About RiskAnalytica for Health Analysis

RiskAnalytica provides objective, independent and evidence based analysis dedicated to a comprehensive and collaborative understanding of the short and long term risks and returns behind policy decisions and health and economic outcomes.

RiskAnalytica serves governments, not-for-profits and private organizations that seek a best-of-breed understanding of the issues facing them using expertise combined with a many variable computational socio-economic and population health policy evaluation platform.

About This Report

This report was prepared by RiskAnalytica on behalf of the Ontario Pharmacists Association. In keeping with the RiskAnalytica’s guidelines for funded research, the design and method of research, as well as the content of this study, were determined solely by RiskAnalytica. The research was conducted by Paul Smetanin, Boriana Miloucheva, Douglas McNeil and Charles Burger.

Statistics Canada data and relevant literature was used to inform the computer simulation models used to produce the results of this report. All quantitative methods used are documented herewith.

The interpretation and reporting of the results of the mathematical modelling contained within this report do not necessarily represent policy position or the opinion of the Ontario Pharmacists Association.

Forecasts and research often involve numerous assumptions and data sources, and are subject to inherent risks and uncertainties. This information is not intended as specific investment, accounting, legal, or tax advice.

Citation:

EXECUTIVE SUMMARY

POLICY CONSIDERATIONS AND SCOPE

Widespread use of vaccinations has led to the decrease in occurrence of many infectious diseases (Ak-Sukhni, Avarino, McArthurt, & McGeer, 2008) and has been responsible for the reduction in the annual morbidity of diseases such as polio, chickenpox and smallpox (Ak-Sukhni, Avarino, McArthurt, & McGeer, 2008). Prior to 2003, there were eight publicly available vaccines in Ontario; today there are twenty-two vaccines available and they each have the potential to save people more than $2,500 in health care costs over their lifetime (Ministry of Health and Long-term Care, 2015) and under some circumstances are required in order to attend Ontario public schools (Ontario Ministry of Health and Long-Term Care, 2014).

Pharmacists, being the most accessible health care providers, possess the ability to help increase immunization rates, while relieving added pressure placed on health care resources such as general practitioners (GPs). An expanded role for pharmacists as vaccine administrators is not a new concept. In Alberta, pharmacy-based immunization has increased the vaccinated population by 3% between 2010 and 2012 (Shoppers Drug Mart, 2013). Moreover, physicians are in favour of an increased pharmacy vaccination program as it allows patients faster and more convenient access to vaccines (Shoppers Drug Mart, 2013). The Ontario Pharmacists Association (OPA) wants to investigate whether a business case exists to support their proposal to increase education and access to immunizations for pertussis (whooping cough), pneumococcal diseases (PD), and herpes zoster (shingles). In doing so, it hopes to reduce the symptomatic cases of these diseases, as well as the associated burden on the health care system.

The purpose of this analysis is to understand the value of education and access to immunizations for pertussis, pneumococcal diseases, and shingles. In order to support such an evaluation, RiskAnalytica has undertaken an analysis with the primary objective of demonstrating how health care utilization, intervention costs (costs to increase pharmacists’ scope to administer immunizations for select diseases) and symptomatic cases change in response to changing immunization rates. This analysis provides policy and decision makers with an understanding and insight into the value of this OPA proposal.

STATUS QUO (BASELINE) AND EXPANDED PROGRAM

Under status quo assumptions of baseline population growth, Ontario is expected to grow from 13.8 million people to 17.3 million between 2015 and 2045. In addition, the total number of vaccines that will be given out by doctors under this scenario is estimated to be approximately 10.5 million vaccinations by 2045. Among the three disease categories, by 2045, it is expected that there will be:

- 4 million vaccinations administered against pertussis;
- 6 million vaccinations administered against pneumococcal diseases; and
- 500,000 vaccinations administered against shingles.

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Evaluation of the Impact of an Expanded Immunization Program

Under the proposed expansion of the vaccination program, pharmacists would be permitted to administer vaccines for pertussis, pneumococcal diseases, and shingles. The effect of an expanded vaccination program is that pharmacists would increase the vaccination prevalence rate amongst these vaccines up to 100% within the Ontario-eligible population. Sensitivity analysis is performed on this parameter and we find that OPA’s proposed expansion creates value in the form of statistically significant reduced health care costs and prevention of illness events across the three targeted disease types.

**PERTUSSIS (WHOOPING COUGH)**

By expanding the pharmacy immunization program to include other vaccines beyond influenza, there will be an additional 2.1 million pertussis vaccines administered by 2045, which will increase the vaccinated proportion of the eligible population in 2045 by 24 percentage points, from 69% to 93%, compared to the base case as shown on the left of Figure 1.

**Figure 1** Vaccinated population and total health care costs prevented of Pertussis in Ontario (Real, 2015 $)

The increased vaccination rate will result in a reduction in the cases of pertussis. By 2045, we estimate a 19% reduction in the incidence of pertussis in Ontario. This will reduce the burden on Ontario’s health care system by 2045 by a total of:

- 4,000 GP visits, reducing costs by 19%;
- 2,600 emergency room (ER) visits, reducing costs by 20%; and
- 400 hospitalizations, reducing costs by 20%.

The right graph of Figure 1 shows the total health care costs prevented due to this reduction in pertussis incidences across GPs, ERs and hospitalizations. The total health care costs prevented by 2045 amount to around $9.4 million.

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1 GP refers to General Practitioners and ER refers to Emergency Room
Evaluation of the Impact of an Expanded Immunization Program

**Pneumococcal Diseases**

Expanding the vaccination program will result in an additional 4.3 million vaccines administered for pneumococcal diseases given by 2045. This will increase the vaccinated proportion of the population in 2045 by 22 percentage points, from 37% to 55%, compared to the base case scenario as shown on the left graph of Figure 2.

**Figure 2**  Vaccinated population and total health care cost savings of Pneumococcal Disease in Ontario (Real, 2015 $)

The increased vaccination rate will reduce the incidence cases of pneumococcal diseases by 17% by 2045. This will reduce the burden on Ontario’s health care system by 2045 by a total of:

- 9,700 GP visits, reducing costs by 17%;
- 67,500 ER visits, reducing costs by 19%; and
- 11,500 hospitalizations, reducing costs by 19%.

This will result in total cost prevention in pneumococcal disease related health care costs of $256 million by 2045.

**Herpes Zoster (Shingles)**

Expanding the vaccination program to include pharmacists will increase the number of shingles vaccines administered by approximately 7.6 million by 2045. This increase in vaccinations will result in an increase in the eligible vaccinated population by 58 percentage points, compared to the base case, by 2045. This is an increase from 7% to 65%, respectively, between the base and expansion scenarios, as shown in the left graph of Figure 3.

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2 GP refers to General Practitioners and ER refers to Emergency Room
The increased vaccination rate will reduce the incidence cases of shingles by 8% by 2045. This will reduce the burden on Ontario’s health care system\(^5\) by 2045 by a total of:

- 284,000 GP visits, reducing costs by 8%; and
- 1,300 hospitalizations, reducing costs by 2%.

This will result in total cost prevention in shingles related health care costs of $35 million by 2045, as shown in Figure 3.

**NET BENEFIT**

The total health care costs avoided from illnesses prevented across the three disease categories through an expanded vaccination program that includes pharmacists is approximately $300 million by 2045. However, the additional costs incurred when pharmacists administer vaccines need to also be considered. This is a cost of approximately $7.50\(^6\) (Real, 2015 $) per vaccination. Assuming pharmacists solely capture the increased demand for vaccines that occurs when expanding the vaccination program, there will be a cost of $89 million by 2045. Therefore, expanding the program will see total net value added of $210 million by 2045, or yearly value added of $6.8 million, as shown in Figure 4. The total value added from

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\(^3\) The bump present in the shingles costs saved when compared to the other diseases is due to the fact that shingles presents predominantly in older individuals, as opposed to the other conditions which can present at younger and older ages. Therefore, the majority of costs saved occur in the early years of the program from the ramp-up period, after which costs saved decrease due to fewer people getting vaccinated as they move into the older age bracket.

\(^4\) GP refers to General Practitioners and ER refers to Emergency Room

\(^5\) Note: In the case of herpes zoster the effect of the expanded vaccination program on the costs incurred through ER visits were not reported due to lack of available data.

\(^6\) It should be noted that while $7.50 is the current reimbursed rate to pharmacy for influenza immunizations under the Universal Influenza Immunization Program, cost recovery is estimated at approximately $8.50 for the time required to administer the injection and any associated supplies.
Evaluation of the Impact of an Expanded Immunization Program

the program can reach as high as $217 million by 2045 (or $7 million per year) if pharmacists fully replace GPs as immunizers.

**Figure 4** Net Value of expanded vaccination program (Real, 2015 $)

![Net Value of expanded vaccination program](chart)

<table>
<thead>
<tr>
<th>Proportion of Total Vaccines</th>
<th>Pertussis</th>
<th>Pneumococcal Diseases</th>
<th>Herpes Zoster (Shingles)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>4,000</td>
<td>9,700</td>
<td>147,000</td>
</tr>
<tr>
<td>10%</td>
<td>4,000</td>
<td>9,700</td>
<td>284,000</td>
</tr>
<tr>
<td>25%</td>
<td>180,000</td>
<td>434,000</td>
<td>12.6 Million</td>
</tr>
<tr>
<td>50%</td>
<td>1,9%</td>
<td>17%</td>
<td>8%</td>
</tr>
<tr>
<td>75%</td>
<td>2,600</td>
<td>67,000</td>
<td>-</td>
</tr>
<tr>
<td>100%</td>
<td>2,600</td>
<td>67,000</td>
<td>-</td>
</tr>
</tbody>
</table>

**CONCLUSIONS**

By 2045, expanding the pharmacy immunization program to include other vaccines beyond influenza is expected to reduce the total number of disease cases, health care utilization and generate value by a cumulative 160,000 cases, 380,000 visits, and $300 million, respectively. Across the three disease categories, the effect of increased vaccination throughout this period is shown in Table 1.

**Table 1** Summary of the effect of increase vaccination across the three disease types

<table>
<thead>
<tr>
<th>Categories (Cumulative by 2045, Real 2015 $)</th>
<th>Pertussis</th>
<th>Pneumococcal Diseases</th>
<th>Herpes Zoster (Shingles)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cases Prevented</td>
<td>4,000</td>
<td>9,700</td>
<td>147,000</td>
</tr>
<tr>
<td>General Practitioners</td>
<td>4,000</td>
<td>9,700</td>
<td>284,000</td>
</tr>
<tr>
<td>Visits Prevented</td>
<td>180,000</td>
<td>434,000</td>
<td>12.6 Million</td>
</tr>
<tr>
<td>Costs Saved</td>
<td>19%</td>
<td>17%</td>
<td>8%</td>
</tr>
<tr>
<td>Emergency Room</td>
<td>2,600</td>
<td>67,000</td>
<td>-</td>
</tr>
<tr>
<td>Visits Prevented</td>
<td>950,000</td>
<td>26.3 Million</td>
<td>-</td>
</tr>
<tr>
<td>Costs Saved</td>
<td>20%</td>
<td>19%</td>
<td>-</td>
</tr>
<tr>
<td>Hospitalizations</td>
<td>444</td>
<td>12,000</td>
<td>1,300</td>
</tr>
<tr>
<td>Visits Prevented</td>
<td>8.3 Million</td>
<td>229 Million</td>
<td>22 Million</td>
</tr>
<tr>
<td>Costs Saved</td>
<td>20%</td>
<td>19%</td>
<td>2%</td>
</tr>
</tbody>
</table>
In addition to the health care value added, expanding the vaccination program has the potential to divert funding from the higher GP immunizer cost base to a lower pharmacist immunizer cost base. In doing so, further value can be achieved. Net benefits of the program and varying vaccination levels are shown in Table 2.

**Table 2**  Net benefits of expansion across various pharmacy uptakes (Real, 2015 $)

<table>
<thead>
<tr>
<th>Percent Vaccinated by Pharmacists</th>
<th>Net Value Added by 2045</th>
<th>Percent Change in costs by 2045 from Base Case</th>
<th>Annual Value Added</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>$210 Million</td>
<td>8.1%</td>
<td>$6.8 Million</td>
</tr>
<tr>
<td>10%</td>
<td>$211 Million</td>
<td>8.1%</td>
<td>$6.8 Million</td>
</tr>
<tr>
<td>25%</td>
<td>$212 Million</td>
<td>8.2%</td>
<td>$6.9 Million</td>
</tr>
<tr>
<td>50%</td>
<td>$214 Million</td>
<td>8.2%</td>
<td>$6.9 Million</td>
</tr>
<tr>
<td>75%</td>
<td>$216 Million</td>
<td>8.3%</td>
<td>$7.0 Million</td>
</tr>
<tr>
<td>100%</td>
<td>$217 Million</td>
<td>8.4%</td>
<td>$7.1 Million</td>
</tr>
</tbody>
</table>

It is important to note that the net benefits from expanding the vaccination program to include pharmacists are positive across all tested effectiveness levels of the program. Under the most conservative projections (that is, pharmacists capturing only additional demand, with no substitution away from vaccination through physicians) the program is still estimated to reduce health care spending in this area as a result of associated illnesses by 8.1% (generating an additional $210 million value in the health care system) by 2045. Under this same scenario, if vaccine administration was shifted away from GPs towards pharmacists (which literature review has shown to occur upon expansion of pharmacists’ roles (Shoppers Drug Mart, 2013)), we estimate a maximum potential value added of 8.4% (generating a net benefit to the health care system of $217 million) by 2045.