

The Importance of Indirect Costs in Primary Cardiovascular Disease Prevention

Can We Save Lives and Money With Statins?

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Background: The losses in productivity due to cardiovascular disease (CVD) are substantial but rarely considered in health economic analyses. We compared the cost-effectiveness of lipid level modification in the primary prevention of CVD with and without these indirect costs.

Methods: We used the Cardiovascular Life Expectancy Model to estimate the long-term benefits and cost-effectiveness of lipid level modification with atorvastatin calcium, including 28% and 38% reductions in total cholesterol and low-density lipoprotein cholesterol levels, respectively, and a 5.5% increase in high-density lipoprotein cholesterol level. The direct costs included all medical care costs associated with CVD. The indirect costs represented the loss of employment income and the decreased value of housekeeping services after different manifestations of CVD. All costs were expressed in 2000 Canadian dollars.

Results: When only direct medical care costs were considered, the incremental cost-effectiveness ratios for life-long therapy with atorvastatin calcium, 10 mg/d, were generally positive, ranging from a few thousand to nearly \$20 000 per year of life saved. When the societal point of view was adopted and indirect costs were included, the total costs were generally negative, representing substantial cost savings (up to \$50 000) and increased life expectancy for most groups of individuals.

Conclusions: Lipid therapy with statins can reduce CVD morbidity and mortality as demonstrated in a number of clinical trials. Adding the indirect CVD costs associated with productivity losses at work and home can result in forecasted cost savings to society as a whole such that lipid therapy could potentially save lives and money.

Arch Intern Med. 2003;163:333-339

CARDIOVASCULAR disease (CVD) is the leading cause of death in Canada and a major cause of hospitalization for men and women (excluding childbirth).^{1,2} Among individuals of all ages, 36% of all deaths are attributable to CVD.¹ For instance, almost 30% of CVD deaths occur among men aged 45 to 64 years.¹

Although heart disease is most prevalent among older persons, a substantial number of people aged 35 to 64 years have received diagnoses of heart conditions.³ Because people in this age range are at the peak of their productive capacities, the impact of CVD is clinically and financially significant, as it results in premature mortality and preventable losses of employment, income, and quality of life. Among individuals aged 35 to 64 years, 345 000 (3% of the total population) have been estimated to have a diagnosis of heart disease.³

Recent studies have shown that treating dyslipidemia among patients with CVD is effective and cost-effective.⁴⁻⁸ The pri-

mary prevention in individuals without CVD is more problematic.^{6,8-10} At present, treating only individuals at high risk for the development of CVD appears to be cost-effective. Particularly in primary prevention, the presence of multiple risk factors is an important marker for future CVD events and cost-effective therapy.⁸⁻¹⁰

A number of studies have calculated cost-effectiveness ratios well under the threshold value of \$50 000 per year of life saved for high-risk individuals in primary prevention.^{6,10-12} However, most of these studies have focused only on the direct costs associated with health care and overlooked the indirect costs due to losses in productivity. The indirect costs of a disease are usually defined as the value of production lost to society due to illness with respect to paid and unpaid labor. These costs can be specified in terms of losses due to temporary absence from work, short- and long-term disabilities, and premature mortality.

We have completed an economic analysis of the prevention of CVD by treat-

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ing significant dyslipidemia with statin therapy. A comparison of results with and without indirect costs underscores their importance in economic analyses of CVD prevention.

METHODS

We estimated the costs and benefits of statin therapy in the primary prevention of CVD. Atorvastatin calcium (10 mg/d) was selected as a relatively inexpensive therapy on the basis of the results of treating significant dyslipidemia in an efficacy study comparing atorvastatin with simvastatin, pravastatin sodium, lovastatin, and fluvastatin sodium (CURVES Study).¹³ In this multicenter, randomized, open-label study, varying doses of specific statins were compared among patients with significant hyperlipidemia (low-density lipoprotein cholesterol [LDL-C] level, ≥ 160 mg/dL [≥ 4.2 mmol/L]). Long-term benefits of therapy were based on the forecasted results of statin therapy using the Cardiovascular Life Expectancy Model.⁸

We calculated direct and indirect costs. The direct costs included all medical care costs associated with CVD. The indirect costs represented the employment income lost and the value associated with decreased housekeeping activities after disease diagnosis. The benefits, expressed in terms of years of life saved (YOLS), and the cost-effectiveness estimates were generated from the Cardiovascular Life Expectancy Model,⁸ a validated Markov model.^{9,14,15}

THE CARDIOVASCULAR LIFE EXPECTANCY MODEL

The Cardiovascular Life Expectancy Model estimates the risk for fatal and nonfatal cardiovascular end points for a specified cohort of subjects with a given risk profile.⁸ The events estimated by the model include angina pectoris, coronary insufficiency, fatal and nonfatal myocardial infarction (MI), congestive heart failure, sudden coronary death, transient ischemic attack, fatal and nonfatal stroke, angioplasty, coronary artery bypass graft surgery, pacemaker insertion, catheterization, and arrhythmia. The benefits of risk factor modification are obtained by comparing model estimates generated under control and treatment conditions. In the present analysis, the benefits of statin therapy are expressed as YOLS, ie, the difference between the life expectancy after statin therapy vs no treatment. The incremental cost-effectiveness ratio is the difference in costs derived under treatment and control conditions divided by the benefits of treatment expressed in YOLS. Future costs and benefits were discounted 3% annually.

The risk factors used by the Cardiovascular Life Expectancy Model include sex, age, mean blood pressure, the natural logarithm of the LDL-C–high density lipoprotein cholesterol (HDL-C) ratio, and the presence of CVD, smoking, and glucose intolerance.⁸ Further details on the Cardiovascular Life Expectancy Model have been published.^{9,14,15} The validity of the model has been assessed across multiple clinical trials. For instance, in the Scandinavian Simvastatin Survival Study (4S), the observed difference in coronary heart disease mortality rates between statin-treated patients and a control group was 36.06 (per 1000) vs 35.04 forecasted by the model based on a net reduction of LDL-C level of 35% and an increase of HDL-C level of 8%.⁸ These changes in lipid levels are similar to those used for the present analyses.

LIPID THERAPY

The present analysis assumes daily treatment with a 10-mg tablet of atorvastatin calcium among subjects free of CVD and diabetes at baseline. Among such patients in the CURVES Study,¹³ total cholesterol and LDL-C levels were reduced by 28% and

38%, respectively, whereas HDL-C level increased by 5.5%. The baseline lipid profile of CURVES Study participants was also used in the present analysis. At baseline, CURVES Study participants had an average total cholesterol level of 300 mg/dL (7.76 mmol/L), average LDL-C level of 217 mg/dL (5.62 mmol/L), and average HDL-C level of 49 mg/dL (1.28 mmol/L).¹³ Estimates were generated for low- and high-risk patients aged 40, 50, and 60 years, where low risk represents normotensive (120/80 mm Hg) nonsmokers and high risk represents hypertensive (160/100 mm Hg) smokers. In these analyses, we assumed that modifying blood lipid levels lowers cardiovascular risk (after a lag of 1 year) to that of untreated individuals with the same blood lipid levels. This assumption is consistent with published trial results.⁸

DIRECT HEALTH CARE COSTS

Treatment costs included the costs of hospitalizations, physician fees, outpatient care, and emergency services where applicable. Hospital costs were estimated with the use of the Canadian Institute for Health Information methods.¹⁶ The average costs of Canadian physician services were based on reimbursement fee schedules from the provinces of Quebec and Ontario.^{17,18} Outpatient care costs for survivors of CVD events included separate cost estimates for the first year after the event and the subsequent years. The costs of stroke, in addition to hospital admission and outpatient care costs, included the costs of rehabilitation weighted by the probability of receiving rehabilitation. The same analysis was performed for the costs of admission to long-term care facilities.

All costs are expressed in 2000 Canadian dollars (\$1 Canadian = \$0.65 American) and were calculated using data from Statistics Canada¹⁹⁻²¹ and Intercontinental Medical Surveillance.²² The annual cost of a daily 10-mg tablet of atorvastatin calcium (including dispensing fees) was \$704 on the basis of IMS Compuscript data.²² Details for estimating all health care costs have been previously reported in detail.⁹

INDIRECT COSTS ASSOCIATED WITH CVD

Indirect CVD costs were estimated by comparing the productivity of individuals with CVD with that of subjects without the disease. The productivity losses were calculated using the employment income losses and loss of housekeeping services. We accounted for losses of productivity due to nonfatal and fatal CVD events. Individuals who died were assigned a value of zero productivity at work and at home.

Age- and sex-specific annual employment income for individuals with and without various manifestations of CVD were derived using the Statistics Canada Health and Activity Limitation Survey of Adults in Household and the Ontario Health Survey.^{23,24} For example, 50% of men aged 40 to 49 years reported disabling limitations after an MI. On average, they earned annually \$30441, or \$9945 less than individuals who had not experienced an MI.^{19,23,24} However, the remaining 50% of patients with MI did not report any disabling limitations; therefore we assumed that they earned \$40386 per year. Thus, all men with MI, aged 40 to 49 years, earned, on average, \$35492 per year, or \$4894 less than men without the disease.

We also estimated the annual indirect CVD costs attributable to losses in housekeeping services. These estimates value housekeeping services provided at home by individuals with and without CVD. They are based on the number of hours devoted to housekeeping, an estimate of the value of these services, and the difference between disability days reported due to illness experienced by individuals with and without CVD.^{25,26}

The value of housekeeping services was derived using the opportunity cost method. This method values the activity given

Table 1. Estimated Annual Employment Income and Value of Housekeeping Services Lost Due to CVD*

Sex, Age Group	Employment Income and Value of Housekeeping Services, CAD					
	Without CVD	Lost Due to CVD				
		Angina Pectoris	Coronary Insufficiency	Myocardial Infarction	Congestive Heart Failure	Stroke
Men						
40-49 y	49 788	9268	9185	5912	17 561	17 685
50-59 y	43 759	6212	4473	6378	7119	14 494
60-69 y	25 739	2404	2549	3463	2939	6259
70-79 y	9498	417	461	382	522	1042
≥80 y	6174	315	299	219	312	457
Women						
40-49 y	34 399	7163	6638	7143	7353	9189
50-59 y	28 203	4749	4989	5380	5628	6753
60-69 y	19 525	1117	1134	1304	1328	2090
70-79 y	9291	689	666	694	667	632
≥80 y	7035	177	162	175	174	238

Abbreviations: CAD, 2000 Canadian dollars; CVD, cardiovascular disease.

*Employment income and value of housekeeping services lost due to disease are calculated by subtracting employment income and housekeeping services with CVD from employment income and housekeeping services without CVD.

up for housekeeping as paid work where the hourly pay net of taxes is forgone. Underlying this method is the assumption that the market earnings potential of people who are not employed is, on average, equivalent to the earnings of the employed.²⁶ Combining the average hours of housekeeping, the average number of days of inactivity, and the opportunity costs for housework allowed us to calculate an annual value for housekeeping adjusted for age and sex.

SENSITIVITY ANALYSES

We initially completed these analyses assuming that the benefits of statin therapy would be enjoyed over an entire lifetime. Given the lack of data proving significant risk reduction among those older than 75 years, we also completed these analyses assuming that statin therapy would not reduce risk beyond 74 years of age, even if the costs of medication consumed remained constant.

RESULTS

INDIRECT COSTS

The annual employment income lost due to CVD was highest for those aged 40 to 49 years and ranged from \$4894 to \$16667 for men and from \$4381 to \$6933 for women. The employment losses were smaller for women than for men. This is consistent with the observation that women tend to have a lower probability of employment, and lower wages, and fewer hours worked relative to men. Since average employment income is lower for women than for men, they experienced a smaller drop in income on development of CVD. The employment losses tended to decrease with increasing age for both sexes, reflecting the decreasing rate of labor force participation with age.

Productivity losses for housekeeping were more extensive for women than for men. For example, for women the losses were estimated at \$2257 among those aged 40 to 49 years and at \$3083 among those aged 50 to 59 years. The corresponding values for men were \$1018 and \$896, respectively.

Table 2. Benefits of Atorvastatin Calcium Therapy in the Primary Prevention of CVD

Risk Level, Sex	Undiscounted YOLS, Age Group		
	40 y	50 y	60 y
Low*			
Men	3.42	3.03	2.46
Women	2.36	2.21	1.93
High†			
Men	4.90	3.93	2.72
Women	4.29	3.77	2.88

Abbreviations: CVD, cardiovascular disease; YOLS, years of life saved.

*Defined as nonsmokers with a blood pressure of 120/80 mm Hg.

†Defined as smokers with a blood pressure of 160/100 mm Hg.

By combining the losses arising from CVD for employment income and household services, we derived the total annual indirect costs associated with disease. Inclusion of housekeeping substantially increased the productivity losses due to CVD experienced by women and decreased the relative difference between men and women. For instance, among individuals with angina aged 40 to 49 years, men on average would encounter \$9268 in lost productivity value compared with \$7163 among women (**Table 1**). The productivity losses decreased with age for both sexes.

BENEFITS OF LIPID THERAPY

The benefits of lipid therapy among individuals with a baseline total cholesterol level of 300 mg/dL (7.76 mmol/L), LDL-C level of 217 mg/dL (5.62 mmol/L), and HDL-C level of 49 mg/dL (1.28 mmol/L) are presented in **Table 2**. Among normotensive, nonsmoking low-risk men, the life-long benefits of lipid therapy with a 10-mg/d dosage of atorvastatin calcium ranged from 3.42 YOLS in those aged 40 years to 2.46 YOLS in those aged 60 years. The benefits were even higher among hypertensive smokers. Among

Table 3. Cost-Effectiveness of Atorvastatin Calcium Therapy in the Primary Prevention of CVD

Risk Level, Sex	Cost per YOLS, CAD*					
	Direct, Age Group			Direct and Indirect, Age Group		
	40 y	50 y	60 y	40 y	50 y	60 y
Low†						
Men	11 816	7885	5365	CS	CS	CS
Women	19 866	10 747	4275	6625	CS	CS
High‡						
Men	5124	4161	3846	CS	CS	CS
Women	7580	4982	3756	CS	CS	CS

Abbreviations: CAD, 2000 Canadian dollars; CS, cost savings; CVD, cardiovascular disease; YOLS, years of life saved.

*The model assumes that the benefits of treatment accrue during the lifetime of the subjects. Costs and benefits are discounted at 3% annually.

†Defined as nonsmokers with a blood pressure of 120/80 mm Hg.

‡Defined as smokers with a blood pressure of 160/100 mm Hg.

Table 4. Lifetime Net Costs per 1000 Subjects Treated Associated With Atorvastatin Calcium Therapy in the Primary Prevention of CVD*

Risk Level, Sex	Net Costs, CAD†					
	Direct, Age Group			Direct and Indirect, Age Group		
	40 y	50 y	60 y	40 y	50 y	60 y
Low‡						
Men	13.1	9.8	6.7	(8.3)	(7.8)	(5.3)
Women	13.7	8.9	3.9	4.6	(0.5)	(4.5)
High§						
Men	11.1	8.9	6.8	(50.9)	(37.5)	(18.0)
Women	13.3	9.7	6.8	(19.3)	(20.1)	(13.4)

Abbreviations: CAD, 2000 Canadian dollars; CVD, cardiovascular disease.

*The model assumes that the benefits of treatment accrue during the lifetime of the subjects. Costs and benefits are discounted at 3% annually.

†Calculated as lifetime CVD cost associated with treating 1000 patients with statins minus the lifetime CVD cost associated with not treating 1000 patients with statins. Data are reported as CAD in millions. Data in parentheses indicate cost savings.

‡Defined as nonsmokers with a blood pressure of 120/80 mm Hg.

§Defined as smokers with a blood pressure of 160/100 mm Hg.

women, similar results were observed, but the absolute benefits of therapy tended to be less than those estimated for similar men, underscoring the lower absolute risk for CVD among women, all other things being equal. Exceptions to this generalization are high-risk older men who smoke and have hypertension. Remaining life expectancy is so attenuated that the benefits of statin therapy are also reduced.

INCREMENTAL COST-EFFECTIVENESS OF LIPID THERAPY

The incremental cost-effectiveness of lifelong therapy among men and women is presented in **Table 3**. For example, when only direct medical care costs are considered, the cost-effectiveness of atorvastatin ranges from \$5365 to \$11816 per YOLS among low-risk men. As a rule, high-risk men and women tend to have lower cost-effectiveness ratios compared with those at low risk.

When the societal point of view is adopted and the indirect costs are included in the analysis, lipid therapy results in YOLS and cost savings among low- and high-risk patients of all ages except for low-risk women aged 40 years. Accordingly, lipid therapy saves lives and money

across all ages and risk factors for men, and across all ages and risk factors for women starting from 50 years of age.

Estimated discounted lifetime net costs comparing 1000 patients treated with a drug that lowers lipid levels and 1000 untreated patients are presented in **Table 4**. For example, on average it costs \$13.1 million (direct costs only) more to treat 1000 men aged 40 years with atorvastatin during their lifetime to prevent CVD compared with the costs of 1000 similar men who would not receive the preventive treatment. Among the low-risk men, the cost differences, including only direct costs, range from \$6.7 million to \$13.1 million per 1000 subjects. Among the high-risk individuals, the additional costs of preventive treatment with atorvastatin range from \$6.8 million to \$11.1 million and from \$6.8 to \$13.3 million per 1000 subjects among men and women, respectively. Inclusion of indirect costs results in cost savings across all ages and risk factors for men and women, with the exception of low-risk women aged 40 years.

A sensitivity analysis was performed under the assumption that the benefits of lipid therapy would cease at 75 years of age but that the costs of lipid therapy would continue until death. Under this hypothesis, the benefits of lipid therapy are substantially reduced across all

Table 5. Lifetime Net Costs per 1000 Subjects Treated Associated With Atorvastatin Calcium Therapy if Treatment Benefits Stop at 75 Years of Age*

Risk Level, Sex	Net Costs, CAD†					
	Direct, Age Group			Direct and Indirect, Age Group		
	40 y	50 y	60 y	40 y	50 y	60 y
Low‡						
Men	14.7	12.1	10.0	(4.6)	(2.7)	2.1
Women	16.1	12.2	8.6	9.0	5.6	4.0
High§						
Men	10.6	8.1	5.7	(50.8)	(37.2)	(17.4)
Women	12.0	7.8	4.0	(19.5)	(20.4)	(13.5)

Abbreviations: CAD, 2000 Canadian dollars; CVD, cardiovascular disease.

*The model assumes that the benefits of treatment stop at 75 years of age. Costs are discounted at 3% annually.

†Calculated as lifetime CVD cost associated with treating 1000 patients with statins minus the lifetime CVD cost associated with not treating 1000 patients with statins. Data are reported as CAD in millions. Data in parentheses indicate cost savings.

‡Defined as nonsmokers with a blood pressure of 120/80 mm Hg.

§Defined as smokers with a blood pressure of 160/100 mm Hg.

ages and risk factors owing to increased numbers of fatal and nonfatal CVD events. For example, among those aged 40 years, the estimated benefits of lipid therapy under the assumption that benefits would cease at 75 years of age are reduced to 2.07 YOLS compared with 3.42 YOLS under the assumption of lifetime benefits. Consequently, the costs per YOLS are increased, since the costs of therapy continue until death.

Table 5 presents the discounted lifetime cost differences between 1000 patients treated with atorvastatin to prevent CVD and 1000 patients with no treatment, given the assumption that the benefits of therapy for lowering of lipid levels would cease at 75 years of age. The assumption that the benefits cease at that age results in increased direct cost differences between treatment and no-treatment arms among low-risk patients. In Tables 4 and 5, low-risk patients benefiting from atorvastatin therapy for life have better survival and experience fewer CVD events and less lifetime costs, despite the longer life expectancy, compared with those for whom the benefits would stop at 75 years of age. High-risk patients who benefit during an entire lifetime also have better survival. However, they also experience more CVD follow-up events, especially subsequent strokes, due to remaining risk factors during this longer survival; hence, they incur more direct lifetime costs compared with those among whom the benefits stop at 75 years of age. Once again, consideration of indirect costs results in cost savings among groups of individuals in Table 5.

COMMENT

These analyses demonstrate the substantial impact that indirect costs may have on economic analyses of lipid therapy to prevent cardiovascular disease. While statin therapy may be cost-effective across a wide range of high-risk patients, it does not result in net savings when only the direct costs of health care are considered. However, consideration of the indirect costs associated with losses in productivity can result in potential cost savings to society as a whole such that lipid therapy saves lives and money. It should be recognized that the forecasted ben-

efits estimated herein are based on the very high lipid values observed in the CURVES Study (average baseline LDL-C level, 217 mg/dL [5.62 mmol/L]). Lower baseline lipid values or smaller changes with treatment would be expected to result in less favorable cost-effectiveness ratios.²⁷

The human capital approach is often used in cost-effectiveness studies in the calculation of indirect costs²⁸⁻³¹ where lost earnings are used as a surrogate for the value of lost productivity. The concept of human capital is not without controversy. Earnings might be a poor estimate for the production lost to society, because some groups are undervalued, such as women, the young, and the elderly. Moreover, the human capital approach fails to recognize the costs of pain and suffering and the psychosocial consequences of illness. In addition, the real production losses might be much smaller than the potential losses, because sick people can often be replaced at little cost in a market with less than full employment.²⁸⁻³¹ Nonetheless, recent recommendations by Weinstein and colleagues³² suggest that time costs for individuals in the labor force can be generally valued by the wage rate as an acceptable measure of opportunity costs of time in a cost-effectiveness analysis. Moreover, since wage rates alone generally do not adequately reflect the value of time, inclusion of housekeeping activity losses should also be considered. In our analysis we included employment and housekeeping losses.

According to a recent Canadian health survey,³ poor overall health affects the employment status of adults with CVD. Although 35 to 64 years constitute a prime age range for labor force participation, just 48% of men with heart disease reported being employed, compared with 83% among those with no disease. For women, the corresponding numbers were 36% and 64%, respectively. For both sexes, the age-adjusted odds that those with heart disease would be employed were less than half of those for people without the disease. Thirty percent of people aged 35 to 64 years with heart disease were not working because they were on disability. By contrast, only 6% without disease cited not working because of disability. The age-adjusted odds that people with heart disease would

not be working because of illness or disability were 5.5 times higher than those of people without the disease. More than a third (36%) of people with heart disease reported needing help with housework or personal care, compared with only 8% of those without heart disease. In fact, the odds that adults aged 35 to 64 years with heart disease would need help were 5 times higher compared with those with no disease. This study suggests that the indirect costs of CVD are substantial. Unfortunately, this analysis and our data are unable to determine whether the indirect costs relate directly to the presence of CVD or indirectly to other comorbid conditions and risk factors such as diabetes, obesity, or a sedentary lifestyle.

One prospective study confirms that these cost estimates directly relate to the appearance of CVD. In a Swedish study, the costs of sick leave, disability, and early retirement before and 1 year after hospitalization were calculated for patients with CVD.³³ For individuals younger than 64 years, the losses, translated into Canadian dollars, were approximately \$6000 for MI, \$6000 for angina pectoris, and more than \$9000 for coronary insufficiency.³³ In our calculations, which included the housekeeping losses, the values closely approximated the Swedish data. For example, among individuals with MI aged 40 to 59 years, the losses ranged from \$5912 to \$6378 for men and from \$7143 to \$5380 for women (Table 1).

Many studies have been published on the cost-effectiveness of agents that lower lipid levels in the primary and secondary prevention of CVD.^{4,6,9-12} However, only a few include the indirect costs in their calculation of cost-effectiveness ratios.^{4,11,12} For example, Johansson and colleagues⁴ calculated the differences in labor productivity per patient-year before and after coronary events for the patients in the 4S placebo group. The estimates were based on the patient's work status, assessed every 6 months. Our lifetime estimated cost savings, including direct and indirect costs, were consistent with the short-term results of the 4S data. For instance, we estimated that when the reduction in the indirect costs associated with morbidity was included, treatment led to a savings among high-risk men and women aged 40 years with a pretreatment total blood cholesterol level of 300 mg/dL (7.76 mmol/L) (Table 3). The 4S data also resulted in cost saving. Moreover, our estimates suggested that cost savings would also occur among men and women across all ages except for low-risk women aged 40 years.

In a cost-effectiveness analysis based on the results of the Lipid Research Clinics Coronary Primary Prevention Trial, including savings of indirect costs from averted nonfatal events reduced the costs per YOLS from 10% to 50%.¹² An economic evaluation by Glick et al¹¹ also included expected lifetime direct and indirect costs of CHD. However, in the final results, it is not entirely clear how the inclusion of indirect costs affected the costs per YOLS.

Overall, the presence of CVD has had a significant economic impact in Canada. If one uses the cost-of-illness method, CVD is the largest cost category (15.3%) in terms of total (\$19.7 billion), direct (\$7.4 billion), and indirect (\$12.3 billion) costs among all diagnostic categories.²⁸ More than 60% of total CVD costs result from indirect losses of productive capacity due to premature

mortality and disabilities. In terms of the direct costs, the major cost components are hospital care (66%), drugs (21%), and physician care (12%). The major elements of the indirect costs of CVD are premature mortality (60%) and long-term disability (36%).

In the past 30 years, a steady decline in CVD death rates in the industrialized countries has been well documented. In Canada, CVD death rates have been declining steadily since the mid-1960s. Thus, the 1997 death rates are almost half those of 1969.^{1,2} Unfortunately, no Canadian data are available to link how the reduction in CVD mortality rates affects the direct and indirect CVD costs over time. However, a cost-of-illness study is available from Finland, where the CVD mortality rate declined by 50% from 1972 to 1992.³⁴ Among men aged 35 to 64 years, direct health care costs for CVD increased substantially (+124%) during these 20 years. However, indirect cost savings associated with reductions in morbidity (-18%) and premature mortality (-42%) more than compensated, resulting in a 24% reduction in total costs of CVD among working-age men. If elderly men (65 years and older) were included, the reduction in total costs was 14%. For men and women of all ages, the total costs of CVD declined 4%.

Lipid therapy with statins can reduce cardiovascular morbidity and mortality, as demonstrated in a number of clinical trials. The analyses presented herein forecast a reduction in total costs to society when the indirect costs associated with productivity and housekeeping services are considered.

Accepted for publication June 14, 2002.

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Dr Grover was a senior research scholar (Chercheur-boursier) supported by the Fonds de la Recherche en Santé du Québec and Dr Pilote was a research scholar of the Heart and Stroke Foundation of Canada. This study was funded in part by research grant 6605-4666-302 from the National Health Research and Development Program. Additional financial support was also provided by an unrestricted grant from Pfizer Canada Inc, Kirkland, Quebec.

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