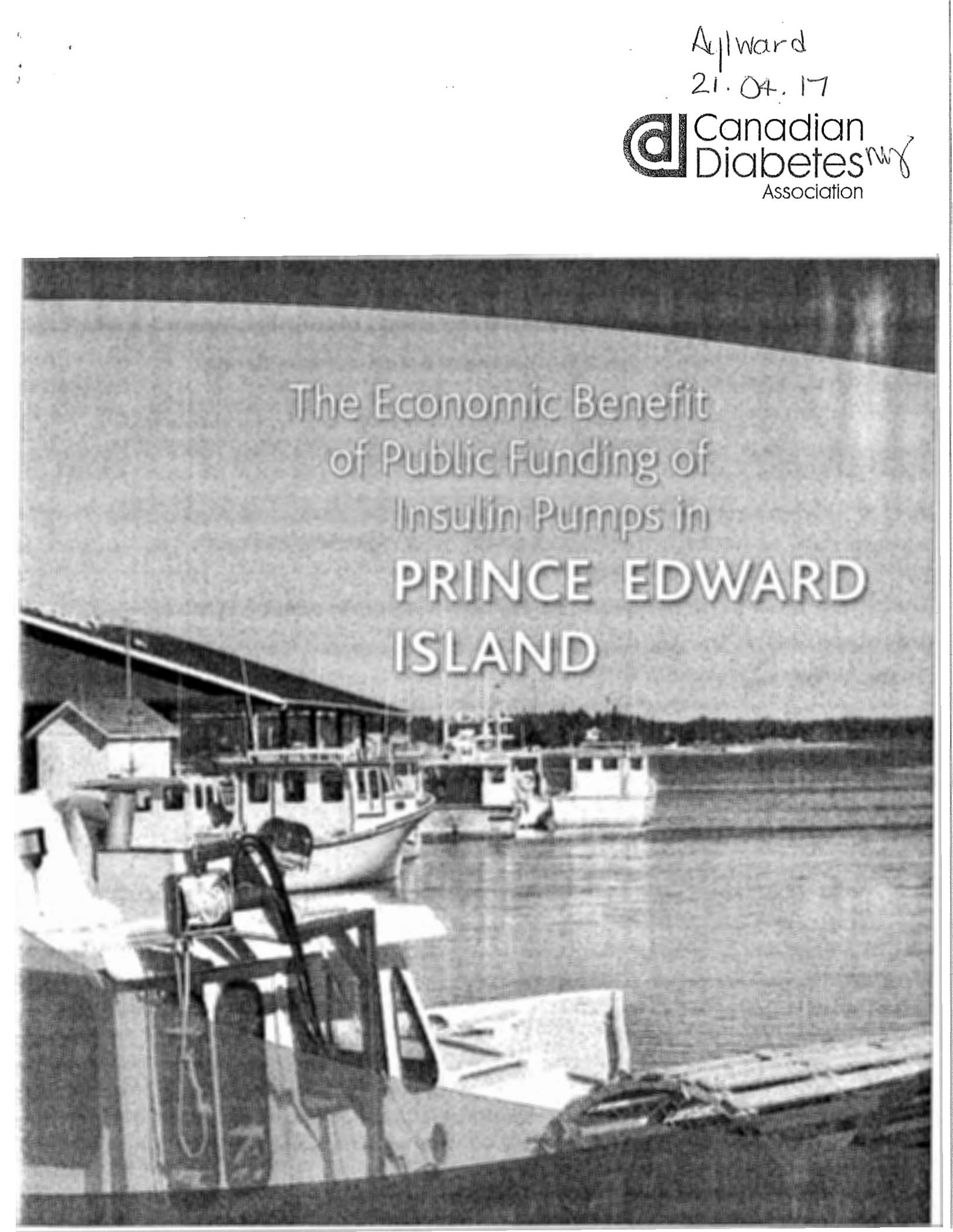


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 Canadian
Diabetes *my*
Association



The Economic Benefit
of Public Funding of
Insulin Pumps in
**PRINCE EDWARD
ISLAND**

Executive Summary

Every day, Prince Edward Islanders living with type 1 diabetes take insulin to live. Many deliver insulin by manually injecting it several times a day by syringe or insulin pen, while others use an insulin pump to deliver the appropriate amount of insulin throughout the day.

Significant evidence already exists demonstrating the medical benefits of insulin pumps versus multiple daily injections of insulin. These benefits also lead to real cost savings for the government, through a noted reduction in costly diabetes complications including heart attack, stroke, blindness, limb amputation and kidney failure.

This report will illustrate how a government investment into a publicly funded insulin pump program will not only lead to better health outcomes for many Prince Edward Islanders living with type 1 diabetes, but also provide the province considerable cost savings over time.

Key Report Findings¹:

- The number of people living with diabetes in Prince Edward Island is expected to rise from 13,000 people in 2012 to 25,000 people by 2032. Of this total, the estimated number of people living with type 1 diabetes is estimated at 640 people in 2012, and is projected to rise to 810 by 2032.
- The annual cost of providing insulin pumps and supplies for those with type 1 diabetes who chose to use an insulin pump is estimated to be \$400,000 in 2012 and projected to reach \$680,000 by 2032.
- These costs will be strongly offset by savings achieved through the reduction of secondary complications. The net direct cost is zero in 2012 but annual net savings will reach \$450,000 by 2032.
- When also factoring indirect cost savings arising from decreased diabetes mortality and disability, Prince Edward Island will save an estimated \$20,000 in 2012. The net savings to society by 2032 would total \$470,000 a year, with \$450,000 of those savings arising from net direct costs.

¹ All cost calculations used in this report are estimates, which assume the pump cost to be amortized over a six year period. These estimates have been based on the assumption that government is bearing the entire cost of the program. However, the true cost to government for this program would be dependent on a number of key factors, including the actual uptake rate for the program and the division of costs between government, individuals and insurance companies. Because of this, the true cost to government would likely be significantly less than the estimates provided in this report, resulting in even greater savings to the health care system.

Introduction

Diabetes is a chronic, often debilitating and sometimes fatal disease, in which the body either cannot produce insulin or cannot properly use the insulin it produces. This leads to high levels of glucose in the blood, which can damage organs, blood vessels and nerves. Persons diagnosed with diabetes can be classified as having either type 1, type 2, gestational or prediabetes—a condition that, if left unchecked, puts you at risk of developing type 2 diabetes.² Type 1 and type 2 diabetes currently affects about 8% of the population in Prince Edward Island.³

Every day, Prince Edward Islanders living with type 1 diabetes take insulin so that they can live healthy lives. Many choose to deliver the insulin by manually injecting it several times a day while others use an insulin pump to deliver the appropriate amount of insulin when required throughout the day.

There is compelling evidence of the medical benefits of insulin pumps versus multiple daily injections of insulin.⁴ This report builds on that evidence to demonstrate that not only does the use of insulin pump technology lead to better health outcomes for people living with diabetes, but that government investment into insulin pump programs is a cost effective method of addressing the burden of diabetes in the province.

This report will identify how the use of an insulin pump, in place of multiple daily injections will, over the long-term, reduce the number of serious complications experienced by people living with type 1 diabetes. These complications are the true drivers of the increasing costs of diabetes in the province.⁵ As such, the report will also demonstrate how the province's savings from the reduced number of complications will not only match, but in fact exceed the financial costs of implementing an insulin pump program in the province. Further, the amount of savings to the province will continue to grow each year.

Through the introduction of a pump program to include all people with type 1 diabetes, research shows that:

- The net savings from the program in the first year of implementation will be \$20,000.
- The net savings are projected to grow each year, reaching approximately \$470,000 by 2032.

² Prediabetes is a condition where a person's blood glucose level is elevated but not high enough to be diagnosed as type 2 diabetes. 50% of all people living with prediabetes will move on to develop type 2 diabetes in the future.

³ Canadian Diabetes Association, *Diabetes: Canada at the Tipping Point – Charting a New Path*. Available at: www.diabetes.ca/dpr.

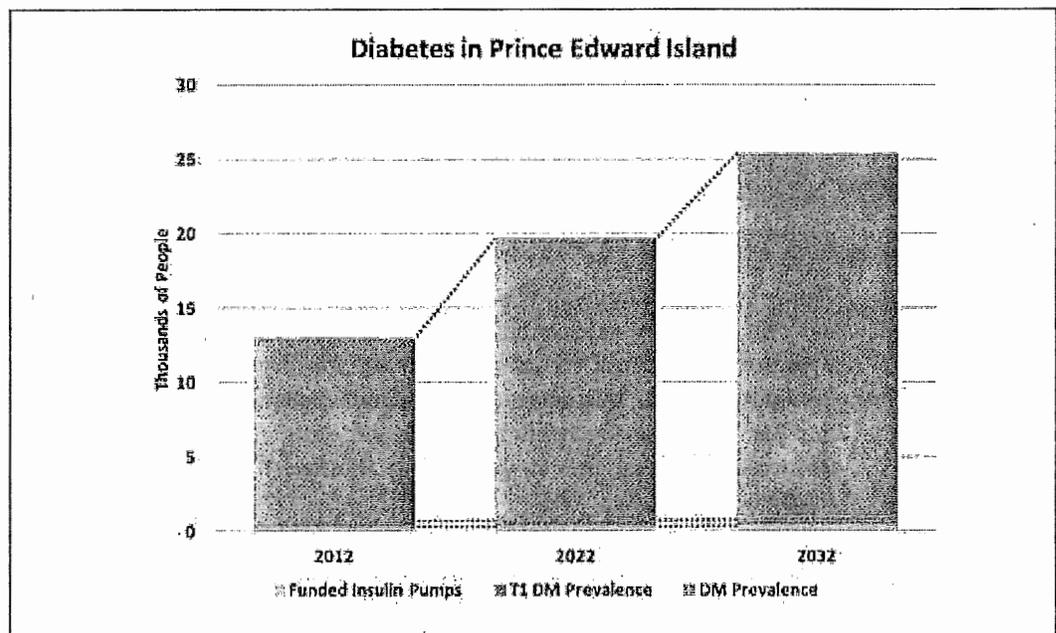
⁴ For reference, please see Slover RH, Welsh JB, Criego A, Weinzimer SA, Willi SM, Wood MA, Tamborlane WV. Effectiveness of sensor-augmented pump therapy in children and adolescents with type 1 diabetes in the STAR 3 study. *Pediatric Diabetes*, 2011 or Thomas Danne, M.D., Olga Kordonouri, M.D., Martin Holder, M.D., Holger Haberland, M.D., Sven Golembowski, M.D., Kerstin Remus, R.N., Sara Blasig, R.N., Tanja Wadien, R.N., Susanne Zierow, R.N., Reinhard Hartmann, M.D., and Andreas Thomas, Ph.D., Prevention of Hypoglycemia by Using Low Glucose Suspend Function in Sensor-Augmented Pump Therapy, *DIABETES TECHNOLOGY & THERAPEUTICS*, Volume 13, Number 11, 2011.

⁵ Canadian Diabetes Association, *Diabetes: Canada at the Tipping Point – Charting a New Path* op.cit.

Diabetes in Prince Edward Island

According to recent findings from the Canadian Diabetes Association's Prince Edward Island Diabetes Cost Model report,⁶ diabetes in Prince Edward Island is expected to rise from 13,000 people in 2012 to 25,000 people by 2032. Of this total, the estimated number of people living with type 1 diabetes is estimated at 640 people in 2012, and is projected to rise to 810 by 2032 (Figure 1).⁷

Figure 1



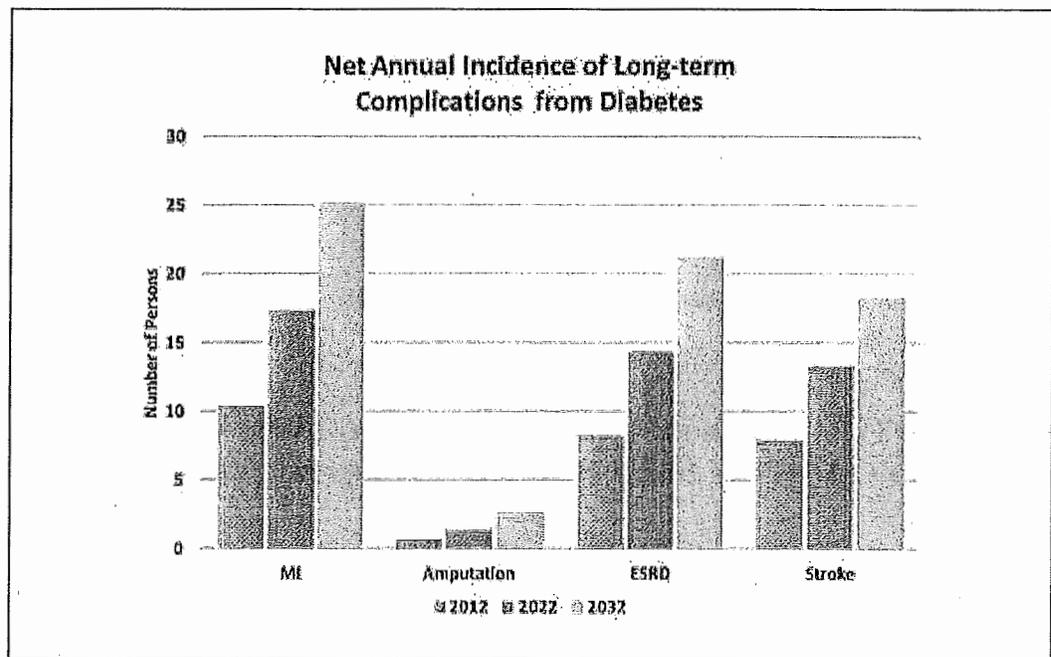
⁶ The Prince Edward Island Cost Model Report is available at: <http://www.diabetes.ca/advocacy/reports-and-information/federal-provincial-cost-model-reports/>

⁷ Based on this population size, the number of publicly funded pumps in 2012 is estimated to be 290, rising to 370 by 2032. These estimates are based on the assumption that 60% of persons with type 1 diabetes under the age of 20 would use an insulin pump while 40% of persons over the age of 20 would do so. Existing programs in Canada typically only serve 30 to 35% of eligible persons.

People living with type 1 diabetes are also at high risk of developing one or more serious long-term complications that can be attributed to the disease, such as end stage renal disease (kidney failure), myocardial infarction (heart attack), stroke and lower limb amputation.

The greatest impact will be on the number of persons experiencing a heart attack, as their numbers will rise from a net increase of 10 persons in 2012 to 25 persons by 2032. The number of people projected to suffer from end stage renal disease, stroke and lower limb amputations in the province, are also expected to rise over the next two decades (Figure 2).

Figure 2



Health Impact

The use of an insulin pump in place of multiple daily injections has been shown to improve A1C values and will, over the long-term, reduce the number of serious complications experienced by people in Prince Edward Island living with type 1 diabetes.⁸ Research conducted by IMS using the CORE model estimated the average annual change in the incidence of myocardial infarction, end stage renal disease, lower limb amputations and stroke shown in Table 1.⁹

The IMS research also included sensitivity analysis to determine the 95% confidence interval bounds for these estimates. The average cost per case (measured in 2009 dollars) reveals the burden that each of these complications places upon our healthcare system.

Table 1

Complication	% Change in Annual Incidence Rate			Average Cost per Case (2009\$)
	Base Case	Low 95% CI	High 95% CI	
Myocardial Infarction	-10.0%	-3.3%	-35.8%	\$20,935
End Stage Renal Disease	-20.4%	-16.3%	-24.5%	\$188,771
Lower Limb Amputation	-7.0%	-1.9%	-38.7%	\$28,461
Stroke	17.5%	4.4%	219.2%	\$34,785

Switching from daily insulin injections to an insulin pump reduces the overall expected reduction of secondary complications, most notably in end stage renal disease. The research also indicates that there will be an increase in the number of people expected to suffer from stroke. While this may not seem to be a positive outcome, persons using the insulin pump live longer lives without experiencing as many other complications from diabetes, thus, have more opportunity to suffer an age-related stroke.

⁸ For reference, please see Charles ME, Sadri H, Minshall M. and Tunis S. Health Economic Comparisons Between Continuous Subcutaneous Insulin Infusion and Multiple Daily Injections of Insulin for the Treatment of Adult Type 1 Diabetes in Canada, *Clinical Therapies: The International Peer-Reviewed Journal of Drug Therapy*, Vol 31, N.3 or Doyle EA, et al. A randomized prospective trial comparing the efficacy of insulin pump therapy with multiple daily injections using insulin glargine. *Diabetes Care* 2004;27:1554. These findings are also supported in several other studies, including Slover RH, Welsh JB, Criego A, Weinzimer SA, Willi SM, Wood MA, Tamborlane WV. Effectiveness of sensor-augmented pump therapy in children and adolescents with type 1 diabetes in the STAR 3 study. *Pediatric Diabetes*, 2011 and Thomas Danne, M.D., Olga Kordonouri, M.D., Martin Holder, M.D., Holger Haberland, M.D., Sven Golembowski, M.D., Kerstin Remus, R.N., Sara Blasig, R.N., Tanja Wadien, R.N., Susanne Zierow, R.N., Reinhard Hartmann, M.D., and Andreas Thomas, Ph.D., Prevention of Hypoglycemia by Using Low Glucose Suspend Function in Sensor-Augmented Pump Therapy, *DIABETES TECHNOLOGY & THERAPEUTICS*, Volume 13, Number 11, 2011

⁹ Although the CORE model and the DCM both include a broader set of complications associated with the disease, the four included in this research account for more than 99% of the costs. This study uses these average annual changes in incidence to generate the expected average change in the number of complications and their cost. It can however, take up to a decade for these healthcare benefits to be realized by patients. As a result, the short-term benefits arising from public funding of insulin pumps may be overstated.

Economic Impact

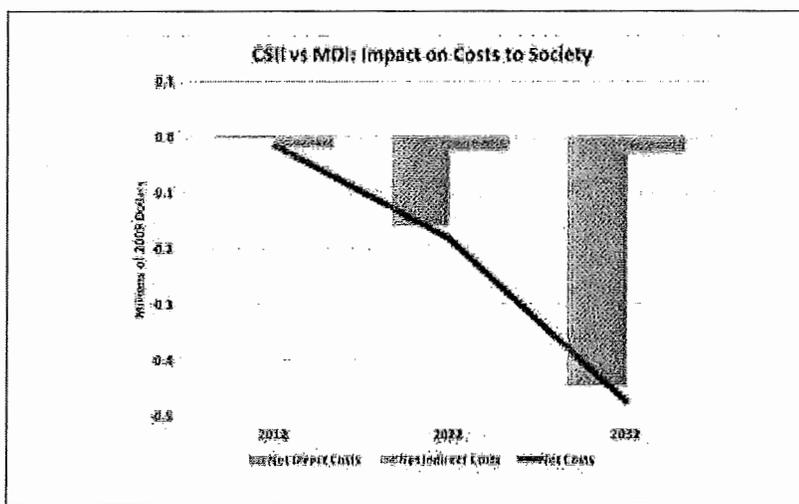
Insulin pumps and their supplies are expensive. Currently, there are a number of public funding models to assist with costs which then transfer some or all of the cost to the public healthcare system. The overall annual cost of providing insulin pumps and supplies to persons with type 1 diabetes in Prince Edward Island is estimated to be \$400,000 in 2012 rising to \$680,000 after twenty years.¹⁰

However, a pump program would allow for significant cost savings to the healthcare system through reductions in the annual cost of treatment for diabetes complications. The reduction in the annual cost of treatment for serious complications from diabetes is \$400,000 in 2012 but rises to \$1.1 million by 2032. When factoring in these savings, the net direct cost is zero in 2012 but becomes an annual net savings of \$450,000 by 2032.

Beyond the direct costs are indirect costs which arise from increases in mortality and disability associated with diabetes. The indirect costs for persons switching from daily insulin injections to an insulin pump lead to fewer serious complications. This, in turn, leads to fewer deaths and a reduction in the people experiencing difficulty with daily living.¹¹

When considering both direct and indirect costs savings, by implementing an insulin pump program, Prince Edward Island will save an estimated \$20,000 in 2012, the first year the program would be introduced. The net savings to society after two decades amount to \$470,000 a year with \$450,000 of those savings arising from net direct costs.¹²

Figure 3



¹⁰ The actual profile of cash outlays for the insulin pumps and supplies may differ from that shown in this analysis depending on the financing options arranged with pump vendors and the involvement of private health insurance plans. If the cost of the pump is paid in full at the outset, i.e. without financing, then the costs would be considerably higher in the first year and then much lower in each subsequent year.

¹¹ The DCM mortality and disability costs are relatively conservative at \$225,000 and \$4,000 per person respectively.

¹² It is important to note that these figures concerning the reduction in the cost of treatment for long-term diabetes-related complications are estimates and may be subject to change. The 95% confidence bounds were used to estimate upper and lower bound savings in direct costs from reduced long-term complications.

About the Report

The report was prepared by Robin Smeeth, Ph.D., of The Centre for Social Economics (CSE) using the Core Model in conjunction with Prince Edward Island Diabetes Care Model as produced by Canadian Diabetes Associations specific to that region. The CSE model is a dynamic and iterative economic and demographic change throughout Canada in simulated 500 levels of projections. It also provides customized studies on the economic, industrial and community aspects of various fiscal and eligibility changes, and develops customized impact and projection models for on-board client use.

About the Canadian Diabetes Association

Today, more than nine million Canadians live with diabetes or pre-diabetes. Across the country, the Canadian Diabetes Association is leading the fight against diabetes by helping people with diabetes live healthy lives, while we work to find a cure. Our national, city-based network of supporters help us provide education and resources to prevent, detect, understand, and control the disease, while we work toward a cure and to better research and practice applications.

For more information, please visit diabetes.ca or call
1-800-BANTING (226-8464)

Disclaimer:

The Prince Edward Island Diabetes Care Model was created for the Association by the Centre for Social Economics based on the Canadian Diabetes Care Model developed by Symmetria Canada, and made possible by our generous education fund grant provided by Novo Nordisk Canada Inc. The two main sources of data used in the model are the results from the National Diabetes Surveillance System (NDSS) and Health Canada's study the Economic Burden of Diabetes in Canada. The Model does not integrate the administrative prevalence and incidence estimates from NDSS with the economic and expenditure from EBC. The Model supports analysis of the sensitivity of the prevalence and cost estimates to changes in demographic data, incidence and mortality rates by age and sex, as well as the cost and utilization of health care services.