Controlling the Ischemic Heart Disease Epidemic: Strategies for the 21st Century

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The twentieth century has been a time of remarkable success in public health. Improved living conditions and prevention of infectious diseases have increased life expectancy by almost 30 years.¹ Ischemic heart disease (IHD) is now the most common cause of death in Canada.² Although there have been recent reductions in incidence and mortality from IHD, our aging population portends future increases in both IHD burden and healthcare resource consumption.² Thus, we urgently need a comprehensive and coordinated program of prevention. The goals of this program should include reducing incidence, diminishing symptoms and sequelae, and prolonging life.³ From a population health perspective, most of the excess risk of IHD can be attributed to hyperlipidemia (43%), hypertension (25%), and smoking (22%).^{4,5} Modification of these three factors should form the cornerstones of any IHD prevention strategy. In this paper, we review the rationale for chronic disease prevention and discuss strategies available for IHD.

Prevention of chronic diseases

Preventing chronic disease is difficult: latency periods are long, causality between risk factor exposure and disease is difficult to establish, and most risk factors only weakly predict whether an individual will

develop disease.^{6,7} Furthermore, preventive interventions can lead to additional costs,⁸ while preventing fatal disease in middle age may result in greater downstream morbidity as survivors age and accumulate disabilities.⁹ Although prevention may not be cost saving, "it is better to be healthy than ill or dead...that is the beginning and the end of the only real argument for preventive medicine."⁶

Despite skepticism about the effectiveness of prevention, IHD incidence has declined since the 1960s, paralleling secular reductions in cholesterol, blood pressure, and smoking.¹⁰ Much of this decline has been attributed to primary (25%) and secondary (29%) prevention.¹¹

Strategies for the prevention of IHD

Primordial Prevention

The determinants of disease for a population are not necessarily the same as the determinants for an individual.^{3,6,12,13} Primordial prevention is directed at the social determinants of health and attempts to address social inequities. While there is only circumstantial evidence that primordial prevention would prevent IHD, the data establishing the risks of socioeconomic inequities are compelling. For instance, 2- to 4-fold differences in mortality exist across socioeconomic gradients, after controlling for differences in traditional IHD risk factors and even in countries with universal access to medical care.^{13,14} In fact, the differences in risk along socioeconomic gradients are similar in magnitude to those attributed to traditional IHD risk factors.

Primary Prevention – Population Approach

Primary prevention is the attempt to reduce the likelihood that a disease will develop in an individual through risk fac-

tor modification. It can be directed at individuals with particularly adverse risk profiles (high-risk approach) or at everyone (population approach).

The population approach attempts to lower the mean level of risk factors and shift the entire distribution of exposure.⁶ There are at least two advantages to this approach. First, most IHD occurs in individuals who are not high risk and small changes in the level of exposure across a population can have profound effects.^{6,7} For instance, a 10% reduction in the average cholesterol level in a population should lead to a 20-30% decrease in IHD.^{4,6,7} Similarly, reducing average sodium intake to <100 mmol/day within this population should result in a 2 mmHg drop in mean diastolic pressure, reducing the number of myocardial infarctions (MI) by 9%.¹⁵ Second, this approach is "behaviourally appropriate" in that it aims to change social norms rather than the behaviour of marginalized subgroups.⁶ For example, since 75% of daily sodium intake comes from that added in food processing, it should be easier to reduce the population's average sodium intake (by regulating the processing industry) than trying to reduce the intake of a few individuals.¹⁵

There are also disadvantages. First, the "prevention paradox" (a strategy that brings large benefits to the community offers little to each participating individual) limits our collective enthusiasm.⁶ Second, given the small benefits for the individual, the benefit/risk ratio is precarious and interventions that carry even minimal risk may lead to grave consequences. For example, sodium restriction may be associated with adverse metabolic changes and increased mortality in some groups.¹⁶ Finally, there is a common perception that

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this approach is less cost-effective than a "high-risk" strategy. However, cost-effectiveness ratios of \$34,640(US) per year of life saved were recently reported from a trial of lipid lowering in high-risk individuals,¹⁷ compared with an estimated \$3,200(US) per year of life saved using a population-wide approach to cholesterol reduction.¹⁸

Primary Prevention – High-risk Approach

This strategy has several potential advantages over the population approach. First, the high-risk strategy fits within the current biomedical framework – it makes sense to patients and physicians and this may maximize enthusiasm.⁶ Second, it is "appropriate" for the at-risk patient, without infringing on the rest of the lower-risk population. Third, untoward consequences of any intervention are borne only by those who have the most to gain. Finally, this strategy is likely to yield substantial benefits for high-risk individuals: MI risk can be reduced by 50% with smoking cessation, 2% for each 1% reduction in cholesterol, and 2% for each 1 mmHg decline in diastolic pressure.¹⁹

Nevertheless, the only way to deliver these interventions is by identifying pre-clinical patients with costly and laborious screening programs. For example, in MRFIT, 361,662 men were screened (at \$150[Cdn]/man) to find 12,000 high-risk subjects.⁷ Such costs, in terms of time, money, and effort, are incurred before any intervention starts. Even well-accepted practices, such as cholesterol screening, can be difficult to implement. A chart audit of 20,000 Canadian adults revealed that only one quarter had ever had a lipid profile performed (G. Fodor, personal communication).

Despite its intuitive appeal, there are disadvantages. First, labelling individuals as high risk tends to "medicalize" prevention and labelling itself may induce adverse psychological outcomes. Second, this strategy has been criticized as "behaviourally inappropriate," because it singles out a subgroup and demands that they pursue a different lifestyle than the norm. Third, it ignores the social determinants of disease. As observed by a MRFIT investigator: "every time we finally helped a man stop

smoking, on that day one or two children in a schoolyard somewhere were for the first time taking their first tentative puffs on a cigarette...we have done nothing to influence those forces in society that caused the problem in the first place."²⁰ Fourth, the high-risk strategy depends on the correct classification of individual risk, and we are currently limited in our ability to do this accurately.^{6,7}

Finally, we see the other side of Rose's prevention paradox: a large number of people at low risk may give rise to more disease than a small number at high risk.⁶ In MRFIT, IHD mortality was highest in subjects with cholesterol >7 mmol/L, although most deaths occurred in those with a cholesterol <6 mmol/L.²¹ A high-risk approach with ideal risk factor modification (cholesterol lowered to 4.9 mmol/L, diastolic pressure lowered to 80 mmHg) would reduce IHD mortality by one third,⁶ while a population approach that lowered cholesterol and diastolic pressure to the same degree would reduce IHD mortality by two thirds.⁷

Secondary Prevention

Secondary prevention refers to slowing progression, reducing disability, and prolonging life in those with disease. These patients are symptomatic and are easier to target for intervention. Secondary prevention represents a highly cost-effective approach. While the high-risk primary prevention approach to lipid-lowering was associated with costs of \$34,360(US) per year of life saved,¹⁷ the costs were \$1,200 to \$13,300(US) in a recent statin trial for secondary prevention.²²

The main barrier to secondary prevention is inadequate implementation of proven efficacious treatments.²³ We believe better implementation strategies (e.g., critical pathways, multidisciplinary case management) are essential to close the documented care gap for secondary prevention.^{23,24}

The way forward

There is convincing evidence that maneuvers to reduce the burden of IHD exist and are cost effective. However, a gap remains between the available evidence and its real-world application. We believe a comprehensive strategy to prevent IHD

must include: addressing underlying socioeconomic inequities; public education; population-wide primary prevention that targets some interventions (particularly pharmacologic ones) at high-risk groups; and maximization of efficacious therapies for secondary prevention. There is no single method to improve the vascular health of our population – what is required is vision, political will, and comprehensive planning. This is the path we must take to control the IHD epidemic that is upon us.

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deviation units. The effect size for the PAQLQ summary score was 0.12. These represent very small effect and will require a large sample size to prove statistically significant improvement due to education alone.

However, the education sessions appear to have resulted in subjective improvements in health behaviours and knowledge, and the majority of participants were satisfied with the sessions. Moreover, education is relatively inexpensive compared to medical care, so even modest improvements in quality of life may be considered worthwhile.

The main limitation of this study was its small sample size. This was due in part to its pilot nature, but was exacerbated by a poor response rate. The main recommendation for future trials is to inflate the number of students approached to ensure a larger consenting population, and to consider beginning the program during regular classroom time. It appeared that the requirement of parental involvement throughout the program was a limiting factor for some families.

CONCLUSIONS

The Air Force Program for educating children with asthma and their families has a small but clinically important effect. Since the cost of the intervention is minimal, and it is not associated with risk, further investigation is warranted. It was advantageous to deliver it through the local

schools. It should be targeted at those with the fewest external resources for learning to manage their asthma, and should be updated prior to initiating a full-scale randomized controlled trial. Evidence from this study may be helpful in identifying areas of improvement for the program (e.g., to address multi-cultural diversity).

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