Atherosclerosis: (Gr: athero: gruel, porridge; sclerose: harden). Arteries occluded by atheromatous disease the reason why most people have ‘heart attacks; and many people have ‘strokes’. And that athero – or arterio – sclerosis begins in childhood has been known since, at least, the Korean and Vietnam wars: military fatalities in their early twenties from Western countries were found at autopsy to have established disease in the heart’s coronary arteries. (In comparison their Asian counterparts had none). More recent studies with Intravascular Ultrasound have shown that arteriosclerotic streaking with atheroma can even begin in utero. Considering that Cardio-Vascular Disease costs Canadians upwards of $20 billion a year, it is incredible that Primary prevention of Coronary Heart Disease has almost completely ignored its adolescent origins. Indeed from the 1950s, when Coronary Heart Disease became epidemic in the Western world, medical prevention has concentrated huge sums of money to reverse the secondary outcomes of this disease in adults – angina, coronary thrombosis, sudden cardiac death – using paramedic services, diagnostic testing, hospitalization, surgical intervention and expensive medical treatment to the almost total exclusion of attempts to stop the progress of the disease from its initial source. Any commitment to Public Health initiatives have been repeated pleadings to the adult population to quit smoking, eat more nutritiously and stay active. Despite these efforts Coronary Heart Disease continues to spread to younger and younger age groups. Mortality and morbidity have been reduced by the interventions noted above but, with the exception of cigarette smoking, (which is showing some decline), other established behavioural heart hazards – obesity, inactivity, atherogenic diets – continue unabated.

In addition, most individuals are totally unaware of their own genetic or metabolic risk with respect to levels of Blood Pressure, Blood Cholesterols, Blood Sugars etc and are therefore poorly equipped to make behavioural choices based on their own individual make-up.

It is a great credit to the creator of homo sapiens sapiens that despite the atherogenicity of 20th and 21st century lifestyles only 50% of us in western countries develop arterial disease – (it may be that 100% develop it to some degree but only half of us show signs and symptoms or alternately have excellent genes and avoid smoking, and avoid eating land animal by-products and stay very active.

The difficulty for most people is in deciding which half they belong to at an early enough stage to take avoiding action. The early enough stage to avoid arteriosclerosis all together – for most individuals – has got to be childhood. “The Child is Father of the Man”. The only way for society to assist with this is by a total commitment to a Public Health solution.
Indeed there are few, if any, human illnesses which have been eradicated – or successfully modified – without a Public Health approach: either whole population strategies such as vaccination, water control, infant testing, or by strategies which identify high risk or affected populations such as those in need of antimalarials or retroviral agents for HIV.

Logically, whole population strategies for the prevention of arteriosclerosis which focus on advising society not to smoke, to eat heart healthily and to be active can only hope to work if there is some attempt to curtail the sale of cigarettes and to remove heart unhealthy foods from the market place and to make activity a beneficial option. This has not occurred. Due to commercial considerations in the first two and due to the large financial input required for the third. Yet it is too much to expect individuals – especially in low income groups – to adopt heart healthy behaviour when alternate choices are so much easier and less expensive. As the encouraging decline in cigarette smoking has shown it is only when an unhealthy behaviour starts to become socially ostracized at all levels of society that a positive reaction occurs. That has not happened with consumption of atherogenic foods or with the choice to be inactive. It is hard to conceive that the average Canadian starting school is going to be totally convinced of the evils of cigarettes and heart unhealthy foods and inactivity when cigarettes are being sold in every corner store beside the newspapers and magazines and while heart unhealthy food makes up most of the choice in supermarkets and restaurants and while they are told that physical education at school will stop next year.

The other public health option of identifying individuals or individual groups who are at increased risk is easier to achieve. High risk of future CHD is known to be associated with positive family histories of male parents or grandparents happening in their 50s and female parents and grandparents happening in their 60s. Indeed Canadian guidelines are suggesting that the famous Framingham Scoring method of stratifying future risk of Coronary Disease should be doubled for those individuals with such a Family History. Low birth weight is also a known risk factor, (presumably on the basis of smaller arteries), which is easily noted. It also would cost very little to acquaint adolescents (and their parents) with their present level of blood pressure or their present measurement of blood cholesterol and blood sugar. And these figures tend to track with aging ie a high cholesterol in ones teens will be higher in ones thirties if no remedial action is taken. Similarly physical fitness is also genetic and can be measured and poor genetic fitness is a risk factor for CHD.
The issue, of course, is what do you do with this knowledge? Will the knowledge of being at high risk for future Heart Disease due to possessing bad genes influence an individual or individual group to modify lifestyle choices in order to avoid future adverse outcomes. Will the adolescent who is aware of a positive family history and known high blood cholesterol elect never to smoke cigarettes and to remain physically active for life? Or is it advisable for very high risk individuals to start on medication at an early enough age to prevent hardened arteries from ever occurring. After all most accredited research into the prevention of arterial disease suggests that lowering Low Density Lipoprotein Cholesterol, (LDLC or “bad” cholesterol) to below 2 millosmols per litre in the general population would eradicate the disease almost entirely. (Indeed the best predictor of risk for future ‘heart attack’ is the ratio of Apolipoprotein B – a bad cholesterol molecule – to Apolipoprotein A – a good cholesterol molecule: it would cost $40 per student to do this on every child) And generally speaking most people with elevated levels as children will end up on medication later in their lives – if they live that long – so why not start on it earlier. Although there is some evidence to suggest that if the counseling of the genetic implications is presented in the proper manner - and at a young enough age - many individuals will make the right choices without the use of medication. But for those who cannot protect themselves medication would be the safest approach. After all young diabetics who cannot control sugar impairment with lifestyle alone are prescribed medication. Concerns about the relative risk from side effects of taking the medication often leave out the much higher relative risk of not taking the medication. One problem at resent is that adolescents advised by one health care professional that high blood pressure and high cholesterol may lead to future disease will be told by another health care professional that this is rubbish and they should ignore it. One common myth is that young children should not be deprived of a few harmless years of smoking and eating potato crisps in front of the TV as it will do them no harm. In fact the Bogalusa Heart Study shows us that is exactly the period when the damage is done which then slowly progresses to disease outcomes in a few more decades. If pedantic views still insist that individuals have a right to enjoy smoking and inactivity at some stage in their lives it would be more logical to advise children to adopt activity and abstain from smoking in their early and middle years and plan for an inactive and cigarette smoking old age because if they adopt these behaviours in their 70s they will succumb to some other illness before their arteries have time to occlude.
So, there is a choice in any plan to eradicate CHD; either whole population strategies comparable to vaccinating everyone against diphtheria or identifying the high risk groups comparable to giving antimalarials only in those countries where malaria is prevalent. (The best choice of all would be to adopt both strategies). If we choose to support the whole population approach we have to back it up with action: not just dispense advice; we have to restrict sales of cigarettes, (perhaps to those already addicted, or even move outlets to designated sites as we do with alcohol), not just restrict places to smoke. We have to legislate against the use of saturated fats such as trans and cis fatty acids in food preparation – as has been done in New York City – not only in restaurants but also in packaged items in supermarkets; and we have to legally curtail the amount of sugar being used in beverages and foods. We have to show a support for physical activity by returning to the daily ‘Phys. Ed’ period for all our students in all our schools; and we have to show adults a clearly visible benefit from daily activity such as tax deductions on memberships of clubs and associations and activities which promote exercise of any sort.

To adopt the at-risk approach is possibly easier than trying to recruit the entire population and while combining both options would be the best way to proceed identifying the at-risk population at a young age is more practical. This obviously requires a Public Health initiative within schools as this is the only source of 100% participation and is impacting on the only section of society that does not already have established disease. It also has the advantage of Public Health Nurses and Phys Ed teachers on hand. One such design was originated in the Niagara Peninsula in the mid 1980’s by Heart Niagara Inc.

Heart Niagara is a small organisation in the Niagara Peninsula which was originally founded, in 1977, to provide secondary prevention programmes in Cardio-Pulmonary Resuscitation and Advanced Cardiac Life Support training aimed primarily at establishing a Regional Paramedic programme. But its founding charter as a Community Coronary Care programme included a commitment to tertiary prevention in providing Cardiac Rehabilitation for survivors of Arteriosclerotic Heart Disease, (initially Myocardial Infarction and unstable angina but later Coronary Artery Bypass graft surgery and Angioplasty). The design also included a Primary Prevention section of the organisation to operate in the Workplace with local industry and in schools in co-operation with the local Public Health Department: Niagara Region Public Health Unit. The brainchild of this latter co-operation was the Niagara Schools Healthy Heart Project: first piloted among 6 high schools in Niagara Falls in 1987.
The project design is based on a co-operative association between the founding organisation: Heart Niagara – who provide the funding for administration, equipment and supervision; and the Niagara Region Health Department Youth Connection Nurses; and the present 2.(used to be 4), School Boards whose Physical Education teachers deliver the curriculum. The programme was so successful that it was expanded to all Niagara Region Secondary Schools in 1988 and over 4,000 Grade 9 Students in the Niagara Region are individually counselled each year. Grade 9 stage was chosen in 1987 because that was the last year which included mandatory Physical Education and the Project was intended to link activity as strongly as possible with the positive messages on Heart Health which the Project would convey. (Arguably the whole process should begin at a much younger age and, in fact, Heart Niagara has already entered the Elementary School system in the Niagara region with a similar curriculum based on the teaching of Cardio-Pulmonary Resuscitation. The original design of the Project in 1987 included even earlier interventions on Heart Health during vaccination visits at Family Physician and Paediatrician offices especially at the Pre-School visit as this would enroll the whole paediatric population).

Each student receives a Lifestyle Questionnaire at the commencement of the programme which includes a section for the parents to complete on Family History and also a signed authorisation for the student to participate in individual testing. The student completes the sections on their own smoking behaviour, nutrition and activity. The curriculum component on the pathogenesis and biochemistry of CHD and on measures to ensure future Heart Health are delivered by the Physical Education teachers in each school and is followed by a class for measurement of weight and height to attain age/gender specific Body Mass Index; blood pressure measurement, finger prick testing for Total Cholesterol and finally a shuttle run to evaluate fitness levels. There is a scoring mechanism for the Questionnaire and the measurements tested which is again age/gender specific for Blood Pressure and Blood Cholesterol There is a scoring mechanism for the Questionnaire and the measurements tested which is again age/gender specific for Blood Pressure and Blood Cholesterol. There is then a follow –up class to evaluate individual scores and outcomes which was initially delivered by the School Nurse but is now done by the Teacher. Niagara Health Unit Youth Connection Nurses assess each scorecard and contact students who show high risk features with respect to genes or behaviour. The student is counseled on lifestyle choices and the parents are notified in order to have themselves assessed by their Family Physician and also for the student to have a more clinical assessment which normally would include a full biochemical profile.
Recommendations are included for the parent and FP on issues such as referring students with Total Cholesterols above the 95th %tile to Paediatric Lipid Clinics in Hamilton or Toronto. Also in recent years various Medical groups including the Ontario Medical Association have recommended that all adolescents who are overweight or obese, (over the 85th percentile for age/gender specific Body Mass Index), be referred to a Physician. There is a recommended protocol for investigation and treatment which includes offering various resources to both parent and child. The Niagara Schools Healthy Heart Programme is ideally structured to advise parents to comply with this recommendation and to advise every Niagara adolescent at risk to seek follow-up.

In the 20 years that the programme has been running hundreds of young people and their parents have been referred for stratification of their risk of future CHD and for counselling and treatment if indicated. Regrettably the Project has never had enough funding to be able to evaluate outcomes and in recent years cutbacks to Public Health funding has reduced the availability of Youth Connection Nurses to conduct suitably intensive follow-up of those with High Risk profiles. However, many studies are now being released – some that include students referred from the Heart Niagara Programme – which demonstrate that early intervention can achieve a significant reduction in risk level and also can identify parents who have silent risk factors such as prediabetes, hypercholesterolaemia and hypertension.

The inevitable conclusion is that without enrolling students (and their parents) in programmes such as above there is no hope of reducing the early stages of arteriosclerotic change and therefore no possibility of modifying its role as an adult disease. If every Public Health Department in Ontario was equipped with a “Heart Niagara” Section which included adequate staffing for follow-up and counseling the potential savings in future health care costs could be enormous.