Life and Economic Impacts of Nosocomial Methicillin-Resistant *Staphylococcus Aureus*, Clostridium Difficile and Vancomycin-Resistant Enterococci in Canada

2009 to 2038

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RiskAnalytica

RiskAnalytica is an employee owned management science solutions firm specializing in independent consulting, development and implementation of management science solutions. In this respect, RiskAnalytica represents a fusion of management consulting with contemporary scientific theories and technology development.

RiskAnalytica has researched and developed an approach to health care risk management. This approach has been realized into a framework called Life at Risk®, which represents the core product and business interests of RiskAnalytica. The Life at Risk® simulation platform has been used over the past five years to evaluate in excess of sixty leading population health policy interventions.

EXECUTIVE SUMMARY

SCOPE OF THE REPORT

The goals of the current report are: (1) to estimate the life and economic burden in Canada attributed to the incidence of three nosocomial infections; and (2) to demonstrate the value proposition significance if this burden can be reduced by systematic interventions to improve strategies for nosocomial infections control and prevention.

The stated goals of the report are achieved by applying a systematic discrete event simulation analysis to the life and economic impacts of methicillin-resistant *Staphylococcus aureus (*MRSA), clostridium difficile (c. difficile) and vancomycin-resistant enterococci (VRE) upon the Canadian population and economy from 2009 to 2038. Further, three intervention scenarios are considered by the analysis. The intervention scenarios are generated under the assumptions that the current responses to manage nosocomial infections will improve between 2009 and 2038 as a result of a nation-wide strategy for nosocomial infection control and prevention. It is assumed that implementation of the strategy over a 30-year period will result in a reduction in the incidence of the nosocomial infections as well as the attributed mortality. Each intervention scenario estimates a hypothetical reduction in economic burden for the society and the Government. The following intervention scenarios are considered by this study:

- Scenario 1: Lower Impact. The strategy will result in a 10% reduction in the incidence of the considered nosocomial infections over the 30-year period;
- Scenario 2: Intermediate Impact. The strategy will result in a 20% reduction in the incidence of the considered nosocomial infections over the 30-year period; and
- Scenario 2: Higher Impact. The strategy will result in a 30% reduction in the incidence of the considered nosocomial infections over the 30-year period.

Implementation of each intervention scenario is assumed to begin in 2009 and reach its intervention goal by 2019.

The analysis contained for this section was conducted using the Life at Risk® simulation platform developed by RiskAnalytica. Life at Risk® is a 'discrete event simulation' decision analytic policy platform that incorporates the design of peer reviewed empirical models (e.g. clinical trials) and empirical data (eg. historical and surveillance data, health costs) into modulized discrete event simulations. This simulation platform is designed to conduct modern multidisciplinary quantitative modeling that supports evidence-based performance evaluation and tracking of health care initiatives. The Life at Risk® simulation platform has been used over the past five years to evaluate over sixty leading health policy interventions.

SUMMARY OF MAIN FINDINGS

Nosocomial MRSA, c. difficile and VRE infections represent a substantial problem for Canada. Current standard practices of nosocomial infection prevention and control translate into high costs for the health care system, reduced business and government revenue due to loss of employment and overall social burden associated with disability. Exhibit 1 illustrates the combined cumulative burden of the MRSA, c. difficile and VRE in life and economic terms for specified benchmark years.

Exhibit 1 Considered Nosocomial Infections, Life and Economic Impacts (Cumulative as of 2009), Five-Year Intervals, Total Canadian Population, All Age Groups, Dollar Amounts in 2008 Present Values: 2009-2038

Year	Life and Economic Impacts				
	Incidence	Mortality	Health Costs (millions)	Wages Lost (millions)	Taxation Revenue Lost (millions)
2009	27,694	9,229	$436	$790	$104
2013	144,807	48,132	$2,279	$3,836	$498
2018	306,054	101,361	$4,700	$7,709	$1,024
2023	487,725	161,034	$7,185	$12,074	$1,644
2028	688,816	226,767	$9,705	$16,658	$2,337
2033	907,846	298,071	$12,307	$21,824	$3,218
2038	1,142,057	374,011	$14,978	$27,561	$4,237

Analytical source: Smetanin & Kobak, RiskAnalytica Life at Risk Model simulation for the L5L Project, August 2008.

The risk-based analysis conducted for this study demonstrates the impact of a nation-wide strategy for nosocomial infection control and prevention over a thirty-year period. According to the analysis, if the strategy results in a 10% reduction in the incidence of the considered nosocomial infections over the 30-year period, its cumulative life and economic impact by 2038 is expected to result in:

- Reducing the incidence of the considered nosocomial infections by 70,388 cases;
- Reducing the mortality attributed to the considered nosocomial infections by 25,478 cases;
- Recovering over $916 million in health care costs (2008 present value);
- Recovering over $1.6 billion in lost wages (2008 present value); and
- Recovering over $261 million in lost taxation revenue (2008 present value).

Alternatively, if the strategy results in a 20% reduction in the incidence of the considered nosocomial infections over the 30-year period, its cumulative life and economic impact by 2038 is expected to result in:

- Reducing the incidence of the considered nosocomial infections by 126,371 cases;
- Reducing the mortality attributed to the considered nosocomial infections by 40,711 cases;
- Recovering over $1.5 billion in health care costs (2008 present value);
- Recovering over $3.2 billion in lost wages (2008 present value); and
- Recovering over $523 million in lost taxation revenue (2008 present value).

Finally, if the strategy results in a 30% reduction in the incidence of the considered nosocomial infections over the 30-year period, its cumulative life impact by 2038 is expected to result in:

- Reducing the incidence of the considered nosocomial infections by 186,880 cases;
- Reducing the mortality attributed to the considered nosocomial infections by 59,933 cases;
- Recovering over $2.2 billion in health care costs (2008 present value);
- Recovering over $4.8 billion in lost wages (2008 present value); and
- Recovering over $791 million in lost taxation revenue (2008 present value).

VALUE PROPOSITION FOR THE L5L INITIATIVE

The outcomes of the current research were used to develop value proposition for the L5L initiative[1] under the assumptions of Scenario 2: a 20% reduction in the incidence of the considered nosocomial infections over the 30-year. The value proposition analysis demonstrates the following cumulative net present value (NPV) factoring in 15 year costs of financing Scenario 2:

- From the perspective of the Canadian society, it will take 7.5 years to recoup all costs of financing the L5L initiative during its start-up 5-year period;
- From the perspective of the Governments of Canada (collectively federal and provincial), it will take 14.5 years for the Governments of Canada to recoup all costs of financing the L5L initiative during its start-up 5-year period.

[1] Refer to the *L5L Inaugural Business Plan* for detailed description of the L5L initiative

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TABLE OF EXHIBITS

1 INTRODUCTION

The current report has two goals. The first goal is to estimate the scope of the life and economic burden in Canada attributed to the incidence of three nosocomial infections and the associated mortality. The second goal is to demonstrate the value proposition significance if this burden can be reduced by systematic interventions efforts to improve strategies for nosocomial infections control and prevention.

The stated goals are achieved by generating one base and three intervention scenarios that simulate life and economic impacts of methicillin-resistant *Staphylococcus aureus (*MRSA), clostridium difficile (c. difficile) and vancomycin-resistant enterococci (VRE) upon the Canadian population and economy from 2009 through to 2038. The base scenario assumes that the current responses to prevention and treatment of the nosocomial infections under consideration within the Canadian health care system will remain unchanged throughout the entire simulation period. For the purpose of the current analysis, this means that the historical trends of incidence and mortality rates attributed to the nosocomial infections will continue into the future (until 2038). Within the base scenario, these trends are used to estimate the economic burden of the infections during the simulation period. In the current research, the economic burden is estimated from the perspective of two major stakeholders: the society at large and the Canadian governments, both federal and provincial. From the societal perspective, the economic burden of nosocomial infections is defined as the sum of health care costs and wage loss attributed to the infections. From the perspective of the Canadian governments, the economic burden is defined as the sum of health care costs and loss of provincial and federal taxation attributed to nosocomial infections.

The intervention scenarios are generated under the assumptions that the current responses will improve between 2009 and 2038 as a result of a nation-wide strategy for nosocomial infection control and prevention. It is assumed that implementation of the strategy over a 30-year period will result in a reduction in the incidence of the considered nosocomial infections as well as the attributed mortality. Each intervention scenario estimates a hypothetical reduction in economic burden for the society and the Canadian governments. Three intervention scenarios are considered by this research:

- Scenario 1: Lower Impact. The strategy will result in a 10% reduction in the incidence of the considered nosocomial infections over the 30-year period;
- Scenario 2: Intermediate Impact. The strategy will result in a 20% reduction in the incidence of the considered nosocomial infections over the 30-year period; and
- Scenario 2: Higher Impact. The strategy will result in a 30% reduction in the incidence of the considered nosocomial infections over the 30-year period.

The analysis contained for this section was conducted using the Life at Risk® simulation platform developed by RiskAnalytica. Life at Risk® is a 'discrete event simulation' decision analytic policy platform that incorporates the design of peer reviewed empirical models (e.g. clinical trials) and empirical data (e.g. historical and surveillance data, health costs) into modulized discrete event simulations. This simulation platform is designed to conduct modern multidisciplinary quantitative modeling that supports evidence-based performance evaluation and tracking of health care initiatives.

2 METHODOLOGY

2.1 OVERVIEW OF METHODOLOGY: LIFE AT RISK®

2.1.1 STRUCTURE OF LIFE AT RISK® MODELING ENVIRONMENT

Developed by RiskAnalytica, Life at Risk® is a 'discrete event simulation' decision analytic policy platform that incorporates the design of peer reviewed empirical models (e.g. clinical trials) and empirical data (e.g. historical and surveillance data, health costs) into modulized discrete event simulations.

Discrete event simulation represents the operation of a system as a chronological sequence of events. Each event occurs at a recorded time and marks a change of state in the system[2]. The approach is based upon concepts such as entities, resources, topology, that describes entity flow and resource sharing[3] [4]. Via discrete event simulation, the analysis of the life and economic burden of disease is used to characterize the life and economic dimensions of various health problems/conditions as a key input for planning, budgeting, and priority setting.

Within the Life at Risk® platform, the possible future health states of a population along with the associated disability and economic burden are simulated. By incorporating the relationships between the population, the natural history of the disease, socio-economic risk factors, epidemiology and economic impacts, the simulation framework generates the possible future states for a series of important variables. These include the possible future risk factor exposures and their impacts upon the future states of a health condition, the performance of screening examinations (if applicable), the effectiveness of treatment in various stages, the risks of complications, the competing mortality risks, and the direct and indirect loss of income from disability, death or treatment.

The results of discrete event simulation provide a region of future possibilities[5] which can be interpreted and managed by decision-makers. The aim of the Life at Risk® management framework is a reliable, robust, objective and independent means of evaluating the life and economic burdens of different diseases and the cost-effectiveness evaluations of health interventions proposed by the literature and subject matter experts.

The study design of the life and economic burden of disease and the evaluation of different health care policies in terms of cost-effectiveness and cost-benefit analyses is structured in accordance with the following steps:[6] [7] [8]

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[2] Robinson (2004)

[3] Borshchev and Filippov (2004)

[4] Caro (2005)

[5] The results of the simulations are not just one solution trajectory but rather multiple trajectories or possibilities. The region in which all trajectories lie is known as the possibility space and represents the region of all possible future outcomes based on the information provided by peer reviewed empirical models (eg. clinical trials) and empirical data (eg. historical and surveillance data, health costs).

[6] Drummond *et al* (1997)

[7] Gold *et al* (1996)

[8] Rice (2000)

A. **Identification of the perspective:** Life at Risk® approach to simulating impacts of infectious diseases takes on different perspectives (e.g. society, federal and provincial government) and considers the financial impacts of disability regardless of who pays the costs and who benefits from the effects. The relevant direct and indirect financial impacts and disability effects are measured to the extent provided by the resource utilization (health costs) and data on incidence and mortality

B. **Identification of the quantities of concern:** The relevant quantities of interest for a burden of disease study and policy decision-making metrics are identified. Such quantities take the form of life and economic attributes.
   i. Life attributes include (by age, gender, geography and infection type): incidence, mortality and the associated disability;
   ii. Economic attributes include (by age, gender, geography, infection type, economic disability, attributed to incidence): direct health care cost components, direct non-health care cost components and indirect cost components;

C. **Identification of the history:** An understanding of the future requires an analysis of the past that incorporates the conducted evidence-based empirical models (e.g. studies published in peer-reviewed journals) and empirical data (e.g. historical and surveillance data, health costs);

D. **Simulation of the base case:** As derived from A and C, the future life and economic burden of infectious diseases (expressed in terms of the quantities in B) is simulated without any proposed changes to the health interventions. This is called a base simulation of the population health and economic results and forms the basis of what literature calls the burden of disease[9]. These results represent the expected state population health and economics without an intervention, with the results being derived in the perspective of health, disability, health costs and economic productivity.

E. **Identification of the alternatives:** Candidate prevention, screening and treatment policies for implementation are 'alternate' scenarios that are required to be compared with the base case results (that represent a 'usual care' scenario [10] [11]). The base case results are derived from retrospective clinical and economic data (i.e. historical data of a specified frequency).

F. **Simulation of different intervention scenarios:** As derived from C, D and E, the future life and economic burden of disease is simulated with the proposed changes to the health interventions (e.g. prevention strategies, treatment protocols during hospitalization). These 'alternate' scenarios represent the state of the population health and economics under the added constraint of interventions proposed by disease subject matter experts.

G. **Analysis of the value proposition of different intervention scenarios:** The differences between the base analysis in D and the 'alternate' scenario simulations in F yield the value proposition of a health care intervention. In the Life at Risk® framework, the test of cost-effectiveness and cost-benefit analyses is subject to specific statistical techniques. [12] [13] [14] [15] [16] The costs and effects of the base case results and the 'alternate' scenario results are analyzed separately. Subsequently, the two sets of results are compared to determine a measure of the extent to which the interventions proposed by disease subject matter experts are expected to influence the future health of the population as well as the related economics. These

[9] Rice (2000)
[10] Drummond *et al* (1997)
[11] Gold *et al* (1996)
[12] Barber and Thompson(1998)
[13] Thompson and Barber (2000)
[14] Coyle *et al* (1998)
[15] Coyle (1996)
[16] Desgagne´ *et al* (1998)

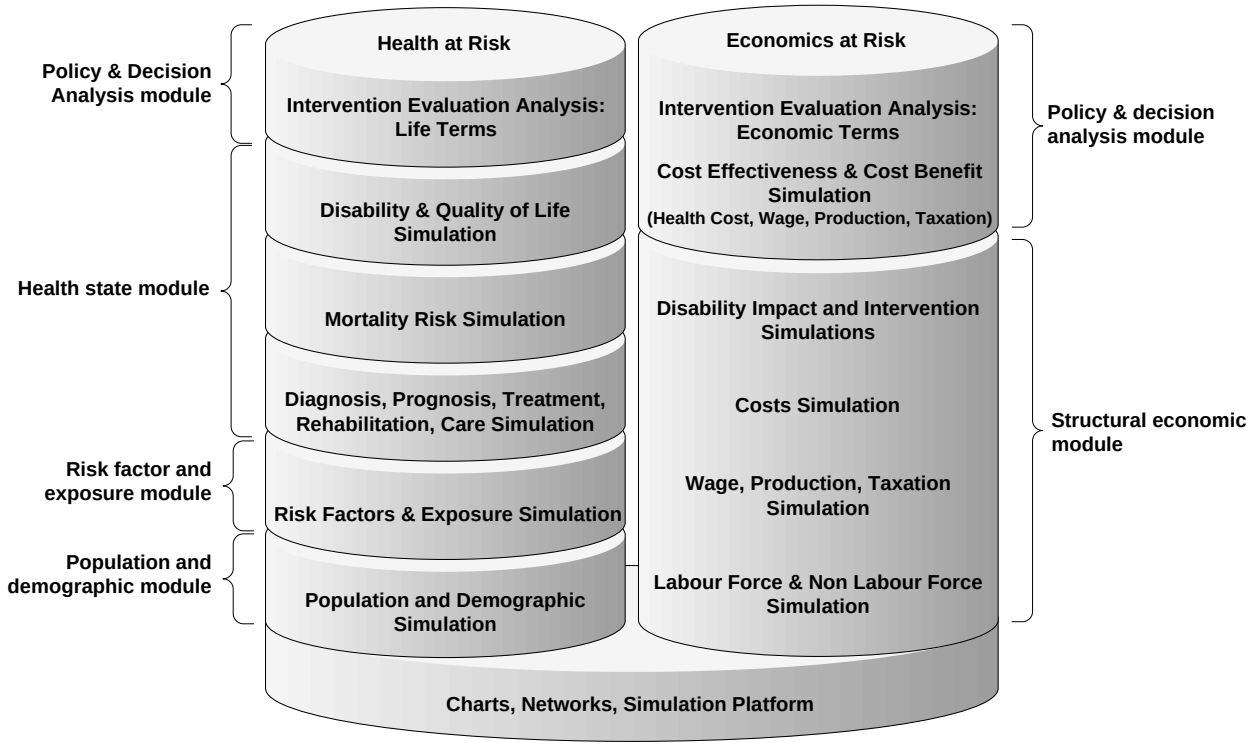
results support policy makers in their evaluations of simulated health care interventions in terms of cost-effectiveness analysis and cost-benefit analysis[17] [18].

2.1.2 MODULIZED DISCRETE EVENT SIMULATIONS

Conducting life/economic burden of disease simulations and the evaluation of different health care policies is no trivial task. It requires the mapping and modeling of many facets of the community that are directly related to the response to disease (e.g. provision of health care) and those facets that respond to the provision of health care. Given the complexity associated with the task, Life at Risk is structured as a set of modules which allow for the proper identification of inputs and outputs that are relevant to the decision-making perspective of the economic evaluation[19] and the distinction between simulation cell types. The simulation module form of Life at Risk is:

- Population and demographic module: all model specifications and simulations of the population in terms of age, gender, race, other important demographic factors, region.
- Risk factor and exposure module: all model specifications and simulations of disease risk factor exposures, attributable risk (etiologic fractions, excess fractions, relative risk).
- Health state: all model specifications and simulations of screening routines, incidence (by severity/stage of disease), mortality (by severity/stage of disease and other causes), prevalence (by severity/stage of disease, time lived with disease); treatment routines, after hospital care routines, disability (by severity/stage of disease, by economic and non-economic).
- Structural economic module: all model specifications and simulations of labour force (further by industry, employed part-time, employed full-time, unemployed by industry), dependents and non-dependents, wages, production functions, income and consumption taxation rates (by government type), corporate revenues and profits, consumption from wages, consumption from production functions, interest rates, inflation rates (by CPI basket components), Gross Domestic Product (key income and expenditure components), demand for health care services and products, ;
- Policy and decision analysis module: all model specifications and simulations of cost effectiveness, cost benefit, direct impact from disability (in terms of population non-participating in labour force, wages by industry, corporate profits by industry, costs and demand for health care services and products, , GDP key income and expenditure components), indirect impact from disability (using same attributes as direct impact from disability).

[17] Drummond *et al* (1997)
[18] Korthals-de Bos *et al* (2004)
[19] Weinstein *et al* (2003)


Policy & Decision Analysis module
Health state module
Risk factor and exposure module
Population and demographic module
Health at Risk
Intervention Evaluation Analysis: Life Terms
Disability & Quality of Life Simulation
Mortality Risk Simulation
Diagnosis, Prognosis, Treatment, Rehabilitation, Care Simulation
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Population and Demographic Simulation
Economics at Risk
Intervention Evaluation Analysis: Economic Terms
Cost Effectiveness & Cost Benefit Simulation
(Health Cost, Wage, Production, Taxation)
Disability Impact and Intervention Simulations
Costs Simulation
Wage, Production, Taxation Simulation
Labour Force & Non Labour Force Simulation
Policy & decision analysis module
Structural economic module
Charts, Networks, Simulation Platform

3 NOSOCOMIAL DISEASE SIMULATION

To conduct Life at Risk® simulations, historical data on the nosocomial infections and economic indicators were used. As is the case with most economic analyses, the reliability of Life at Risk® simulations directly depends on the quality of available data to construct a simulation model. To produce reliable estimates of future life and economic impact of an infectious disease, it is preferred to have at least five years of historical data on incidence of the disease and mortality attributed to the disease. When the actual data are not available they can be substituted with proxies obtained from peer-reviewed literature or provided by subject-matter experts. However, it should be noted that using proxies instead of historical data may weaken reliability of simulations. Taking into consideration that historical data for some of the variables used to generate the current simulations were not available and had to be substituted with proxies, the simulation outcomes have to be interpreted with some caution.

The following table shows the variables used in the Life at Risk simulations and the sources of data for these variables:

3.1 NOSOCOMIAL INFECTION VARIABLES

#	Variable	Source
	MRSA	
1.	MRSA infection and colonization incidence rate per 1,000 hospital admissions	Public Health Agency of Canada, the Canadian Nosocomial Infection Surveillance Program; and Winnipeg Regional Health Authority
2.	Source of infection	Simor, et al., 2001
3.	MRSA incidence, by age groups	Allard, et al., 2008
4.	MRSA incidence by gender	Allard, et al., 2008
5.	Length of hospital stay for a patient with MRSA infection and colonization	Kim, Oh, & Simor, 2001
6.	30-day mortality among patients with MRSA, by age groups and gender	Allard, et al., 2008
7.	Average health care costs of treating a case of nosocomial MRSA infection and colonization	Kim, Oh, & Simor, 2001
	C. Difficile	
8.	C. difficile incidence rate per 1,000 hospital admissions	Public Health Agency of Canada, the Canadian Nosocomial Infection Surveillance Program; and Winnipeg Regional Health Authority
9.	C. difficile incidence by age groups	Pépin, Valiquette, & Gosette, 2005
10.	C. difficile incidence by gender	Pépin, Valiquette, & Gosette, 2005
11.	30-day mortality among patients with c. difficile	Pépin, Valiquette, & Gosette, 2005

#	Variable	Source
12.	Health care costs	Hyland, Ofner-Agostini, Miller, Paton, Gourdeau, & Ishak, 2001
	VRE	
13.	Incidence rate per 1,000 hospital admissions	Public Health Agency of Canada the Canadian Nosocomial Infection Surveillance Program; and Winnipeg Regional Health Authority
14.	Health care costs	Bryce & Kerschbaumer, 2000

3.2 DEMOGRAPHIC VARIABLES

#	Variable	Definition	Data Source
15.	Canadian population	Total population of Canada	Statistics Canada Table 051-0001: "Estimates of population, by age group and sex, Canada, provinces and territories, annual (persons), 1971 to 2006"
16.	Annual hospital admissions in Canada	Number of people admitted to Canadian hospitals annually	CIHI Table "Inpatient/Acute Admissions by Province of Facility Location"

3.3 ECONOMIC VARIABLES

#	Variable	Definition	Data Source
17.	Wages	Wages, salaries and supplementary labour income	Statistics Canada Table 282-0070: Labour force survey estimates (LFS), wages of employees by type of work, National Occupational Classification for Statistics (NOC-S), sex and age group, annual (dollars), 1997 to 2006; and

#	Variable	Definition	Data Source
			Statistics Canada Table 380-0016: Gross Domestic Product (GDP), Wage Data: income-based, annual (dollars), 1961 to 2005.
18.	Wage impact of nosocomial infections	Economic measure (opportunity costs) of infectious disease incidence and mortality impacts on wages of Canadian employees. The value for this variable is calculated using the historical data on Canadian labour force wage distribution and Gross Domestic Product wage data.	Same as the above
19.	Corporate profit	Corporation profit before taxes.	Statistics Canada Table 380-0016: Gross Domestic Product (GDP), income-based, annual (dollars), 1961 to 2005
20.	Corporate profit impact of an infectious disease	Economic measure (opportunity cost) of infectious disease incidence and mortality impacts on the gross operating surplus of the businesses operating in Canada. The value for this variable is calculated using the historical data on income-based Gross Domestic Product.	Same as the above
21.	Taxation revenue	A net compulsory levy imposed by the Canadian Government, and is comprised of income taxes and good and service taxes.	Statistics Canada Table 385-0002: Federal, provincial and territorial general government revenue and expenditures, for fiscal year ending March 31, annual (dollars), 1989 to 2006 and Statistics Canada Table 380-0022: Sector accounts, all levels of government, annual (dollars), 1961 to 2005
22.	Taxation revenue impact of an infectious disease	Economic measure (opportunity costs) of infectious disease incidence and mortality impacts on the Canadian budgetary revenue from payroll and income taxes levied on the individuals. The value for this variable is	Same as the above

#	Variable	Definition	Data Source
		calculated using the historical data on government revenue and expenditures.	

3.4 BASE SCENARIO ASSUMPTIONS

In the current analysis, the base case scenario is a Life at Risk simulation scenario generated under the assumptions that the probabilities getting a nosocomial infection reported in the literature and the current prevention and treatment strategies will remain unchanged in the future.

General Assumptions

1. For each gender and age group, the probability of acquiring a nosocomial infection within the simulation period is assumed to be a function of the historical incidence statistics only;
2. For each gender and age group, the probability of dying from causes attributed to a nosocomial infection within the simulation period is assumed to be a function of the historical mortality statistics only;
3. The practices of treating nosocomial infections in the Canadian health care system remain unchanged for the entire simulation period

MRSA Assumptions

1. 86% of all MRSA infections are acquired in hospitals (Simor, et al., 2001);
2. 61% of patients infected with MRSA in the hospitals are males (Allard, et al., 2008);
3. 30% of people acquiring nosocomial MRSA are between ages of 18 and 64; 42% are between ages of 65 and 74; and 28% are older than 74 (Allard, et al., 2008);
4. Average length of hospital stay is 39 days for a patient with the nosocomial MRSA infection and 44 days for a patient with the nosocomial MRSA colonization (Kim, Oh, & Simor, 2001);
5. Average length of stay in isolation is 28 days for a patient with nosocomial MRSA infection and 21 days for a patient with nosocomial MRSA colonization (Kim, Oh, & Simor, 2001);
6. Average costs of treating a case of MRSA infection is $14,360; average costs of treating a case of MRSA colonization is $1,363 (Kim, Oh, & Simor, 2001);
7. The patients remain in the hospital for the duration of the treatment;
8. From the economic burden perspective, the patients remain 100% disabled for the duration of their hospital stay;
9. After being treated and released from the hospital, the patients are considered cured/healthy;
10. Between 34% and 50% of people who acquire MRSA die within 30 days (Allard, et al., 2008).

C. Difficile Assumptions

1. 57.1% of patients infected with c. difficile in the hospitals are males (Pépin, Valiquette, & Gosette, 2005);
2. 9.9% of people acquiring nosocomial c. difficile are between ages of 18 and 64; 38.5% are between ages of 65 and 74; and 51.6% are older than 74 (Pépin, Valiquette, & Gosette, 2005);
3. Average length of hospital stay for a patient with nosocomial c. difficile infection is 39 days. In the absence of any data in the literature on the average length of stay to treat c. difficile, for the purpose of the current analysis, it was assumed that it is the same as to treat MRSA;

4. Average costs of treating a case of MRSA infection is $12,240 (Hyland, Ofner-Agostini, Miller, Paton, Gourdeau, & Ishak, 2001);
5. The patients remain in the hospital for the duration of the treatment;
6. From the economic burden perspective, the patients remain 100% disabled for the duration of their hospital stay;
7. After being treated and released from the hospital, the patients are considered cured/healthy;
8. 23% of people who acquire c. difficile die within 30 days (Pépin, Valiquette, & Gosette, 2005).

VRE Assumptions

1. 61% of patients infected with MRSA in the hospitals are males. In the absence of any data in the literature on the average length of stay to treat c. difficile, for the purpose of the current analysis, it was assumed that it is the same as to treat MRSA;
2. 30% of people acquiring nosocomial MRSA are between ages of 18 and 64; 42% are between ages of 65 and 74; and 28% are older than 74 (Allard, et al., 2008);
3. Average length of hospital stay for a patient with nosocomial VRE infection is 39 days. In the absence of any data in the literature on the average length of stay to treat VRE, for the purpose of the current analysis, it was assumed that it is the same as to treat MRSA;
4. Average costs of treating a case of MRSA infection is $20,045 (Bryce & Kerschbaumer, 2000);
5. The patients remain in the hospital for the duration of the treatment;
6. From the economic burden perspective, the patients remain 100% disabled for the duration of their hospital stay;
7. After being treated and released from the hospital, the patients are considered cured/healthy.

Economic Assumptions

1. For economic impact calculations, the base year is set at 2006.
2. Present values are calculated in 2008 dollars[20].

3.5 INTERVENTION SCENARIOS ASSUMPTIONS

1. 10% reduction in incidence of MRSA, c. difficile and VRE over a 30-year period
2. 20% reduction in incidence of MRSA, c. difficile and VRE over a 30-year period
3. 30% reduction in incidence of MRSA, c. difficile and VRE over a 30-year period
4. Implementation of each intervention scenario is assumed to begin in 2009 and reach its intervention goal by 2019.

[20] 2008 dollars represent the estimated value in the year specified as viewed by a person living in 2006 after adjusting for the interest rate value of money. The value of 2008 dollars was computed using yield curves for zero-coupon bonds obtained from Bank of Canada (http://www.bankofcanada.ca/en/rates/yield_curve.html).

4 SIMULATION OUTCOMES: LIFE IMPACTS

The base scenario assumes that the current responses to prevention and treatment of the nosocomial infections under consideration within the Canadian health care system will remain unchanged throughout the entire simulation period. For the purpose of the current analysis, this means that the historical trends of incidence and mortality rates attributed to the nosocomial infections will continue into the future (until 2038).

4.1 LIFE IMPACT: BASE CASE

4.1.1 TOTAL LIFE IMPACT: BASE CASE

Exhibit 2 demonstrates the cumulative incidence of nosocomial MRSA, c. difficile and VRE infections in Canada over the next 30 years, under the base scenario assumptions. The exhibit also shows the total cumulative incidence of the simulated infections. The current analysis estimates that between 2009 and 2038 there will be over 1.14 million new cases of nosocomial MRSA, c. difficile and VRE in Canada.

Exhibit 2 Considered Nosocomial Infections, New Cases (Cumulative as of 2009), Five-Year Intervals, Total Canadian Population, All Age Groups: 2009-2038

Year	Incidence			
	MRSA	C. Difficile	VRE	TOTAL
2009	8,465	15,126	4,104	27,694
2013	45,135	77,858	21,815	144,807
2018	98,044	160,607	47,402	306,054
2023	159,831	250,036	77,858	487,725
2028	230,642	344,480	113,694	688,816
2033	310,033	442,936	154,878	907,846
2038	397,257	543,914	200,886	1,142,057

Data Sources:

Incidence rates: Public Health Agency of Canada; Winnipeg Regional Health Authority; Allard, et al., 2008; Pépin, Valiquette, & Gosette, 2005.

Analytical source: Smetanin & Kobak, RiskAnalytica Life at Risk Model simulation for the L5L Project, August 2008.

Exhibit 3 demonstrates the cumulative mortality attributed to nosocomial MRSA, c. difficile and VRE infections in Canada over the next 30 years, under the base scenario assumptions. The exhibit also shows the total cumulative mortality attributed to the infections. The current analysis estimates that between 2009 and 2038 over 374 thousand people will die in Canada from causes attributed to nosocomial MRSA, c. difficile and VRE

Exhibit 3 Considered Nosocomial Infections, Mortality (Cumulative as of 2009), Five-Year Intervals, Total Canadian Population, All Age Groups: 2009-2038

Year	Mortality			
	MRSA	C. Difficile	VRE	TOTAL
2009	2,056	5,642	1,531	9,229
2013	10,955	29,041	8,137	48,132
2018	23,774	59,907	17,681	101,361
2023	38,729	93,263	29,041	161,034
2028	55,869	128,491	42,408	226,767
2033	75,087	165,215	57,769	298,071
2038	96,201	202,880	74,930	374,011

Data Sources:

Mortality rates: Allard, et al., 2008; Pépin, Valiquette, & Gosette, 2005.

Analytical source: Smetanin & Kobak, RiskAnalytica Life at Risk Model simulation for the L5L Project, August 2008.

4.1.2 LIFE IMPACTS OF MRSA: BASE CASE

Exhibit 4 demonstrates the cumulative life impacts of the MRSA infection and colonization under the base scenario assumptions. The current analysis estimates that, if the strategies to control and prevention of nosocomial infections remain the same, within the next 30 years there will be more than 397 thousand new cases of MRSA nosocomial infections and colorizations, which would result in over 96 thousand deaths.

Exhibit 4 MRSA, Life Impact Indicators (Cumulative as of 2009), Five-Year Intervals: 2009-2038

Year	MRSA Life Impact	
	New Cases	Mortality
2013	45,135	10,955
2018	98,044	23,774
2023	159,831	38,729
2028	230,642	55,869
2033	310,033	75,087
2038	397,257	96,201

Data Sources:

Incidence rates: Public Health Agency of Canada; Winnipeg Regional Health Authority; Allard, et al., 2008; Pépin, Valiquette, & Gosette, 2005.

Analytical source: Smetanin & Kobak, RiskAnalytica Life at Risk Model simulation for the L5L Project, August 2008.

4.1.3 LIFE IMPACTS OF C. DIFFICILE: BASE CASE

Exhibit 5 demonstrates the cumulative life impacts of the c. difficile infection under the base scenario assumptions. The current analysis estimates that, if the strategies to control and prevention of nosocomial infections remain the same, within the next 30 years there will be more than 543 thousand new cases of nosocomial c. difficile infection, which would result in over 202 thousand deaths.

Exhibit 5 C. Difficile, Life Impact Indicators (Cumulative as of 2009), Five-Year Intervals: 2009-2038

Year	C. Difficile Life Impact	
	New Cases	Mortality
2013	77,858	29,041
2018	160,607	59,907
2023	250,036	93,263
2028	344,480	128,491
2033	442,936	165,215
2038	543,914	202,880

Data Sources:

Incidence rates: Public Health Agency of Canada; Winnipeg Regional Health Authority; Allard, et al., 2008; Pépin, Valiquette, & Gosette, 2005.

Analytical source: Smetanin & Kobak, RiskAnalytica Life at Risk Model simulation for the L5L Project, August 2008.

4.1.4 LIFE IMPACTS OF VRE: BASE CASE

Exhibit 6 demonstrates the cumulative life impacts of the VRE infection under the base scenario assumptions. The current analysis estimates that, if the strategies to control and prevention of nosocomial infections remain the same, within the next 30 years there will be more than 200 thousand new cases of nosocomial VRE infection, which would result in over 74 thousand deaths.

Exhibit 6 VRE, Life Impact Indicators (Cumulative as of 2009), Five-Year Intervals: 2009-2038

Year	VRE Life Impact	
	New Cases	Mortality
2013	21,815	8,137
2018	47,402	17,681
2023	77,858	29,041
2028	113,694	42,408
2033	154,878	57,769
2038	200,886	74,930

Data Sources:

Incidence rates: Public Health Agency of Canada; Winnipeg Regional Health Authority; Allard, et al., 2008; Pépin, Valiquette, & Gosette, 2005.

Analytical source: Smetanin & Kobak, RiskAnalytica Life at Risk Model simulation for the L5L Project, August 2008.

4.2 INTERVENTION SCENARIO CHANGES (DIFFERENCE FROM THE BASE)

The intervention scenarios are generated under the assumptions that the current responses to nosocomial infections control and prevention will improve between 2009 and 2038 as a result of a nation-wide strategy. It is assumed that implementation of the strategy over a 30-year period will result in a reduction in the incidence of the nosocomial infections as well as the attributed mortality. Each intervention scenario estimates a hypothetical reduction in economic burden. Three intervention scenarios are considered by this research:

- Scenario 1: Lower Impact. The strategy will result in a 10% reduction in the incidence of the nosocomial infections over the 30-year period;
- Scenario 2: Intermediate Impact. The strategy will result in a 20% reduction in the incidence of the nosocomial infections over the 30-year period; and
- Scenario 3: Higher Impact. The strategy will result in a 30% reduction in the incidence of the nosocomial infections over the 30-year period.

4.2.1 TOTAL LIFE IMPACT: EFFECTS OF SCENARIOS

Exhibit 7 demonstrates the combined cumulative reduction of life impacts for nosocomial MRSA, c. difficile and VRE infections, under the intervention scenarios' assumptions. The current analysis estimates that:

- A 10% reduction in incidence of the three nosocomial infections will lead to prevention of over 70 thousand new cases and 25 thousand deaths within the next 30 years;
- A 20% reduction in incidence of the three nosocomial infections will lead to prevention of over 126 thousand new cases and 40 thousand deaths within the next 30 years;
- A 30% reduction in incidence of the three nosocomial infections will lead to prevention of over 186 thousand new cases and 59 thousand deaths within the next 30 years;

Exhibit 7 Considered Nosocomial Infections, Life Impact Indicators, Scenarios' Impacts (Cumulative as of 2009), Five-Year Intervals: 2009-2038

Year	Impact of Intervention Scenarios					
	Scenario 1: 10% Incidence Reduction		Scenario 2: 20% Incidence Reduction		Scenario 3: 30% Incidence Reduction	
	New Cases	Mortality	New Cases	Mortality	New Cases	Mortality
2013	2,149	936	3,856	1,285	4,778	1,559
2018	7,393	2,972	13,390	4,401	18,602	6,050
2023	16,695	6,463	30,124	9,833	43,535	14,114
2028	29,260	11,061	53,901	17,485	77,820	25,055
2033	47,052	17,412	85,124	27,487	124,901	40,105
2038	70,388	25,478	126,371	40,711	186,880	59,933

Analytical source: Smetanin & Kobak, RiskAnalytica Life at Risk Model simulation for the L5L Project, August 2008.

4.2.2 LIFE IMPACTS OF MRSA: EFFECTS OF SCENARIOS

Exhibit 8 demonstrates the cumulative reduction of life impacts of the MRSA infection and colonization under the intervention scenarios' assumptions. The current analysis estimates that:

- A 10% reduction in incidence of the MRSA infection and colonization will lead to prevention of over 20 thousand new cases and 5 thousand deaths within the next 30 years;
- A 20% reduction in incidence of the MRSA infection and colonization will lead to prevention of over 48 thousand new cases and 11 thousand deaths within the next 30 years;
- A 30% reduction in incidence of the MRSA infection and colonization will lead to prevention of over 74 thousand new cases and 18 thousand deaths within the next 30 years;

Exhibit 8 MRSA, Life Impact Indicators, Scenarios' Impacts (Cumulative as of 2009), Five-Year Intervals: 2009-2038

Year	Impact of Intervention Scenarios					
	Scenario 1: 10% Incidence Reduction		Scenario 2: 20% Incidence Reduction		Scenario 3: 30% Incidence Reduction	
	New Cases	Mortality	New Cases	Mortality	New Cases	Mortality
2013	435	107	1,183	288	1,689	406
2018	1,842	457	4,515	1,090	6,742	1,626
2023	4,362	1,078	10,632	2,563	16,140	3,896
2028	8,132	2,005	19,881	4,796	30,266	7,317
2033	13,378	3,295	32,386	7,816	49,479	11,973
2038	20,754	5,100	48,775	11,767	74,671	18,079

Analytical source: Smetanin & Kobak, RiskAnalytica Life at Risk Model simulation for the L5L Project, August 2008.

4.2.3 LIFE IMPACTS OF C. DIFFICILE: EFFECTS OF SCENARIOS

Exhibit 9 demonstrates the cumulative reduction of life impacts of the nosocomial c. difficile infection under the intervention scenarios' assumptions. The current analysis estimates that:

- A 10% reduction in incidence of the c. difficile infection will lead to prevention of over 35 thousand new cases and 13 thousand deaths within the next 30 years;
- A 20% reduction in incidence of the c. difficile will lead to prevention of over 52 thousand new cases and 19 thousand deaths within the next 30 years;
- A 30% reduction in incidence of the c. difficile infection will lead to prevention of over 75 thousand new cases and 28 thousand deaths within the next 30 years;

Exhibit 9 C. Difficile, Life Impact Indicators, Scenarios' Impacts (Cumulative as of 2009), Five-Year Intervals: 2009-2038

Year	Impact of Intervention Scenarios					
	Scenario 1: 10% Incidence Reduction		Scenario 2: 20% Incidence Reduction		Scenario 3: 30% Incidence Reduction	
	New Cases	Mortality	New Cases	Mortality	New Cases	Mortality
2013	1,461	545	2,258	842	2,328	868
2018	4,497	1,678	6,956	2,595	8,812	3,287
2023	9,568	3,569	14,571	5,435	20,011	7,464
2028	15,648	5,837	24,419	9,108	33,408	12,461
2033	24,514	9,144	36,484	13,609	51,709	19,288
2038	35,683	13,310	52,324	19,517	75,841	28,289

Analytical source: Smetanin & Kobak, RiskAnalytica Life at Risk Model simulation for the L5L Project, August 2008.

4.2.4 LIFE IMPACTS OF VRE: EFFECTS OF SCENARIOS

Exhibit 10 demonstrates the cumulative reduction of life impacts of the nosocomial VRE infection under the intervention scenarios' assumptions. The current analysis estimates that:

- A 10% reduction in incidence of the VRE infection will lead to prevention of over 13 thousand new cases and 7 thousand deaths within the next 30 years;
- A 20% reduction in incidence of the VRE infection will lead to prevention of over 25 thousand new cases and 9 thousand deaths within the next 30 years;
- A 30% reduction in incidence of the VRE infection will lead to prevention of over 36 thousand new cases and 13 thousand deaths within the next 30 years;

Exhibit 10 VRE, Life Impact Indicators, Scenarios' Impacts (Cumulative as of 2009), Five-Year Intervals: 2009-2038

Year	Impact of Intervention Scenarios					
	Scenario 1: 10% Incidence Reduction		Scenario 2: 20% Incidence Reduction		Scenario 3: 30% Incidence Reduction	
	New Cases	Mortality	New Cases	Mortality	New Cases	Mortality
2013	252	283	415	155	761	284
2018	1,053	837	1,919	716	3,048	1,137
2023	2,765	1,816	4,921	1,836	7,383	2,754
2028	5,480	3,219	9,600	3,581	14,146	5,276
2033	9,160	4,974	16,254	6,063	23,713	8,845
2038	13,951	7,068	25,273	9,427	36,368	13,565

Analytical source: Smetanin & Kobak, RiskAnalytica Life at Risk Model simulation for the L5L Project, August 2008.

5 SIMULATION OUTCOMES: ECONOMIC BURDEN

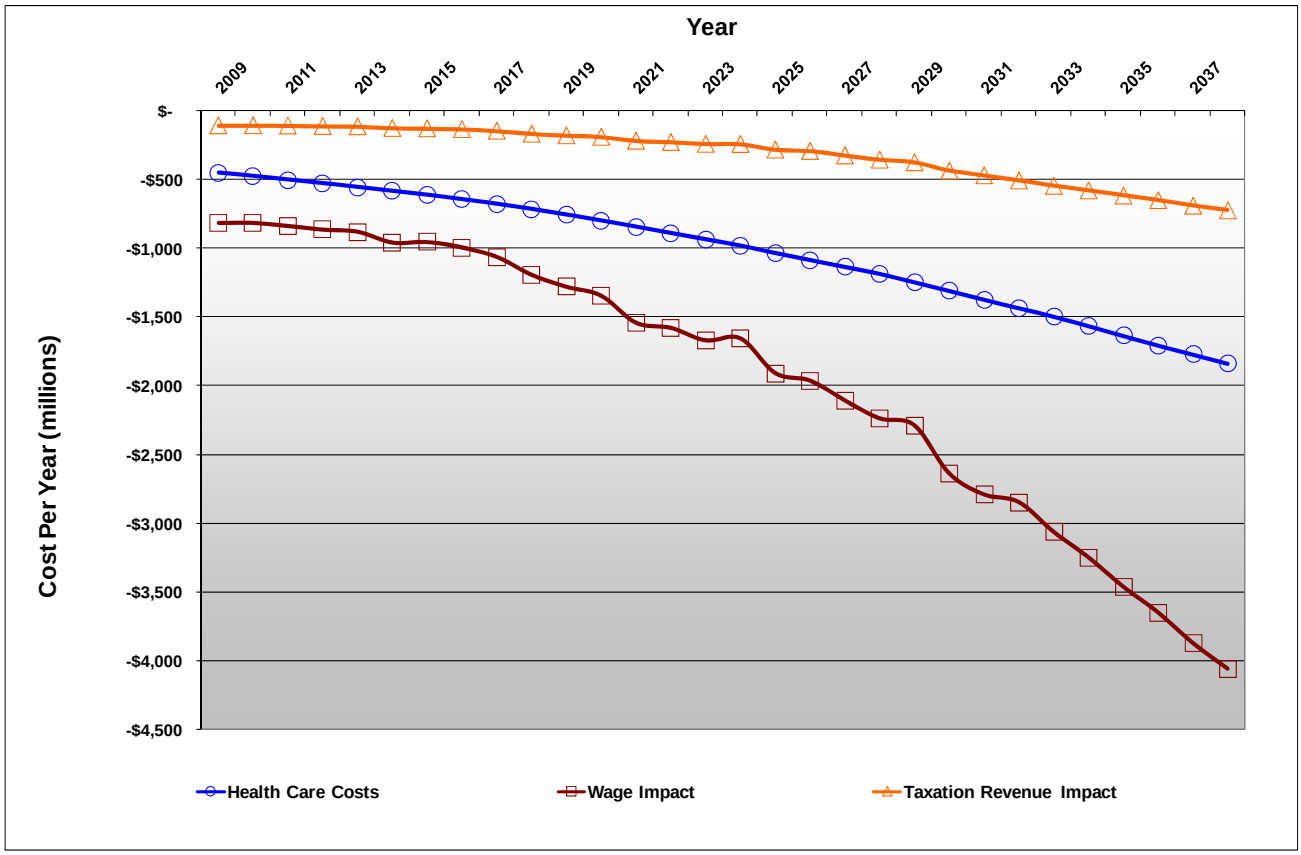
5.1 ECONOMIC IMPACTS: BASE CASE

To estimate future economic burden of the nosocomial infections for the base scenario, the historical trends of incidence and mortality rates for the nosocomial infections under the base scenario assumptions were linked to the Life at Risk® economic indicators. In the current research, the economic burden is estimated from the perspective of two major stakeholders: the society at large and the Canadian federal and provincial governments. From the societal perspective, the economic burden of nosocomial infections is defined as the sum of health care costs and wage loss attributed to the infections. From the perspective of the Canadian governments, the economic burden is defined as the sum of health care costs and taxation revenues loss attributed to the nosocomial infections.

5.1.1 TOTAL ECONOMIC IMPACT: BASE CASE

Exhibit 11 demonstrates, in future values, the components of economic burden attributed to the nosocomial MRSA, c. difficile and VRE infections under the base case assumptions. The economic burden components include health costs of treating the infections as well as loss of wages and taxation revenue due to disability and mortality attributed to the infections.

Exhibit 11 Nosocomial Infections, Economic Burden Components, Future Values, Base Case Scenario: 2009-2038



Data Sources:

Health care costs: Birnbaum, Jandciu, & Twells, 2002; Bryce & Kerschbaumer, 2000; and Hyland, Ofner-Agostini, Miller, Paton, Gourdeau, & Ishak, 2001.

Wages: Statistics Canada Table 282-0070: Labour force survey estimates (LFS), wages of employees by type of work, National Occupational Classification for Statistics (NOC-S), sex and age group, annual (dollars), 1997 to 2006; and Statistics Canada Table 380-0016: Gross Domestic Product (GDP), Wage Data: income-based, annual (dollars), 1961 to 2005.

Taxation revenue: Statistics Canada Table 385-0002: Federal, provincial and territorial general government revenue and expenditures, for fiscal year ending March 31, annual (dollars), 1989 to 2006 and Statistics Canada Table 380-0022: Sector accounts, all levels of government, annual (dollars), 1961 to 2005.

Analytical source: Smetanin & Kobak, RiskAnalytica Life at Risk Model simulation for the L5L Project, August 2008.

Exhibit 12 demonstrates, in 2008 present values, cumulative economic burden to the society attributable to the nosocomial MRSA, c. difficile and VRE infections in Canada over the next 30 years, under the base scenario assumptions. The exhibit shows the impact of individual components of societal economic burden as well as the total impact. Under the base case scenario assumptions, the societal cumulative economic burden of the nosocomial infections is expected to exceed $42.5 billion.

Exhibit 12 Considered Nosocomial Infections, Societal Economic Burden Dissections (Cumulative as of 2009), Five-Year Intervals, 2008 Present Values: 2009-2038

Year	Nosocomial Infections' Economic Burden (millions), Society		
	Health Care Costs	Wage Impact	TOTAL
2009	-$436	-$790	-$1,227
2013	-$2,279	-$3,836	-$6,114
2018	-$4,700	-$7,709	-$12,409
2023	-$7,185	-$12,074	-$19,259
2028	-$9,705	-$16,658	-$26,363
2033	-$12,307	-$21,824	-$34,131
2038	-$14,978	-$27,561	-$42,539

Data Sources:

Health care costs: Birnbaum, Jandciu, & Twells, 2002; Bryce & Kerschbaumer, 2000; and Hyland, Ofner-Agostini, Miller, Paton, Gourdeau, & Ishak, 2001.

Wages: Statistics Canada Table 282-0070: Labour force survey estimates (LFS), wages of employees by type of work, National Occupational Classification for Statistics (NOC-S), sex and age group, annual (dollars), 1997 to 2006; and Statistics Canada Table 380-0016: Gross Domestic Product (GDP), Wage Data: income-based, annual (dollars), 1961 to 2005.

Analytical source: Smetanin & Kobak, RiskAnalytica Life at Risk Model simulation for the L5L Project, August 2008.

Exhibit 13 demonstrates, in 2008 present values, cumulative economic burden to the Canadian Government attributable to the nosocomial MRSA, c. difficile and VRE infections in Canada over the next 30 years, under the base scenario assumptions. The exhibit shows the impact of individual components of the economic burden to the government as well as the total impact. Under the base case scenario assumptions, the cumulative economic burden of the nosocomial infections to the Canadian governments is expected to exceed $19.2 billion.

Exhibit 13 Considered Nosocomial Infections, Government Economic Burden Dissections (Cumulative as of 2009), Five-Year Intervals, 2008 Present Values: 2009-2038

Year	Nosocomial Infections' Economic Burden (millions), Government		
	Health Care Costs	Taxation Revenue Impact	TOTAL
2009	-$436	-$104	-$540
2013	-$2,279	-$498	-$2,777
2018	-$4,700	-$1,024	-$5,723
2023	-$7,185	-$1,644	-$8,829
2028	-$9,705	-$2,337	-$12,042
2033	-$12,307	-$3,218	-$15,525
2038	-$14,978	-$4,237	-$19,215

Data Sources:

Health care costs: Birnbaum, Jandciu, & Twells, 2002; Bryce & Kerschbaumer, 2000; and Hyland, Ofner-Agostini, Miller, Paton, Gourdeau, & Ishak, 2001.

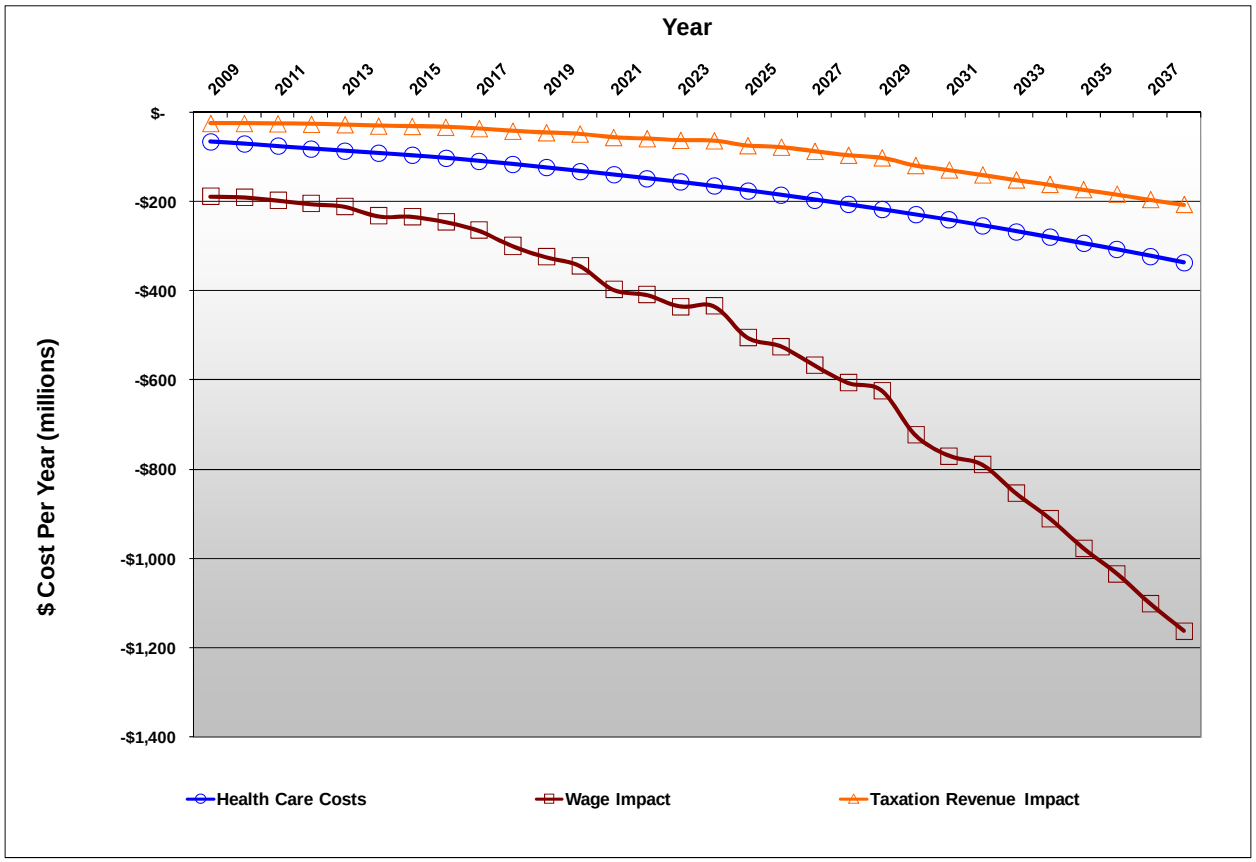
Taxation revenue: Statistics Canada Table 385-0002: Federal, provincial and territorial general government revenue and expenditures, for fiscal year ending March 31, annual (dollars), 1989 to 2006 and Statistics Canada Table 380-0022: Sector accounts, all levels of government, annual (dollars), 1961 to 2005.

Analytical source: Smetanin & Kobak, RiskAnalytica Life at Risk Model simulation for the L5L Project, August 2008.

5.1.2 ECONOMIC IMPACT OF MRSA: BASE CASE

Exhibit 14 demonstrates, in future values, the components of economic burden attributed to the nosocomial MRSA infection and colonization under the base case assumptions. The economic burden components include health costs of treating MRSA infection and colonization as well as loss of wages and taxation revenue due to disability and mortality attributed to the nosocomial MRSA infection and colonization.

Exhibit 14 MRSA, Economic Burden Components, Future Values, Base Case Scenario: 2009-2038



Data Sources:

Health care costs: Birnbaum, Jandciu, & Twells, 2002.

Wages: Statistics Canada Table 282-0070: Labour force survey estimates (LFS), wages of employees by type of work, National Occupational Classification for Statistics (NOC-S), sex and age group, annual (dollars), 1997 to 2006; and Statistics Canada Table 380-0016: Gross Domestic Product (GDP), Wage Data: income-based, annual (dollars), 1961 to 2005.

Taxation revenue: Statistics Canada Table 385-0002: Federal, provincial and territorial general government revenue and expenditures, for fiscal year ending March 31, annual (dollars), 1989 to 2006 and Statistics Canada Table 380-0022: Sector accounts, all levels of government, annual (dollars), 1961 to 2005.

Analytical source: Smetanin & Kobak, RiskAnalytica Life at Risk Model simulation for the L5L Project, August 2008.

Exhibit 15 demonstrates, in 2008 present values, cumulative economic burden to the society attributable to the nosocomial MRSA infection and colonization in Canada over the next 30 years, under the base scenario assumptions. The exhibit shows the impact of individual components of societal economic burden as well as the total impact. Under the base case scenario assumptions, the societal cumulative economic burden of the nosocomial MRSA infection and colonization is expected to exceed $9.7 billion.

Exhibit 15 MRSA, Societal Economic Burden Dissections (Cumulative as of 2009), Five-Year Intervals, Base Case Scenario Assumptions, 2008 Present Values: 2009-2038

Year	MRSA Economic Burden (millions), Society		
	Health Care Costs	Wage Impact	TOTAL
2009	-$63	-$183	-$246
2013	-$343	-$905	-$1,248
2018	-$728	-$1,863	-$2,591
2023	-$1,139	-$2,988	-$4,127
2028	-$1,570	-$4,214	-$5,784
2033	-$2,028	-$5,640	-$7,669
2038	-$2,512	-$7,268	-$9,780

Data Sources:

Health care costs: Birnbaum, Jandciu, & Twells, 2002.

Wages: Statistics Canada Table 282-0070: Labour force survey estimates (LFS), wages of employees by type of work, National Occupational Classification for Statistics (NOC-S), sex and age group, annual (dollars), 1997 to 2006; and Statistics Canada Table 380-0016: Gross Domestic Product (GDP), Wage Data: income-based, annual (dollars), 1961 to 2005.

Analytical source: Smetanin & Kobak, RiskAnalytica Life at Risk Model simulation for the L5L Project, August 2008.

Exhibit 16 demonstrates, in 2008 present values, cumulative economic burden to the Canadian governments attributable to the nosocomial MRSA infection and colonization in Canada over the next 30 years, under the base scenario assumptions. The exhibit shows the impact of individual components of economic burden to the governments as well as the total impact. Under the base case scenario assumptions, the cumulative economic burden of the nosocomial MRSA infection and colonization to the governments is expected to exceed $3.6 billion.

Exhibit 16 MRSA, Government Economic Burden Dissections (Cumulative as of 2009), Five-Year Intervals, Base Case Scenario Assumptions, 2008 Present Values: 2009-2038

Year	MRSA Economic Burden (millions), Government		
	Health Care Costs	Taxation Revenue Impact	TOTAL
2009	-$63	-$24	-$87
2013	-$343	-$117	-$461
2018	-$728	-$248	-$976
2023	-$1,139	-$407	-$1,547
2028	-$1,570	-$593	-$2,163
2033	-$2,028	-$836	-$2,864
2038	-$2,512	-$1,125	-$3,637

Data Sources:

Health care costs: Birnbaum, Jandciu, & Twells, 2002.

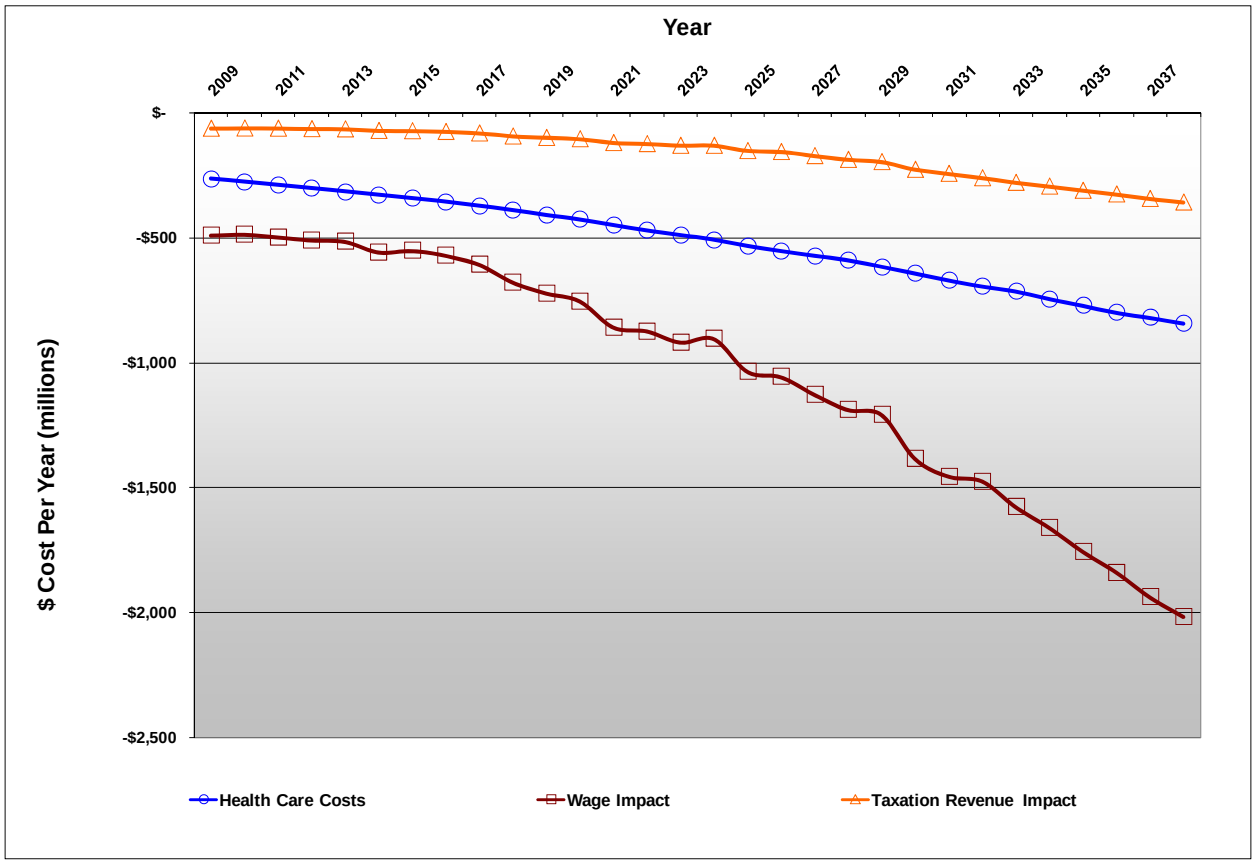
Taxation revenue: Statistics Canada Table 385-0002: Federal, provincial and territorial general government revenue and expenditures, for fiscal year ending March 31, annual (dollars), 1989 to 2006 and Statistics Canada Table 380-0022: Sector accounts, all levels of government, annual (dollars), 1961 to 2005.

Analytical source: Smetanin & Kobak, RiskAnalytica Life at Risk Model simulation for the L5L Project, August 2008.

5.1.3 ECONOMIC IMPACT OF C. DIFFICILE: BASE CASE

Exhibit 17 demonstrates, in future values, the components of economic burden attributed to the nosocomial c. difficile infection under the base case assumptions. The economic burden components include health costs of treating c. difficile infection as well as loss of wages and taxation revenue due to disability and mortality attributed to the nosocomial c. difficile infection.

Exhibit 17 C. Difficile, Economic Burden Components, Future Values, Base Case Scenario: 2009-2038



Data Sources:

Health care costs: Hyland, Ofner-Agostini, Miller, Paton, Gourdeau, & Ishak, 2001.

Wages: Statistics Canada Table 282-0070: Labour force survey estimates (LFS), wages of employees by type of work, National Occupational Classification for Statistics (NOC-S), sex and age group, annual (dollars), 1997 to 2006; and Statistics Canada Table 380-0016: Gross Domestic Product (GDP), Wage Data: income-based, annual (dollars), 1961 to 2005.

Taxation revenue: Statistics Canada Table 385-0002: Federal, provincial and territorial general government revenue and expenditures, for fiscal year ending March 31, annual (dollars), 1989 to 2006 and Statistics Canada Table 380-0022: Sector accounts, all levels of government, annual (dollars), 1961 to 2005.

Analytical source: Smetanin & Kobak, RiskAnalytica Life at Risk Model simulation for the L5L Project, August 2008.

Exhibit 18 demonstrates, in 2008 present values, cumulative economic burden to the society attributable to the nosocomial c. difficile infection in Canada over the next 30 years, under the base scenario assumptions. The exhibit shows the impact of individual components of societal economic burden as well as the total impact. Under the base case scenario assumptions, the societal cumulative economic burden of the nosocomial c. difficile infection is expected to exceed $22.8 billion.

Exhibit 18 C. Difficile, Societal Economic Burden Dissections (Cumulative as of 2009), Five-Year Intervals, Base Case Scenario Assumptions, 2008 Present Values: 2009-2038

Year	C. Difficile Economic Burden (millions), Society		
	Health Care Costs	Wage Impact	TOTAL
2009	-$258	-$478	-$736
2013	-$1,327	-$2,291	-$3,617
2018	-$2,679	-$4,527	-$7,206
2023	-$4,010	-$6,964	-$10,975
2028	-$5,299	-$9,439	-$14,738
2033	-$6,572	-$12,135	-$18,706
2038	-$7,825	-$15,028	-$22,853

Data Sources:

Health care costs estimates: Hyland, Ofner-Agostini, Miller, Paton, Gourdeau, & Ishak, 2001.

Wages: Statistics Canada Table 282-0070: Labour force survey estimates (LFS), wages of employees by type of work, National Occupational Classification for Statistics (NOC-S), sex and age group, annual (dollars), 1997 to 2006; and Statistics Canada Table 380-0016: Gross Domestic Product (GDP), Wage Data: income-based, annual (dollars), 1961 to 2005.

Analytical source: Smetanin & Kobak, RiskAnalytica Life at Risk Model simulation for the L5L Project, August 2008.

Exhibit 19 demonstrates, in 2008 present values, cumulative economic burden to the Canadian governments attributable to the nosocomial c. difficile infection in Canada over the next 30 years, under the base scenario assumptions. The exhibit shows the impact of individual components of the economic burden to the governments as well as the total impact. Under the base case scenario assumptions, the cumulative economic burden of the nosocomial MRSA infection and colonization to the Canadian governments is expected to exceed $10.1 billion.

Exhibit 19 C. Difficile, Government Economic Burden Dissections (Cumulative as of 2009), Five-Year Intervals, Base Case Scenario Assumptions, 2008 Present Values: 2009-2038

Year	C. Difficile Economic Burden (millions), Government		
	Health Care Costs	Taxation Revenue Impact	TOTAL
2009	-$258	-$63	-$321
2013	-$1,327	-$297	-$1,624
2018	-$2,679	-$601	-$3,280
2023	-$4,010	-$947	-$4,958
2028	-$5,299	-$1,321	-$6,620
2033	-$6,572	-$1,781	-$8,352
2038	-$7,825	-$2,295	-$10,120

Data Sources:

Health care costs estimates: Birnbaum, Jandciu, & Twells, 2002.

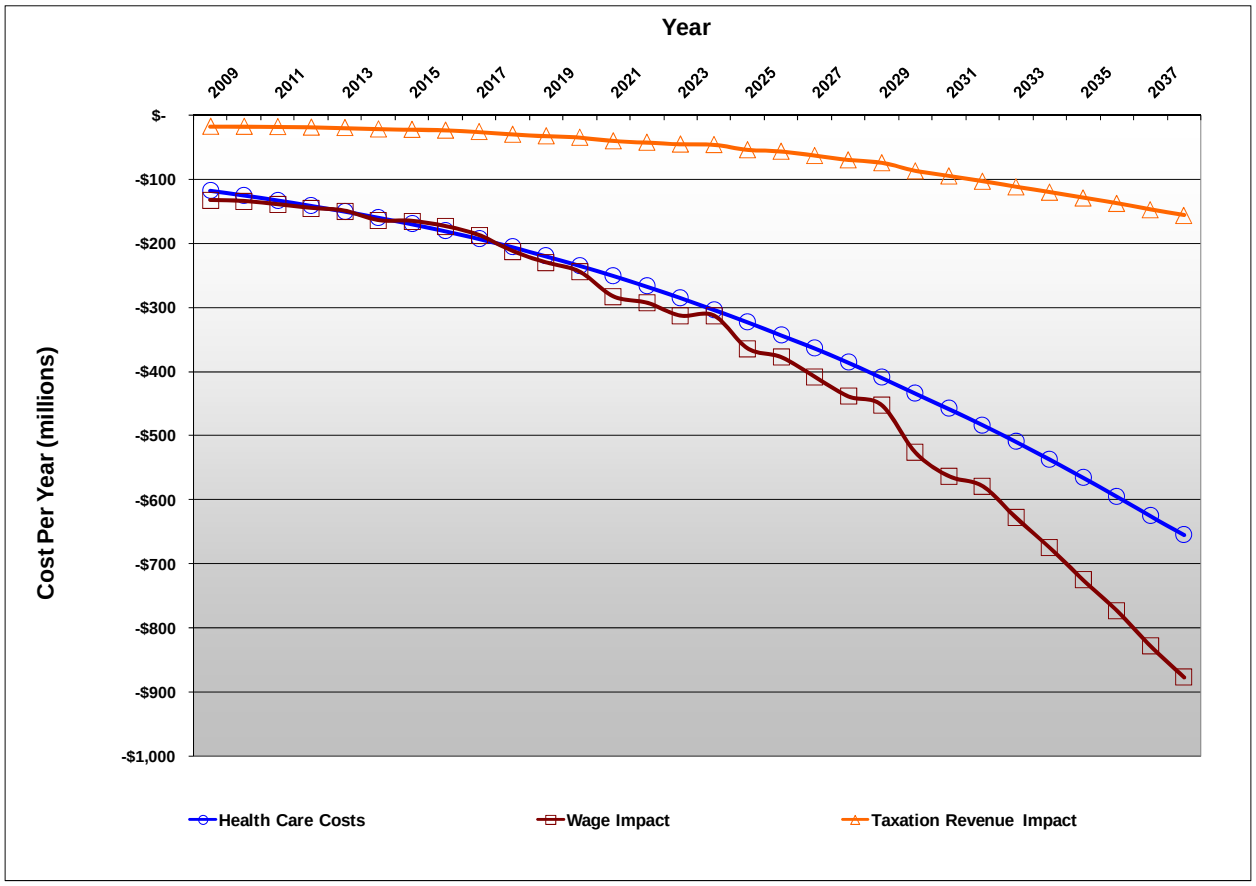
Taxation revenue: Statistics Canada Table 385-0002: Federal, provincial and territorial general government revenue and expenditures, for fiscal year ending March 31, annual (dollars), 1989 to 2006 and Statistics Canada Table 380-0022: Sector accounts, all levels of government, annual (dollars), 1961 to 2005.

Analytical source: Smetanin & Kobak, RiskAnalytica Life at Risk Model simulation for the L5L Project, August 2008.

5.1.4 ECONOMIC IMPACT OF VRE: BASE CASE

Exhibit 20 demonstrates, in future values, the components of economic burden attributed to the nosocomial VRE infection under the base case assumptions. The economic burden components include health costs of treating VRE infection as well as loss of wages and taxation revenue due to disability and mortality attributed to the nosocomial VRE infection

Exhibit 20 VRE, Economic Burden Components, Future Values, Base Case Scenario: 2009-2038



Data Sources:

Health care costs: Birnbaum, Jandciu, & Twells, 2002.

Wages: Statistics Canada Table 282-0070: Labour force survey estimates (LFS), wages of employees by type of work, National Occupational Classification for Statistics (NOC-S), sex and age group, annual (dollars), 1997 to 2006; and Statistics Canada Table 380-0016: Gross Domestic Product (GDP), Wage Data: income-based, annual (dollars), 1961 to 2005.

Taxation revenue: Statistics Canada Table 385-0002: Federal, provincial and territorial general government revenue and expenditures, for fiscal year ending March 31, annual (dollars), 1989 to 2006 and Statistics Canada Table 380-0022: Sector accounts, all levels of government, annual (dollars), 1961 to 2005.

Analytical source: Smetanin & Kobak, RiskAnalytica Life at Risk Model simulation for the L5L Project, August 2008.

Exhibit 21 demonstrates, in 2008 present values, cumulative economic burden to the society attributable to the nosocomial VRE infection in Canada over the next 30 years, under the base scenario assumptions. The exhibit shows the impact of individual components of societal economic burden as well as the total impact. Under the base case scenario assumptions, the societal cumulative economic burden of the nosocomial VRE infection is expected to exceed $9.9 billion.

Exhibit 21 VRE, Societal Economic Burden Dissections (Cumulative as of 2009), Five-Year Intervals, Base Case Scenario Assumptions, 2008 Present Values: 2009-2038

Year	VRE Economic Burden (millions), Society		
	Health Care Costs	Wage Impact	TOTAL
2009	-$115	-$129	-$244
2013	-$609	-$640	-$1,249
2018	-$1,293	-$1,319	-$2,611
2023	-$2,035	-$2,122	-$4,157
2028	-$2,835	-$3,006	-$5,841
2033	-$3,707	-$4,049	-$7,756
2038	-$4,642	-$5,265	-$9,907

Data Sources:

Health care costs: Bryce & Kerschbaumer, 2000.

Wages: Statistics Canada Table 282-0070: Labour force survey estimates (LFS), wages of employees by type of work, National Occupational Classification for Statistics (NOC-S), sex and age group, annual (dollars), 1997 to 2006; and Statistics Canada Table 380-0016: Gross Domestic Product (GDP), Wage Data: income-based, annual (dollars), 1961 to 2005.

Analytical source: Smetanin & Kobak, RiskAnalytica Life at Risk Model simulation for the L5L Project, August 2008.

Exhibit 22 demonstrates, in 2008 present values, cumulative economic burden to the Canadian governments attributable to the nosocomial c. VRE infection in Canada over the next 30 years, under the base scenario assumptions. The exhibit shows the impact of individual components of the economic burden to the governments as well as the total impact. Under the base case scenario assumptions, the cumulative economic burden of the nosocomial MRSA infection and colonization to the Canadian governments is expected to exceed $5.4 billion.

Exhibit 22 C. VRE, Government Economic Burden Dissections (Cumulative as of 2009), Five-Year Intervals, Base Case Scenario Assumptions, 2008 Present Values: 2009-2038

Year	VRE Economic Burden (millions), Government		
	Health Care Costs	Taxation Revenue Impact	TOTAL
2009	-$115	-$17	-$132
2013	-$609	-$83	-$692
2018	-$1,293	-$175	-$1,468
2023	-$2,035	-$289	-$2,324
2028	-$2,835	-$423	-$3,258
2033	-$3,707	-$601	-$4,308
2038	-$4,642	-$817	-$5,459

Data Sources:

Health care costs: Bryce & Kerschbaumer, 2000.

Taxation revenue: Statistics Canada Table 385-0002: Federal, provincial and territorial general government revenue and expenditures, for fiscal year ending March 31, annual (dollars), 1989 to 2006 and Statistics Canada Table 380-0022: Sector accounts, all levels of government, annual (dollars), 1961 to 2005.

Analytical source: Smetanin & Kobak, RiskAnalytica Life at Risk Model simulation for the L5L Project, August 2008.

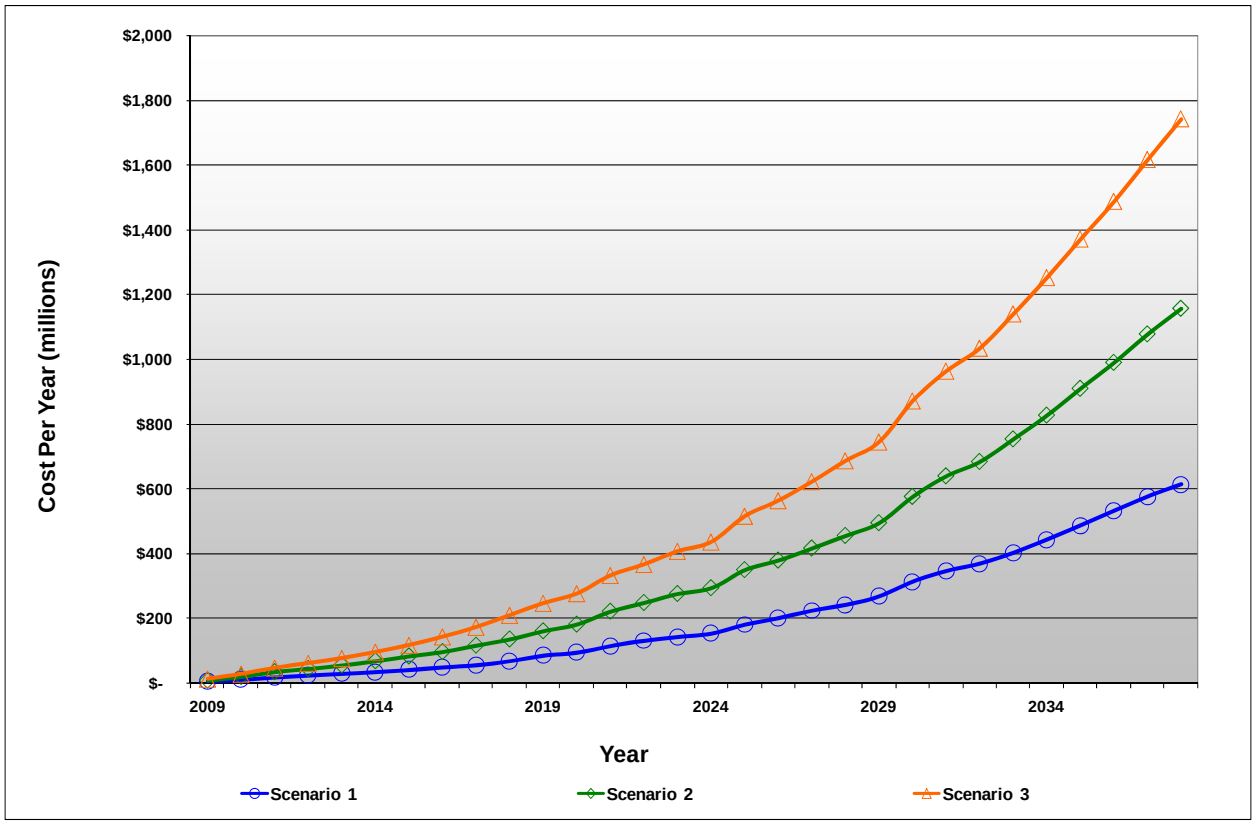
5.2 INTERVENTION SCENARIOS' CHANGES (DIFFERENCE FROM THE BASE)

The reduction of economic the burden of the nosocomial infections is estimated under the assumptions that the current responses to nosocomial infections prevention and control will improve between 2009 and 2038 as a result of a nation-wide strategy for nosocomial infection control and prevention. It is assumed that implementation of the strategy over a 30-year period will result in a reduction in the incidence of the nosocomial infections as well as the attributed mortality. Each intervention scenario estimates a reduction in economic burden for the society and the government.

5.2.1 TOTAL ECONOMIC IMPACT: EFFECTS OF SCENARIOS

Exhibit 23 demonstrates, in 2008 present values, the annual reduction of the societal economic burden attributed to the nosocomial MRSA, c. difficile and VRE infections over the simulated period under the intervention scenarios' assumptions. The graph shows the total amount of health costs and wages recovered as the result of implementing each intervention scenario.

Exhibit 23 Considered Nosocomial Infections, Intervention Scenarios, Societal Economic Burden Reduction, Future Values, Intervention Scenarios: 2009-2038



Data Sources:

Health care costs: Birnbaum, Jandciu, & Twells, 2002; Bryce & Kerschbaumer, 2000; and Birnbaum, Jandciu, & Twells, 2002.

Wages: Statistics Canada Table 282-0070: Labour force survey estimates (LFS), wages of employees by type of work, National Occupational Classification for Statistics (NOC-S), sex and age group, annual (dollars), 1997 to 2006; and Statistics Canada Table 380-0016: Gross Domestic Product (GDP), Wage Data: income-based, annual (dollars), 1961 to 2005.

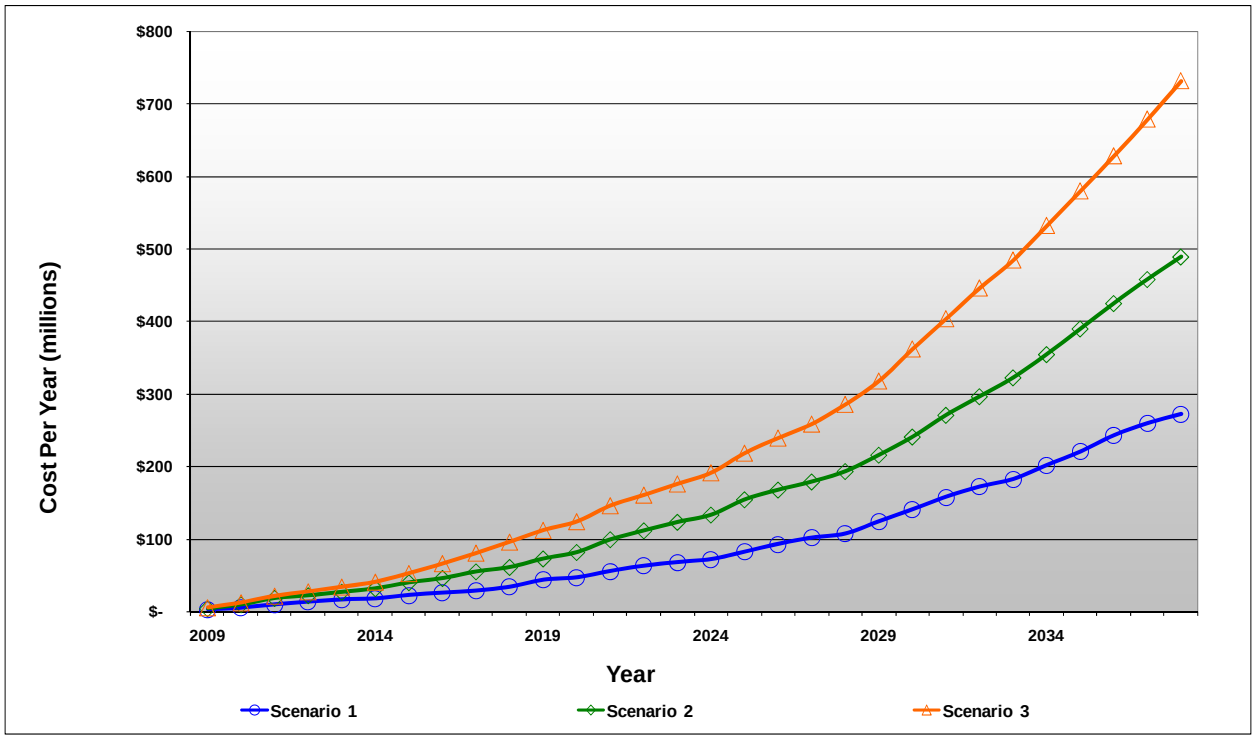
Scenario Assumptions:

Scenario 1: a 10% reduction in the incidence of the considered nosocomial infections over the 30-year period;
Scenario 2: a 20% reduction in the incidence of the considered nosocomial infections over the 30-year period;
Scenario 2: a 30% reduction in the incidence of the considered nosocomial infections over the 30-year period.

Analytical source: Smetanin & Kobak, RiskAnalytica Life at Risk Model simulation for the L5L Project, August 2008.

Exhibit 24 demonstrates, in future values, the annual reduction of the economic burden to the Canadian governments attributed to nosocomial MRSA, c. difficile and VRE infections over the simulated period under the intervention scenarios' assumptions. The graph shows the total amount of health costs and wages recovered as the result of implementing each intervention scenario.

Exhibit 24 Considered Nosocomial Infections, Intervention Scenarios, Government Economic Burden Reduction, Future Values, Intervention Scenarios: 2009-2038



Data Sources:

Health care costs: Birnbaum, Jandciu, & Twells, 2002; Bryce & Kerschbaumer, 2000; and Birnbaum, Jandciu, & Twells, 2002.

Taxation revenue: Statistics Canada Table 385-0002: Federal, provincial and territorial general government revenue and expenditures, for fiscal year ending March 31, annual (dollars), 1989 to 2006 and Statistics Canada Table 380-0022: Sector accounts, all levels of government, annual (dollars), 1961 to 2005.

Scenario Assumptions:

Scenario 1: a 10% reduction in the incidence of the considered nosocomial infections over the 30-year period;
Scenario 2: a 20% reduction in the incidence of the considered nosocomial infections over the 30-year period;
Scenario 2: a 30% reduction in the incidence of the considered nosocomial infections over the 30-year period.

Analytical source: Smetanin & Kobak, RiskAnalytica Life at Risk Model simulation for the L5L Project, August 2008.

Exhibit 25 demonstrates, in 2008 present values, the cumulative impact on the societal economic burden attributed to nosocomial MRSA, c. difficile and VRE infections under the intervention scenarios' assumptions. The societal economic burden is measured in terms of health care cost and lost wages. The current analysis estimates that:

- A 10% reduction in incidence of the nosocomial infections will result in recovering of over $2.5 billion over the next 30 years;
- A 20% reduction in incidence of the nosocomial infections will result in recovering of over $4.7 billion over the next 30 years;
- A 30% reduction in incidence of the nosocomial infections will result in recovering of over $7.1 billion over the next 30 years.

Exhibit 25 Considered Nosocomial Infections, Economic Burden Reduction for the Society, Scenarios' Impacts (Cumulative as of 2009), Five-Year Intervals: 2009-2038

Year	Impact of Intervention Scenarios (millions), Society		
	Scenario 1: 10% Incidence Reduction	Scenario 2: 20% Incidence Reduction	Scenario 3: 30% Incidence Reduction
2013	$73	$146	$199
2018	$255	$519	$745
2023	$585	$1,156	$1,699
2028	$1,047	$2,035	$3,006
2033	$1,689	$3,226	$4,804
2038	$2,519	$4,779	$7,142

Analytical source: Smetanin & Kobak, RiskAnalytica Life at Risk Model simulation for the L5L Project, August 2008.

Exhibit 26 demonstrates, in 2008 present values, the cumulative impact on the Canadian government economic burden attributed to the VRE infection under the intervention scenarios' assumptions. The government economic burden is measured in terms of health care cost and lost taxation revenue. The current analysis estimates that:

- A 10% reduction in incidence of the nosocomial infections will result in recovering of over $1.1 billion over the next 30 years;
- A 20% reduction in incidence of the nosocomial infections will result in recovering of over $2.0 billion over the next 30 years;
- A 30% reduction in incidence of the nosocomial infections will result in recovering of over $3.0 billion over the next 30 years.

Exhibit 26 Considered Nosocomial Infections, Economic Burden Reduction for the Government, Scenarios' Impacts (Cumulative as of 2009), Five-Year Intervals: 2009-2038

Year	Impact of Intervention Scenarios (millions), Government		
	Scenario 1: 10% Incidence Reduction	Scenario 2: 20% Incidence Reduction	Scenario 3: 30% Incidence Reduction
2013	$40	$70	$90
2018	$135	$243	$340
2023	$297	$528	$762
2028	$508	$911	$1,316
2033	$802	$1,420	$2,078
2038	$1,177	$2,083	$3,066

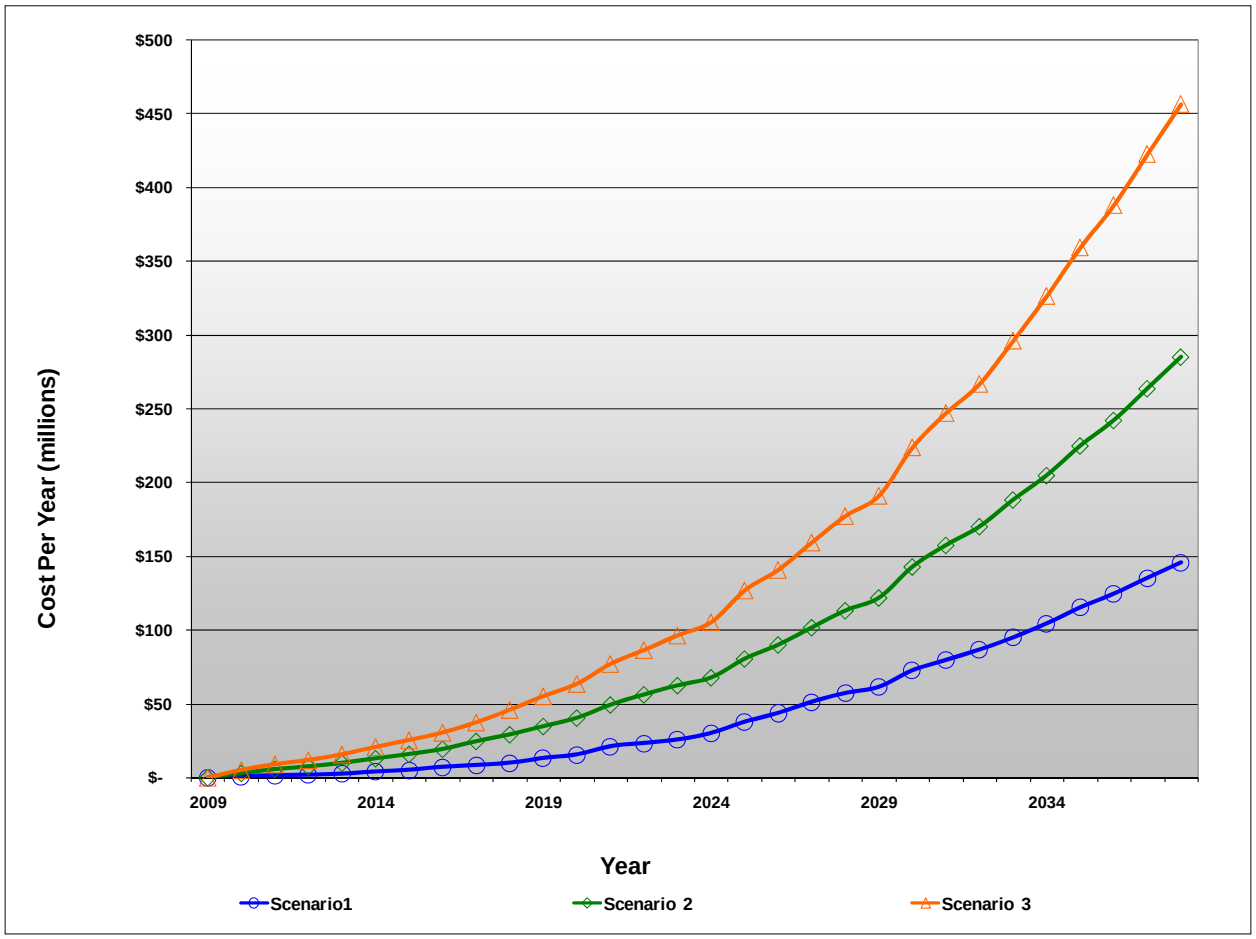
Analytical source: Smetanin & Kobak, RiskAnalytica Life at Risk Model simulation for the L5L Project, August 2008.

5.2.2 ECONOMIC IMPACTS OF MRSA: EFFECTS OF SCENARIOS

Exhibit 27 demonstrates, in future values, the annual reduction of the societal economic burden attributed to nosocomial MRSA infection and colonization over the simulated period under the intervention scenarios'

assumptions. The graph shows the total amount of health costs and wages recovered as the result of implementing each intervention scenario.

Exhibit 27 MRSA, Intervention Scenarios, Societal Economic Burden Reduction, Future Values, Intervention Scenarios: 2009-2038



Data Sources:

Health care costs: Birnbaum, Jandciu, & Twells, 2002.

Wages: Statistics Canada Table 282-0070: Labour force survey estimates (LFS), wages of employees by type of work, National Occupational Classification for Statistics (NOC-S), sex and age group, annual (dollars), 1997 to 2006; and Statistics Canada Table 380-0016: Gross Domestic Product (GDP), Wage Data: income-based, annual (dollars), 1961 to 2005.

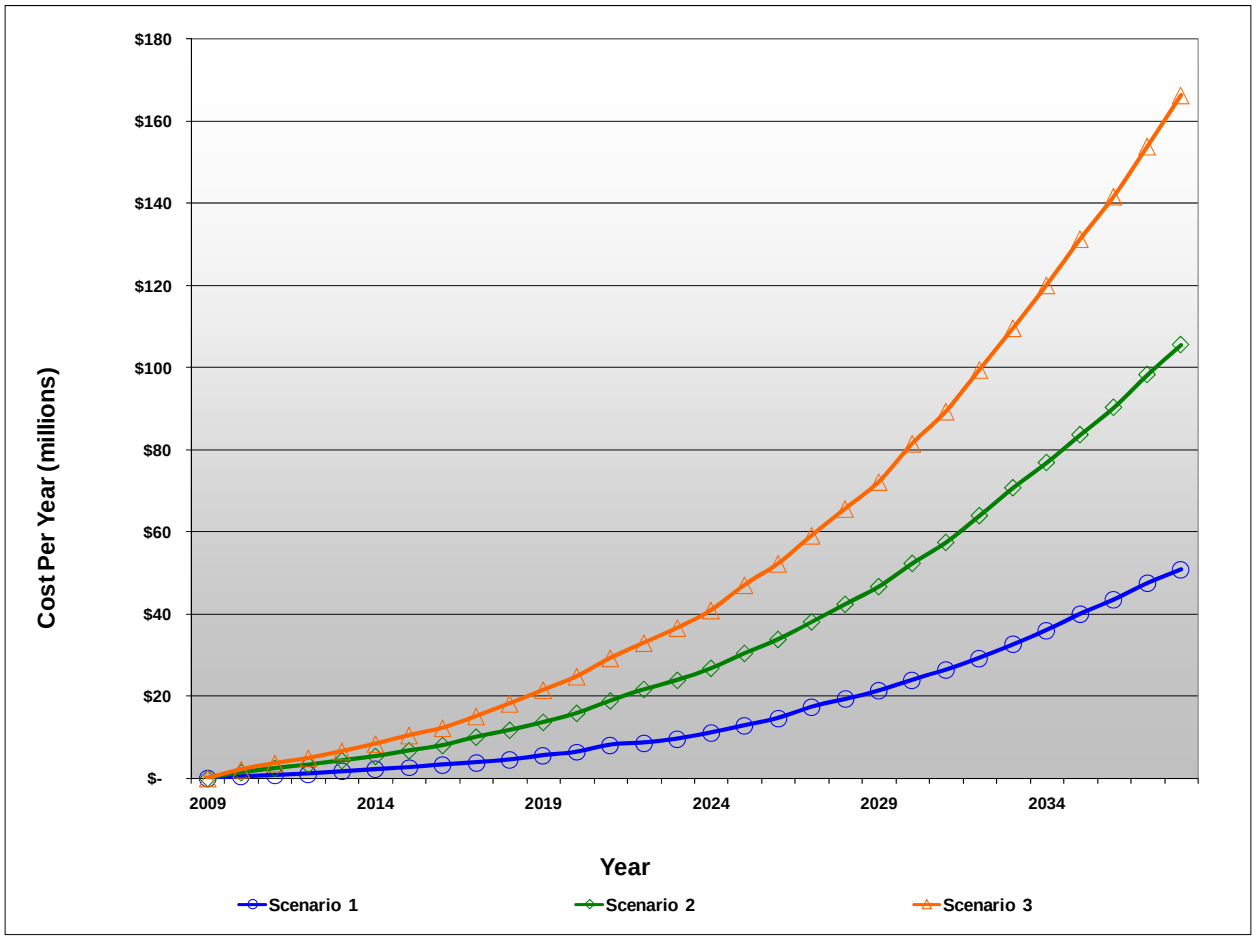
Scenario Assumptions:

Scenario 1: a 10% reduction in the incidence of the considered nosocomial infections over the 30-year period;
Scenario 2: a 20% reduction in the incidence of the considered nosocomial infections over the 30-year period;
Scenario 2: a 30% reduction in the incidence of the considered nosocomial infections over the 30-year period.

Analytical source: Smetanin & Kobak, RiskAnalytica Life at Risk Model simulation for the L5L Project, August 2008.

Exhibit 28 demonstrates, in future values, the annual reduction of the economic burden to the Canadian governments attributed to nosocomial MRSA infection and colonization over the simulated period under the intervention scenarios' assumptions. The graph shows the total amount of health costs and wages recovered as the result of implementing each intervention scenario.

Exhibit 28 MRSA, Intervention Scenarios, Government Economic Burden Reduction, Future Values, Intervention Scenarios: 2009-2038



Data Sources:

Health care costs: Birnbaum, Jandciu, & Twells, 2002.

Taxation revenue: Statistics Canada Table 385-0002: Federal, provincial and territorial general government revenue and expenditures, for fiscal year ending March 31, annual (dollars), 1989 to 2006 and Statistics Canada Table 380-0022: Sector accounts, all levels of government, annual (dollars), 1961 to 2005.

Scenario Assumptions:

Scenario 1: a 10% reduction in the incidence of the considered nosocomial infections over the 30-year period;
Scenario 2: a 20% reduction in the incidence of the considered nosocomial infections over the 30-year period;
Scenario 2: a 30% reduction in the incidence of the considered nosocomial infections over the 30-year period.

Analytical source: Smetanin & Kobak, RiskAnalytica Life at Risk Model simulation for the L5L Project, August 2008.

Exhibit 29 demonstrates, in 2008 present values, the cumulative impact on the societal economic burden attributed to the MRSA infection and colonization under the intervention scenarios' assumptions. The societal economic burden is measured in terms of health care cost and lost wages. The current analysis estimates that:

- A 10% reduction in incidence of the MRSA infection and colonization will result in recovering of over $536 million over the next 30 years;

- A 20% reduction in incidence of the MRSA infection and colonization will result in recovering of over $1.1 billion over the next 30 years;
- A 30% reduction in incidence of the MRSA infection and colonization will result in recovering of over $1.7 billion over the next 30 years.

Exhibit 29 MRSA, Economic Burden Reduction for the Society, Scenarios' Impacts (Cumulative as of 2009), Five-Year Intervals: 2009-2038

Year	Impact of Intervention Scenarios (millions), Society		
	Scenario 1: 10% Incidence Reduction	Scenario 2: 20% Incidence Reduction	Scenario 3: 30% Incidence Reduction
2013	$6	$23	$37
2018	$32	$99	$156
2023	$90	$241	$378
2028	$191	$451	$706
2033	$341	$746	$1,170
2038	$536	$1,128	$1,781

Analytical source: Smetanin & Kobak, RiskAnalytica Life at Risk Model simulation for the L5L Project, August 2008.

Exhibit 30 demonstrates, in 2008 present values, the cumulative impact on the Canadian government economic burden attributed to the MRSA infection and colonization under the intervention scenarios' assumptions. The government economic burden is measured in terms of health care cost and lost taxation revenue. The current analysis estimates that:

- A 10% reduction in incidence of the MRSA infection and colonization will result in recovering of over $192 million over the next 30 years;
- A 20% reduction in incidence of the MRSA infection and colonization will result in recovering of over $429 million over the next 30 years;
- A 30% reduction in incidence of the MRSA infection and colonization will result in recovering of over $665 million over the next 30 years.

Exhibit 30 MRSA, Economic Burden Reduction for the Government, Scenarios' Impacts (Cumulative as of 2009), Five-Year Intervals: 2009-2038

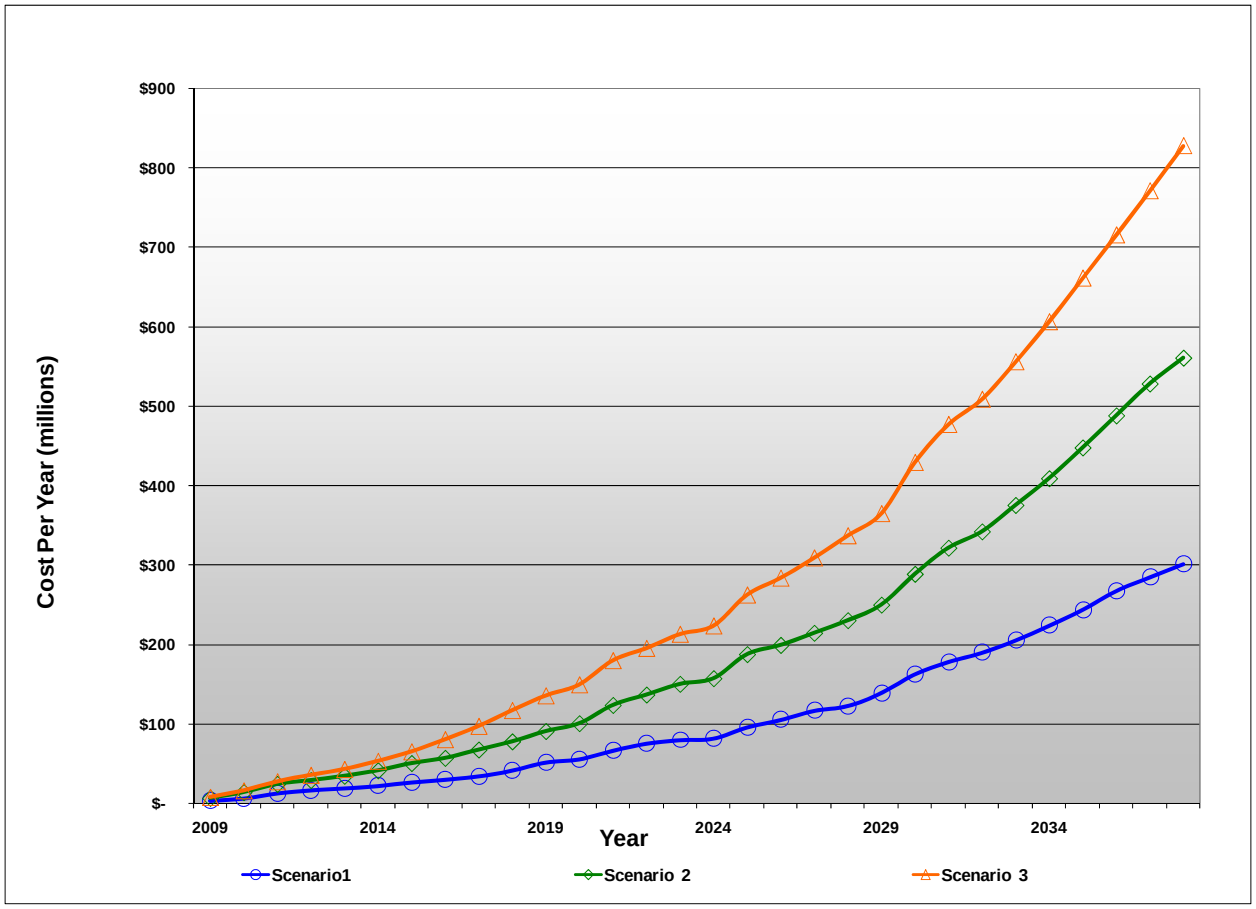
Year	Impact of Intervention Scenarios (millions), Government		
	Scenario 1: 10% Incidence Reduction	Scenario 2: 20% Incidence Reduction	Scenario 3: 30% Incidence Reduction
2013	$4	$10	$15
2018	$16	$41	$63
2023	$38	$96	$148
2028	$73	$176	$271
2033	$124	$286	$442
2038	$192	$429	$665

Analytical source: Smetanin & Kobak, RiskAnalytica Life at Risk Model simulation for the L5L Project, August 2008.

5.2.3 ECONOMIC IMPACTS OF C. DIFFICILE: EFFECTS OF SCENARIOS

Exhibit 31 demonstrates, in future values, the annual reduction of the societal economic burden attributed to nosocomial c. difficile infection over the simulated period under the intervention scenarios' assumptions. The graph shows the total amount of health costs and wages recovered as the result of implementing each intervention scenario.

Exhibit 31 C. Difficile, Intervention Scenarios, Societal Economic Burden Reduction, Future Values, Intervention Scenarios: 2009-2038



Data Sources:

Health care costs estimates: Birnbaum, Jandciu, & Twells, 2002.

Wages: Statistics Canada Table 282-0070: Labour force survey estimates (LFS), wages of employees by type of work, National Occupational Classification for Statistics (NOC-S), sex and age group, annual (dollars), 1997 to 2006; and Statistics Canada Table 380-0016: Gross Domestic Product (GDP), Wage Data: income-based, annual (dollars), 1961 to 2005.

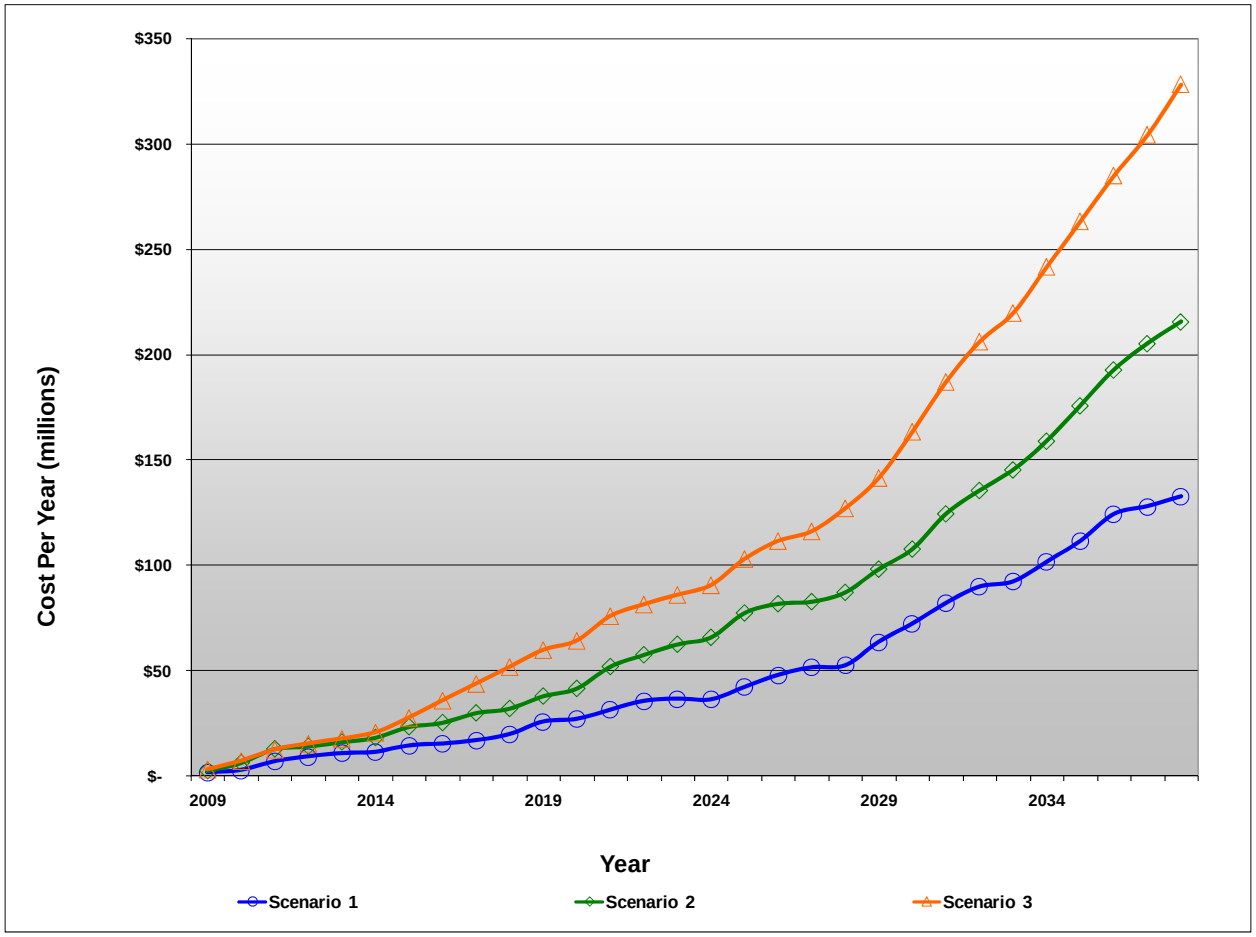
Scenario Assumptions:

Scenario 1: a 10% reduction in the incidence of the considered nosocomial infections over the 30-year period;
Scenario 2: a 20% reduction in the incidence of the considered nosocomial infections over the 30-year period;
Scenario 2: a 30% reduction in the incidence of the considered nosocomial infections over the 30-year period.

Analytical source: Smetanin & Kobak, RiskAnalytica Life at Risk Model simulation for the L5L Project, August 2008.

Exhibit 32 demonstrates, in future values, the annual reduction of the economic burden to the Canadian governments attributed to nosocomial c. difficile infection over the simulated period under the intervention scenarios' assumptions. The graph shows the total amount of health costs and wages recovered as the result of implementing each intervention scenario.

Exhibit 32 C. Difficile, Intervention Scenarios, Government Economic Burden Reduction, 2008 Present Values, Intervention Scenarios: 2009-2038



Data Sources:

Health care costs estimates: Birnbaum, Jandciu, & Twells, 2002.

Taxation revenue: Statistics Canada Table 385-0002: Federal, provincial and territorial general government revenue and expenditures, for fiscal year ending March 31, annual (dollars), 1989 to 2006 and Statistics Canada Table 380-0022: Sector accounts, all levels of government, annual (dollars), 1961 to 2005.

Scenario Assumptions:

Scenario 1: a 10% reduction in the incidence of the considered nosocomial infections over the 30-year period;
Scenario 2: a 20% reduction in the incidence of the considered nosocomial infections over the 30-year period;
Scenario 2: a 30% reduction in the incidence of the considered nosocomial infections over the 30-year period.

Analytical source: Smetanin & Kobak, RiskAnalytica Life at Risk Model simulation for the L5L Project, August 2008.

Exhibit 33 demonstrates, in 2008 present values, the cumulative impact on the societal economic burden attributed to the c. difficile infection under the intervention scenarios' assumptions. The societal economic burden is measured in terms of health care cost and lost wages. The current analysis estimates that:

- A 10% reduction in incidence of the c. difficile infection will result in recovering of over $1.3 billion over the next 30 years;
- A 20% reduction in incidence of the c. difficile infection will result in recovering of over $2.4 billion over the next 30 years;
- A 30% reduction in incidence of the c. difficile infection will result in recovering of over $3.5 billion over the next 30 years.

Exhibit 33 C. Difficile, Economic Burden Reduction for the Society, Scenarios' Impacts (Cumulative as of 2009), Five-Year Intervals: 2009-2038

Year	Impact of Intervention Scenarios (millions), Society		
	Scenario 1: 10% Incidence Reduction	Scenario 2: 20% Incidence Reduction	Scenario 3: 30% Incidence Reduction
2013	$51	$96	$116
2018	$165	$316	$423
2023	$357	$668	$936
2028	$599	$1,127	$1,593
2033	$930	$1,725	$2,477
2038	$1,344	$2,488	$3,599

Analytical source: Smetanin & Kobak, RiskAnalytica Life at Risk Model simulation for the L5L Project, August 2008.

Exhibit 34 demonstrates, in 2008 present values, the cumulative impact on the government economic burden attributed to the c. difficile infection under the intervention scenarios' assumptions. The Government economic burden is measured in terms of health care cost and lost taxation revenue. The current analysis estimates that:

- A 10% reduction in incidence of the c. difficile infection will result in recovering of over $624 million over the next 30 years;
- A 20% reduction in incidence of the c. difficile infection will result in recovering of over $1.0 billion over the next 30 years;
- A 30% reduction in incidence of the c. difficile infection will result in recovering of over $1.4 billion over the next 30 years.

Exhibit 34 C. Difficile, Economic Burden Reduction for the Government, Scenarios' Impacts (Cumulative as of 2009), Five-Year Intervals: 2009-2038

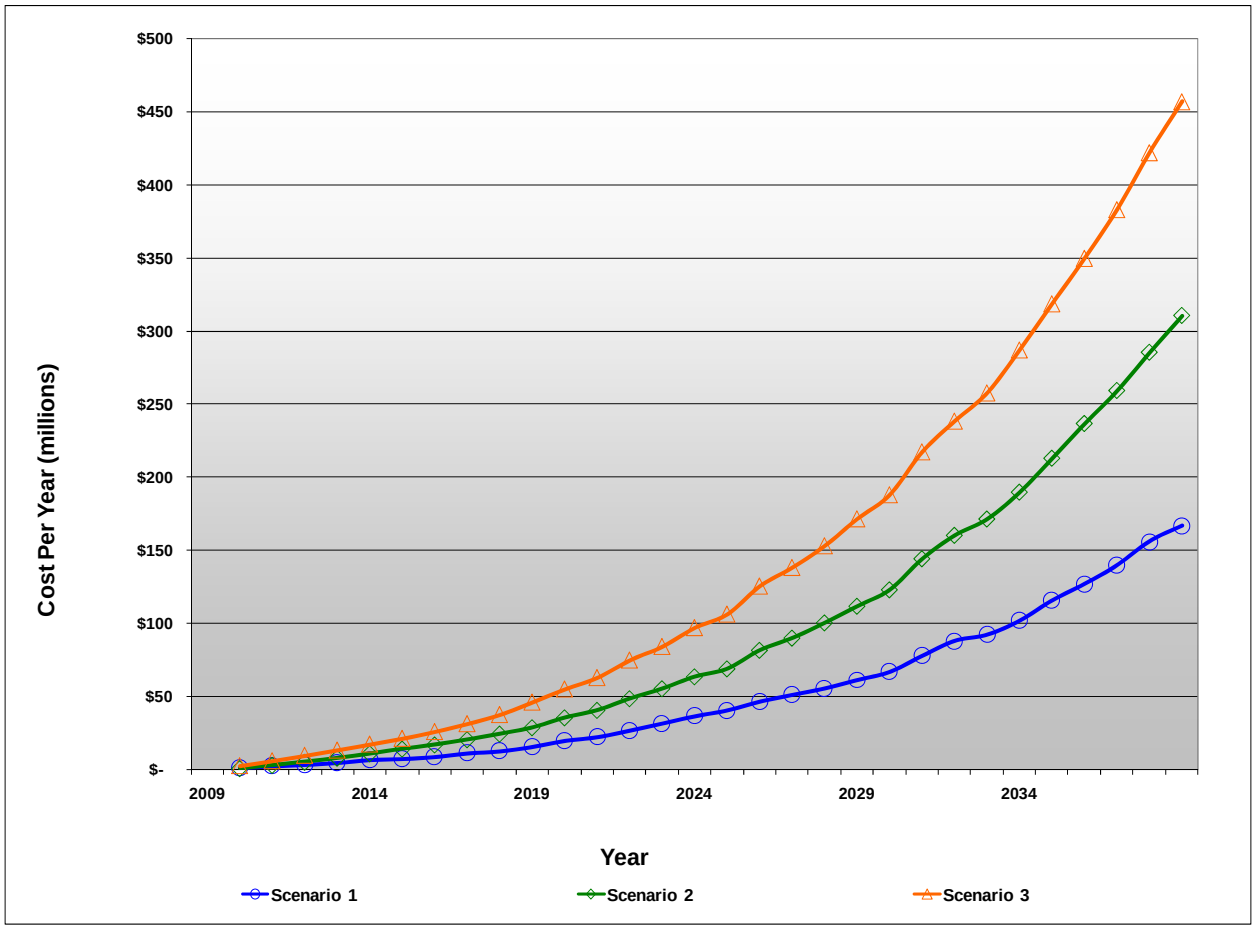
Year	Impact of Intervention Scenarios (millions), Government		
	Scenario 1: 10% Incidence Reduction	Scenario 2: 20% Incidence Reduction	Scenario 3: 30% Incidence Reduction
2013	$28	$46	$50
2018	$87	$142	$182
2023	$179	$289	$398
2028	$286	$473	$653
2033	$437	$704	$999
2038	$624	$1,001	$1,445

Analytical source: Smetanin & Kobak, RiskAnalytica Life at Risk Model simulation for the L5L Project, August 2008.

5.2.4 ECONOMIC IMPACTS OF VRE: EFFECTS OF SCENARIOS

Exhibit 35 demonstrates, in future values, the annual reduction of the societal economic burden attributed to nosocomial VRE infection over the simulated period under the intervention scenarios' assumptions. The graph shows the total amount of health costs and wages recovered as the result of implementing each intervention scenario.

Exhibit 35 VRE, Intervention Scenarios, Societal Economic Burden Reduction, Future Values, Intervention Scenarios: 2009-2038



Data Sources:

Health care costs: Bryce & Kerschbaumer, 2000.

Wages: Statistics Canada Table 282-0070: Labour force survey estimates (LFS), wages of employees by type of work, National Occupational Classification for Statistics (NOC-S), sex and age group, annual (dollars), 1997 to 2006; and Statistics Canada Table 380-0016: Gross Domestic Product (GDP), Wage Data: income-based, annual (dollars), 1961 to 2005.

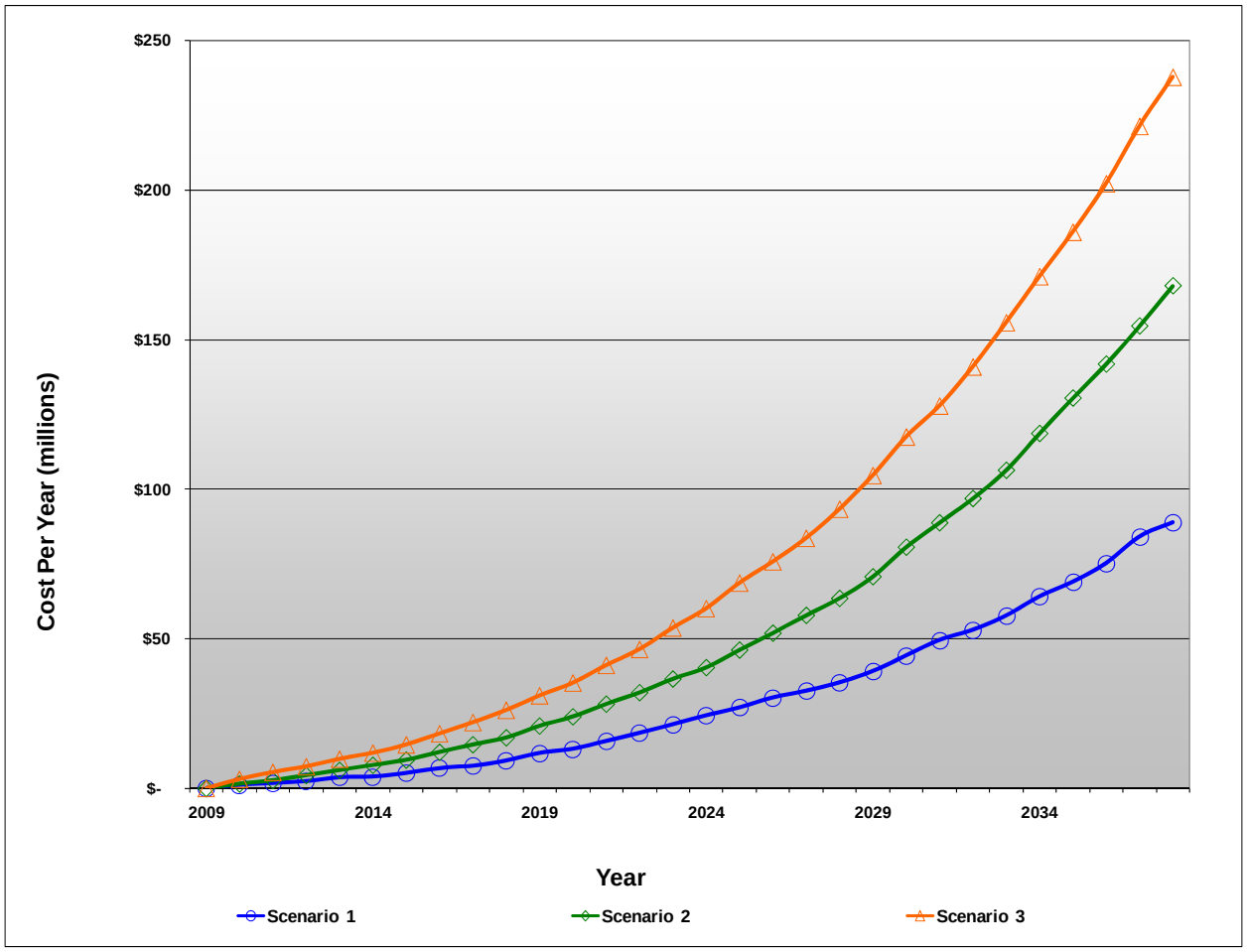
Scenario Assumptions:

Scenario 1: a 10% reduction in the incidence of the considered nosocomial infections over the 30-year period;
Scenario 2: a 20% reduction in the incidence of the considered nosocomial infections over the 30-year period;
Scenario 2: a 30% reduction in the incidence of the considered nosocomial infections over the 30-year period.

Analytical source: Smetanin & Kobak, RiskAnalytica Life at Risk Model simulation for the L5L Project, August 2008.

Exhibit 36 demonstrates, in future values, the annual reduction of the economic burden to the Canadian governments attributed to nosocomial VRE infection over the simulated period under the intervention scenarios' assumptions. The graph shows the total amount of health costs and wages recovered as the result of implementing each intervention scenario.

Exhibit 36 VRE, Intervention Scenarios, Government Economic Burden Reduction, Future Values, Intervention Scenarios: 2009-2038



Data Sources:

Health care costs: Bryce & Kerschbaumer, 2000.

Taxation revenue: Statistics Canada Table 385-0002: Federal, provincial and territorial general government revenue and expenditures, for fiscal year ending March 31, annual (dollars), 1989 to 2006 and Statistics Canada Table 380-0022: Sector accounts, all levels of government, annual (dollars), 1961 to 2005.

Scenario Assumptions:

Scenario 1: a 10% reduction in the incidence of the considered nosocomial infections over the 30-year period;
Scenario 2: a 20% reduction in the incidence of the considered nosocomial infections over the 30-year period;
Scenario 2: a 30% reduction in the incidence of the considered nosocomial infections over the 30-year period.

Analytical source: Smetanin & Kobak, RiskAnalytica Life at Risk Model simulation for the L5L Project, August 2008.

Exhibit 37 demonstrates, in 2008 present values, the cumulative impact on the societal economic burden attributed to the VRE infection under the intervention scenarios' assumptions. The societal economic burden is measured in terms of health care cost and lost wages. The current analysis estimates that:

- A 10% reduction in incidence of the VRE infection will result in recovering of over $639 million over the next 30 years;

- A 20% reduction in incidence of the VRE infection will result in recovering of over $1.1 billion over the next 30 years;
- A 30% reduction in incidence of the VRE infection will result in recovering of over $1.7 billion over the next 30 years.

Exhibit 37 VRE, Economic Burden Reduction for the Society, Scenarios' Impacts (Cumulative as of 2009), Five-Year Intervals: 2009-2038

Year	Impact of Intervention Scenarios (millions), Society		
	Scenario 1: 10% Incidence Reduction	Scenario 2: 20% Incidence Reduction	Scenario 3: 30% Incidence Reduction
2013	$17	$25	$44
2018	$58	$103	$165
2023	$139	$246	$384
2028	$257	$456	$706
2033	$418	$754	$1,156
2038	$639	$1,163	$1,760

Analytical source: Smetanin & Kobak, RiskAnalytica Life at Risk Model simulation for the L5L Project, August 2008.

Exhibit 38 demonstrates, in 2008 present values, the cumulative impact on the government economic burden attributed to the VRE infection under the intervention scenarios' assumptions. The government economic burden is measured in terms of health care cost and lost taxation revenue. The current analysis estimates that:

- A 10% reduction in incidence of the VRE infection will result in recovering of over $360 million over the next 30 years;
- A 20% reduction in incidence of the VRE infection will result in recovering of over $652 million over the next 30 years;
- A 30% reduction in incidence of the VRE infection will result in recovering of over $953 million over the next 30 years.

Exhibit 38 VRE, Economic Burden Reduction for the Government, Scenarios' Impacts (Cumulative as of 2009), Five-Year Intervals: 2009-2038

Year	Impact of Intervention Scenarios (millions), Government		
	Scenario 1: 10% Incidence Reduction	Scenario 2: 20% Incidence Reduction	Scenario 3: 30% Incidence Reduction
2013	$8	$13	$23
2018	$32	$58	$92
2023	$79	$141	$213
2028	$148	$261	$390
2033	$240	$429	$635
2038	$360	$652	$953

Analytical source: Smetanin & Kobak, RiskAnalytica Life at Risk Model simulation for the L5L Project, August 2008.

6 L5L INITIATIVE: VALUE PROPOSITION

6.1 VALUE PROPOSITION ASSUMPTIONS

The current section demonstrates the value proposition of investing $487.47 million over the initial start-up phase (over five years) into the capital infrastructure and operational activities of the L5L initiative[21] using the findings presented in Sections 4 and 5 of the current report. The value proposition provides an estimate of the time it would take the Canadian society and governments to receive full return on the investment into the initiative. All dollar amounts in the current section are presented in all of in 2008 equivalent dollars. The value proposition was developed under the following assumptions:

1. Capital and operating costs associated with L5L scientific and knowledge transfer activities in the area of infectious disease control and prevention will require an investment of $487.47 million over a five-year period which is assumed to be financed over a 15-year period;
2. The impact of these activities will result in the reduction of life an economic burden of the nosocomial infections stipulated by Scenario 2 (i.e. 20 % reduction in incidence of MRSA, c. difficile and VRE within a 30-year period)[22];
3. Implementation of the 20% incidence reduction scenario will begin in 2009 and will reach its intervention goal by 2019[23];
4. The 20% reduction of the three nosocomial infections' incidence and the associated mortality will result in the recovery over a 30-year period of: $523 million in lost taxation revenue, $1.6 billion in health care costs and $3.2 billion in lost wages;
5. From the perspective of the Canadian society, implementation of the 20% incidence reduction scenario will result in recovery of $4.78 billion between 2009 and 2038[24]; and
6. From the perspective of the Canadian governments, implementation of the 20% incidence reduction scenario will result in recovery of $2.08 billion between 2009 and 2038[25].

Since the focus of L5L research in the area of infectious disease control and prevention will be broader than the three nosocomial infections, the current value proposition should be considered a conservative estimate of the return on investment into the L5L initiative.

6.2 VALUE PROPOSITION SCOPE

Exhibit 39 demonstrates the cumulative net present value (NPV) factoring in 15 year costs of financing the 20% incidence reduction scenario from the societal and governments of Canada perspectives. The value proposition analysis demonstrates the following:

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[21] Refer to the *L5L Inaugural Business Plan* for detailed description of the L5L initiative.

[22] Refer to Section 3.5 Intervention Scenarios Assumptions for details.

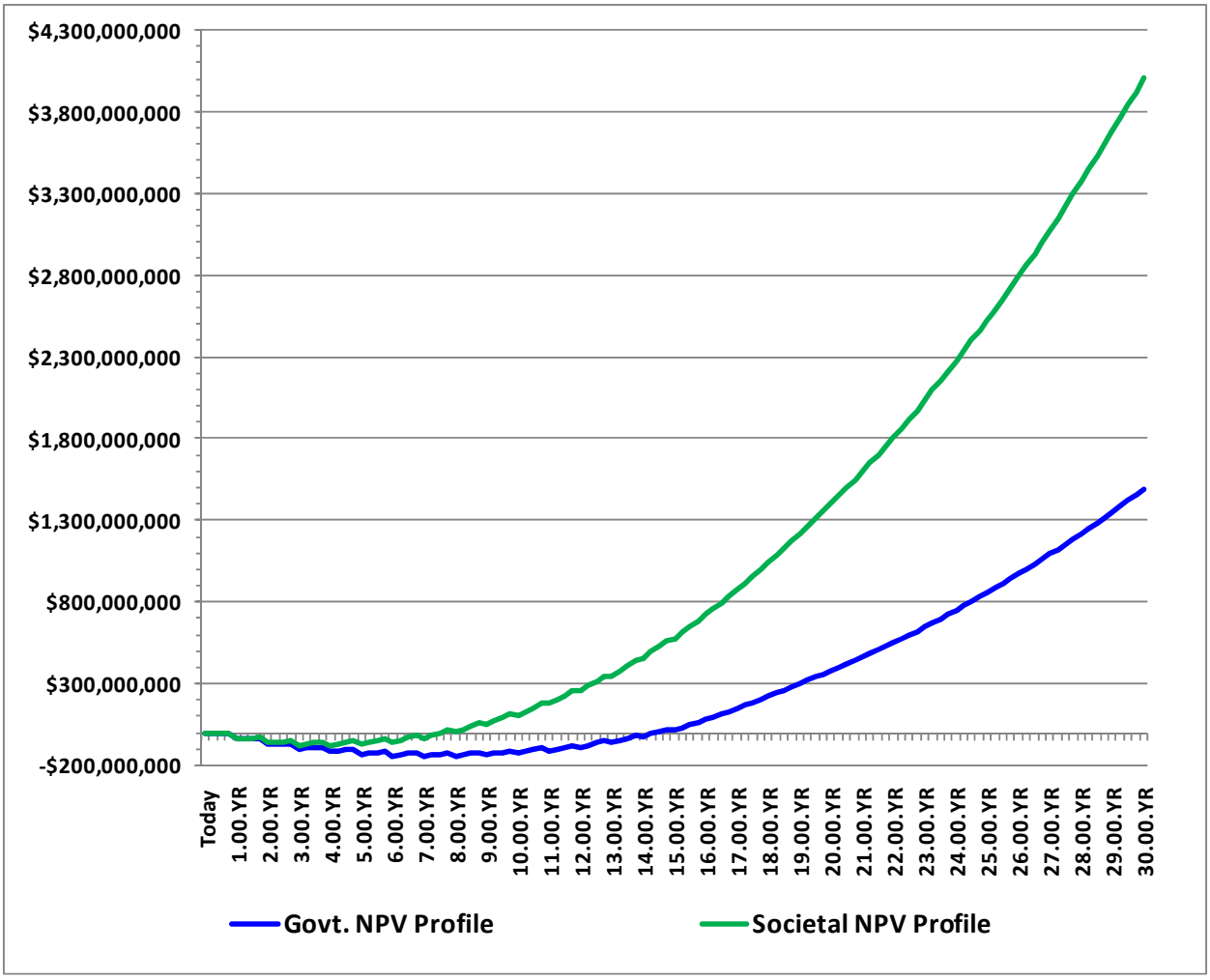
[23] Ibid.

[24] Refer to Section 5.2.1. Total Economic Impact: Effects of Scenarios for details.

[25] Ibid.

- From the perspective of the Canadian society, it will take 7.5 years to recoup all costs of financing the L5L initiative over the startup 5-years period;
- From the perspective of the governments of Canada, it will take 14.5 years Governments of Canada to recoup all costs of financing the L5L initiative over the startup 5-years period.

Exhibit 39 Value Proposition of the L5L Initiative Investment



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Statistics Canada Table 282-0070: Labour force survey estimates (LFS), wages of employees by type of work, National Occupational Classification for Statistics (NOC-S), sex and age group, annual (dollars), 1997 to 2006; and Statistics Canada Table 380-0016: Gross Domestic Product (GDP), Wage Data: income-based, annual (dollars), 1961 to 2005.

Statistics Canada Table 380-0016: Gross Domestic Product (GDP), income-based, annual (dollars), 1961 to 2005.

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