharmacological and technological approaches to CVD treatment;

those concerned with heart health take decisive action outside their traditional professional focus as scientists, clinicians and experts to accept responsibility and leadership for heart health (3).

The mandate of the Canadian Cardiovascular Society (CCS) is to foster optimal cardiovascular health for Canadians. Over the years, it has expanded its activities beyond a focus solely on the treatment of CVD. The leadership has recognized the key role that the membership must play in re-search, prevention and heart-healthy public policy. It has also recognized the need for close collaboration among other health professionals and organizations, such as the Heart and Stroke Foundation of Canada, that are dedicated to the same mission.

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The CCS recognized that research, specifically evidencebased recommendations, forms the basis for our actions in programs of CVD reduction, management and public health policy. The CCS therefore undertook the task, working across disciplines, of bringing together in one document the 1998 accepted evidence base, recommendations and re-search gaps in the areas of CVD prevention and heart health promotion. The resulting document is offered as a beginning, but what challenges do we face as these guidelines are put into practice?

As we move into the next millennium, the time has come to put our collective declarations into action. There are already many coalitions focused on some aspect of CVD control. These range from the Canadian Coalition on High Blood Pressure Prevention and Control, with 23 organizational members, to the National Active Living Coalition, with 30 members, the Canadian Coalition on Enhancing Preventive Practices of Health Professionals, with 18 members, the Canadian Coalition for Quality Daily Physical Education, with 24 members, and about four tobacco coalitions with a total of 35 members. These are examples of how various groups have formed coalitions to intervene in CVD control and cardiovascular health.

It has become evident over the past 10 years in Canada that the determinants of health (eg, income, education and social status) are inextricably linked to the CVD epidemic in Canada. Surveys of risk factors in Canada, conducted through the Canadian Heart Health Initiative, indicate that an east-to-west gradient exists in terms of the level of CVD, with the highest levels in the eastern provinces and the lowest in the western provinces. As well, 77% of men and 73% of women have one risk factor, and 41% of men and 33% of women have two or more risk factors (4).

In the past, groups working in the determinants of health areas (eg, antipoverty groups) have not linked successfully with groups working in the health promotion area. This project may help to bridge these gaps and to determine how we may best use the synergy to create joint activities. Other determinants of health that would be influenced by this process are personal health practices and coping skills, as shown through the ongoing activities of many groups, such as healthy child development with a focus on comprehensive school health and health

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services for the prevention of high risk status and CVD. But, most important, collaboration across sectors is essential to address the determinants of health successfully. Existing partnerships should be strengthened and new ones created with organizations whose mandate or activities have a direct or indirect impact on health.

Gray (5) defined collaboration in two ways:

A process through which parties who see different aspects of a problem constructively explore their differences and search for solutions that go beyond their own limited vision of what is possible, and the pooling of appreciations and/or tangible resources, eg, information, money, by two or more stakeholders to solve a set of problems which neither can solve individually. (5)

She makes the case that "collaboration is a social process particularly suited to situations characterized by interdependence, complexity and uncertainty" (5). This coming together in Canada has resulted in both process and action coalitions forming and, in most cases, achieving a high degree of success. The challenge, however, is that often members feel that their autonomy is threatened, consensus is difficult to achieve and that the focus is on different targets. All too often the process becomes the outcome.

The Catalonia Declaration stated that Collaboration between institutions and bureaucracies is plainly valuable for heart health, and more and more instances have been reported of successful collaboration, particularly at the community level. At the higher, central levels, however, evidence of collaboration is often lacking. Especially within the health system itself, territoriality may make it difficult to collaborate fruitfully with other institutions or bureaucracies. (2)

Of special concern are conflicting philosophical perspectives on prevention that have at times hindered collaboration between constituencies concerned with health promotion and those involved with health care. These different perspectives stem largely from different views of the importance of nonurgent preventive problems in the face of urgent care needs. Unless health

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threats are perceived as being immediate, the need for action does not seem pressing. Health problems that could be prevented are permitted to linger, while action is diverted to the care of clearly manifest diseases whose diagnosis and treatment require complex technologies and labour-intensive efforts.

COLLABORATION IN THE CONTEXT OF CVD

CVD exist on a continuum, from primordial prevention through prevention, intervention, treatment and rehabilitation. Along that continuum there are many health professionals, including the cardiovascular specialist and others who play a key role. Can we find a model to truly integrate our activities? Can we identify overarching goals broad enough to be inclusive and narrow enough to enable groups to continue to do their best work but realize greater synergies in reaching our goal?

Webster's Dictionary defines alliance as "the action of al-lying or state of being allied", "an association to further the common interests of the members" (6). What can an alliance for cardiovascular health be expected to accomplish? There are several areas deserving of attention to further our goal of eliminating preventable CVD and reducing premature mortality.

The first is the establishment of health goals for cardiovascular health for the nation; the second is the capacity to mobilize resources to effect change in public policy; and the third is to have clinical practice guidelines or current recommendations that consistent and complementary for all health practitioners. It has been suggested that establishing national health goals is futile because health is a provincial responsibility. However, without directional goals and an adequate surveillance system for monitoring our progress, we continue to work in an isolated, independent fashion unable to use the tremendous synergy to be achieved, through an alliance, of all involved working together toward measurable outcomes.

Healthy People 2000 is the national prevention agenda for the United States (7). The Public Health Service in the United States issued these goals in 1990. The document set out 300 specific, measurable objectives to be achieved by the year 2000 in 22 priority areas related to

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health promotion, health protection and clinical preventive services. Objectives are deemed to be vital to achieving three overarching national goals: increasing the quality of life, narrowing the disparities in health status among various population groups, and achieving universal access in basic primary care and preventive services for all.

Development of Healthy People 2010 has been initiated by members of the Healthy People Consortium, an alliance of over 600 national membership organizations representing professional, voluntary and business sectors, and the State and territorial public health, mental health, substance abuse and environmental agencies. Overall, development of Healthy People 2010 is guided by the Secretary of Health and Human Services, with the Assistant Secretary of Health as Vice Chair, and is composed of former Assistant Secretaries for Health and all Health and Human Services Operating Division Heads. The Council meets annually (8).

In Canada, a significant number of coalitions, for example, the Canadian Coalition on High Blood Pressure Prevention, have already established goals for their particular area. By forming an alliance and identifying the various coalitions, it would be feasible to create an overarching plan with measurable outcomes and to identify gaps in our knowledge base that could be addressed by research, gaps in our programs of prevention and control, and gaps in our public health policy.

Policy formulation and implementation is one of the most successful heart health strategies and among the most sustainable. Marshalling this support requires a commitment from those who influence political and corporate agendas. Scientists, health and social science professionals, and community leaders who understand the potential value of CVD prevention policies must convince governments and the private and voluntary sectors of the need to act. Support can be obtained by publicizing research and survey findings, pointing to the cost effectiveness of using existing structures and community resources, and emphasizing the degree of public interest that already exists. The process evaluation of the Canadian Heart Health Initiative reports that, of the 311 interventions conducted across Canada, only 29 were directed at policy change. The power of an alliance to be advocates for CVD health policies in a coordinated and concerted way should not be underestimated.

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The CCS regards the 1998 consensus document as one piece of a comprehensive, integrated approach to CVD and their control. As the cardiovascular specialist community, the CCS is committed to working with the broadest community of health and other professionals to ensure that Canada can avert a larger CVD epidemic.

RECOMMENDATIONS

Establish national heart health goals.

Form an interdisciplinary coalition to develop consistent, complementary messages for health professionals and others to relay to the public.

Use the power of alliances and coalitions to ensure the passage of heart health public policies at local, provincial, territorial and national levels.

Ensure the development of materials that reach all of the Canadian public, regardless of socioeconomic status, age, literacy, language, culture or religion.

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REFERENCES

1. The Victoria Declaration on Heart Health. Declaration of the Advisory Board of the International Heart Health, Victoria, Canada, May 28, 1992. Ottawa: Health and Welfare Canada, Heart and Stroke Foundation of Canada, 1992.
2. The Catalonia Declaration Investing in Heart Health. Declaration of the Advisory Board. 2nd International Heart Health Conference. Barcelona, May 28 to June 1, 1995.
3. Pearson TA, Bales V, Blair L, et al. The Singapore Declaration Forging the Will for Heart Health in the Next Millennium. Declaration of the Advisory Board of the Third International Heart Health Conference, Singapore, September 2, 1998. *Cardiovasc Dis Prev* 1998;1:182-206.
4. Canadian Heart Health Surveys: A profile of cardiovascular risk. *Can Med Assoc J* 1992;146:1969-2029.
5. Gray B. Conditions facilitating interorganizational collaboration. *Hum Relations* 1985;38:12.
6. Merriam-Webster's Collegiate Dictionary, 10th edn. Springfield: Merriam-Webster Inc, 1998.
7. Healthy People 2000: National Health Promotion and Disease Prevention Objectives. Washington: US Department of Health and Human Services and Public Health Service, 1990.
8. Developing Objectives for Healthy People 2010, Fact Sheet. Washington: US Department of Health and Human Services and Public Health Service, 1997.

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