The Impact of the CFHI Healthcare Collaborations and Initiatives – Supplementary Report

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Prepared on behalf of Canadian Foundation for Healthcare Improvement by:

RiskAnalytica
The Science of Applied Risk Management

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France Laframboise	M.Sc.RN, IMHL, Assistant Director, Clinical Affairs, MediaMed Technologies
Dr. Garey Mazowita	MD, Chair of the Department of Family and Community Medicine at Providence Health Care
Dr. Jean Mireault	MD, M.Sc., Vice-president, Clinical Affairs, MediaMed Technologies
Margot Wilson	Director, Chronic Disease Management Strategy, Providence Health Care

EXECUTIVE SUMMARY

STUDY OBJECTIVE

Phase one of this study demonstrated the potential benefits that could be achieved if five EXTRA Intervention projects that aimed to reduce emergency department (ED) utilization were to be implemented nation-wide. The results from this analysis demonstrated that if these EXTRA projects were to be implemented across 50% of the Canadian Healthcare system Canada, a resulting average annual cost savings of $210 million (present value) could be achieved. The objective of this second phase was to expand upon this analysis by demonstrating the potential benefits of wide-scale implementation of two of the five EXTRA intervention projects that aim to reduce specialist and hospital utilization in addition to the ED utilization. Specifically, the focus of this analysis was on the impact on the number (and duration) of hospitalizations, and on referrals from family physicians to specialists.

KEY OUTCOMES

As the Canadian population ages, the burden placed on the healthcare system could rise considerably across the continuum of care. The annual number of hospital days could increase by 125%, from 24 million in 2013 to 54 million by 2043 and the annual number of discharges could increase by 92%, from 2.7 million in 2013 to 5.2 million by 2043 if the status quo is maintained. In addition to the aging population, the increase in hospital days and the increase in discharges can also be attributed to the increase in the number of Canadians with chronic comorbid conditions. This population is expected to increase from 1 million to 2.6 million, or from 3% to almost 6% of the population, over the next 30 years. Based on a moderate referral rate scenario, the growth in specialist consultations could reach up to 9 million consultations annually by 2043, or more than a 50% increase. The increases in these variables are significantly greater than the rate of population growth which would only increase by 30% over the same time frame. The impact of two EXTRA intervention projects that affect hospital and specialist utilization, assuming the interventions reach a 50% implementation coverage fraction, is estimated to:

- Avoid an average of 2 million specialist consultations (based on a moderate GP-to-specialist referral rate) each year over the next 30 years;
- Prevent an average of 5 million hospitalization days for patients with multiple chronic comorbid conditions annually over the next 30 years;

- Avoid an average of 440,000 hospital discharges for patients with multiple chronic comorbid conditions annually over the next 30 years;
- Based on the assumption of $50 saved per specialist consultation avoided, an annual average of $86 million over the next 30 years (in present value terms) could be avoided; and
- Given that an average of $5,000 is saved as a result of hospital discharges and hospital days avoided for patients with multiple chronic comorbid conditions, an average of $1.8 billion (present value) in costs could be avoided annually over the next 30 years.

Throughout this study, the EXTRA intervention project investigators were consulted to review and assess the reasonableness of model inputs, model structure, model outputs, and conclusions to ensure that the model is consistent with observed data.

APPROACH

Two EXTRA intervention projects that were partially aimed at reducing specialist consultations resulting from GP referrals, total hospital length of stay and hospital discharge rate, and the resulting costs from the three were analysed within RiskAnalytica's platform. The outcomes from these projects were then used to demonstrate the impact of these interventions on the number of specialist consultations that result from GP referrals, total hospital length of stay and hospital discharge rates if they were to be implemented across 50% of the health care system in Canada. The projects of focus are:

- **RACE**: Rapid Access to Consultative Expertise (RACE) led by Providence Health Care, British Columbia;
- **Integrated Monitoring**: The Challenges of Chronic Conditions: Integrated, Intensified Clinical Monitoring and proactive follow-up of the stratified "chronically ill population" Client Groups in the territory of the CSSS des Sommets in the Laurentians, Quebec.

CONCLUSIONS

Implementation of intervention projects that are supported by rigorous analysis and evidence, such as those supported by the Canadian Foundation for Healthcare Improvement, can play a crucial role in alleviating the burden placed on the health care system in Canada. The intervention projects that were put into practice as a result of CFHI's initiatives through their EXTRA program could have a significant impact on reducing GP referrals that result in specialist consultations, total hospital length of stay and

hospital discharge rates, and the resulting costs if they were to be taken up by 50% of the Canadian healthcare system. Over the next 30 years, the number of GP referrals that result in specialist consultations, total hospital length of stay and hospital discharges could increase much faster than the rate of population growth if the current trends continue. In 2043, the number of specialist consultations could range from 6.7 million visits to more than 12 million visits annually (depending on the referral rate assumption) and the number of hospital days and discharges could increase to 54 million days and 5.2 million discharges per year.

The expansion of the two EXTRA intervention projects at a 50% implementation rate across Canada, could lead to an average annual reduction of 2 million specialist consultations per year under the moderate referral rate assumptions, an average annual reduction of 440,000 hospital discharges per year and an average annual reduction of 5 million hospital days per year (averaged over the next thirty years). Additional analysis demonstrated that in order to significantly reduce the growth rate in total specialist consultations (whether resulting from a GP referral or from a different source) to that comparable to the population growth rate, implementation of the EXTRA intervention project RACE in ninety percent of the healthcare system (moderate referral rate) and in sixty percent implementation (high referral rate) of the health care system.. While no level of coverage of the EXTRA intervention project on Clinical Integrated Monitoring by itself would suffice to reduce the growth in hospital discharges or total hospital length of stay to the growth of the population, 50% implementation of both the projects could substantially bend the cost curve. Over the next 30 years, under the moderate referral rate assumptions, an annual average of $86 million dollars per year could be saved due to RACE and an average of $1.8 billion dollars per year due to clinical integrated monitoring (both in present value).

This analysis highlights the role that CFHI's intervention projects play in identifying and implementing initiatives that are aimed toward provoking system change, thereby improving healthcare for all Canadians.

STRUCTURE OF THE REPORT

This report is divided into 4 sections:

- **Section 1** provides details on the background, purpose and objectives of the evaluation;
- **Section 2** highlights the general approach to the analysis, the subject-matter expert review of the approach and outcomes, and provides details on the Life at Risk® methodology and model assumptions as well as the input data and data assumptions applied for the analysis;
- **Section 3** summarizes the results of the base model, establishing a 30 year annual baseline estimate of specialist and hospital utilization in Canada;
- **Section 4** summarizes the major findings and conclusions.

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1 INTRODUCTION AND BACKGROUND

1.1 PHASE 1 - SUMMARY

In order to analytically demonstrate the potential benefits of CFHI's collaboration initiatives to the health care system if they were to be implemented across 50% of the Canadian healthcare system, five EXTRA intervention projects that aim to reduce emergency department utilization were analysed within RiskAnalytica's Life at Risk Platform. The projects of focus included:

- **Advanced Access**: Increased Number of Advanced Access Practices within Cape Breton District Health Authority, Nova Scotia;
- **RACE**: Rapid Access to Consultative Expertise (RACE) led by Providence Health Care, British Columbia;
- **Patient Flow**: Improving Patient Flow Through ED in Calgary Health Region, Alberta;
- **PCP/ACP**: Primary Care Pathways and Advanced Care Paramedics from Bridging the Gap between Primary and Secondary Care: A DVT Care Process in Queen Elizabeth II Health Science Centre, Nova Scotia; and
- **Integrated Monitoring**: The Challenges of Chronic Conditions: Integrated, Intensified Clinical Monitoring and proactive follow-up of the stratified "chronically ill population" Client Groups in the territory of the CSSS des Sommets in the Laurentians, Quebec.

An emergency department utilization model was developed that was based on over 40 diseases and risk factors and current emergency department demand. Detailed emergency department utilization data from the Canadian Institute for Health Information (CIHI) was used to estimate the baseline emergency demand. A scenario analysis was conducted using select outcomes from these projects to demonstrate the impact of the interventions on reducing ED demand and costs across the country in order to demonstrate the potential benefits that could be achieved if the five EXTRA intervention projects were to be expanded across 50% of the Canadian healthcare system.

1.1.1 KEY OUTCOMES FROM PHASE 1

Over the next 30 years, the results from this analysis suggest that the annual number of emergency visits could increase from 15 million in 2013 to over 21 million in 2043 if no changes are made to health care systems. This 40% increase in visits was found to be significantly greater than the rate of population

growth which would increase by only 30%. Using RiskAnalytica's Life at Risk Platform, the combined impact of the five projects that affect emergency department use was estimated to:

- Avoid an average of 2.5 million emergency department visits each year over the next 30 years (a 14% reduction);
- Reduce the total emergency department length of stay for all patients by an average of 11.8 million hours each year (16% reduction); and
- Save an average of $210 million dollars (present value) annually over the next 30 years if the alternative to emergency department visits, such as GP visits, cost half as much.

1.2 PHASE TWO – OVERVIEW OF ENGAGEMENT SCOPE

Background and Context

In order to expand on the study that was done under phase one, two of the five projects that were aimed at reducing specialist and hospital use as well as emergency department utilization, and the resulting costs were examined.

In 2011, a study conducted by CIHI (2011) found that "Seniors with three or more reported chronic conditions accounted for 40% of reported health care use among seniors, even though they comprised only 24% of all seniors". Additionally, this study reported that the prevalence of chronic conditions among the population is also increasing. Therefore it is likely that the healthcare utilization and costs associated with the population with chronic comorbid (CCM) conditions can be expected to rise, and with it the burden placed on the healthcare system. A study conducted by CIHI reported that consultations and visits to specialists accounted for up to 53.5% of payments and 66.3% of total services provided with total fee-for-service payments totaling $53 billion (52% of total payments). Therefore organizations such as CFHI that invests in programs, such as the EXTRA programs that develop interventions that aim to manage the population with CCM and reduce specialist utilization are necessary in alleviating the burden placed on the healthcare system.

Purpose and Objective

The purpose and objective of this engagement was to expand on the analysis undertaken in phase one by demonstrating the benefits of two EXTRA intervention projects that aim to reduce specialist

consultations that result from GP referrals, hospital discharges and hospital length of stays, and the resulting costs of these variables on the health care system and Canada if they were to be taken up at a 50% implementation rate.

Scope of the engagement

To achieve this objective, RiskAnalytica's Life at Risk Multi Disease Simulation (LRMDS) platform was used to generate a base model that estimated the current specialist and hospital utilization. For the purpose of this analysis, hospital utilization rates focused on hospital length of stay and the number of hospital discharge days. The hospital discharge data were used as a proxy for admission rates. Specialist utilization was based on specialist consultations that result from GP referrals only.

Two EXTRA interventions projects, used in the initial analysis, that aim in part to reduce specialist and hospitalization utilization were selected. The intervention projects that were the focus for this analysis include:

- Rapid Access to Consultative Expertise (RACE) led by Providence Health Care;
- The Challenges of Chronic Conditions: Integrated, Intensified Clinical Monitoring and proactive follow-up of the stratified "chronically ill population" client groups in the territory of the CSSS des Sommets in the Laurentians, Quebec; and

Outcomes from these intervention projects were used to develop scenario analyses that demonstrated the impacts of these projects on reducing specialist consultations that result from GP referrals, total hospital length of stay and hospital discharge and costs across 50% of the Canadian healthcare system. The outcomes of the base model and scenario results were compared to show the benefits that could be achieved if these projects were to be implemented nation-wide.

1.3 OVERVIEW OF EXTRA INTERVENTION PROJECTS

A brief summary on the objectives, interventions and outcomes of the EXTRA intervention projects is provided below. Further details on the individual projects can be found in Appendix B.

RACE - The EXTRA project investigators found that patients with complex chronic conditions often navigate multiple interfaces and may experience fragmented care and poor outcomes as a result. The project team implemented an innovative model of shared care involving a telephone

advice line where family physicians can call one number and choose from a selection of speciality services for real time telephone advice known as RACE (Rapid Access to Consultative Expertise). This intervention project led to a significant reduction in visits to the ED and avoided unnecessary face-to-face consultation with specialists.

Integrated Monitoring and follow-up - The main objective of this intervention project was to identify patients with co-morbid conditions who are complex and use healthcare services extensively, and develop an integrated response by better understanding and bringing together various departments and clinical teams in order to improve their well-being and maximize efficiency of services. The intervention project involved redefining the specific needs of these patients, reconfiguring the care and services that they are offered and intensely monitoring the patients in the community requiring a complex combination of health care services. Besides the improved well-being of the target population, the outcome of this intervention project was a reduction in emergency services use and hospitalizations.

2 OVERVIEW OF METHODOLOGY

2.1 THE LIFE AT RISK PLATFORM

The analysis on the costs and demand for specialist consultations, hospital discharge rates and total hospital length of stay and the impact of the two EXTRA intervention projects were conducted using RiskAnalytica's Life at Risk Platform. The agent-based simulation platform allows detailed simulation of the Canadian population, multiple diseases and risk factors, and continuums of care. The platform tracks representative individuals by age, sex, and health profile typically over a thirty year period. The platform can be divided into three primary sections – demography, health, and utilization. As the platform was designed to be expandable, the scope of the analysis is limited by the data available to populate the model. Sections 2.1.1 to 2.1.3 outline the details of the model structure while Section 2.2 describes the data sources used for this analysis.

2.1.1 DEMOGRAPHY

There are four key processes that determine the overall demographic evolution of the population:

- Birth,
- Immigration,
- Emigration, and
- Death

Birth and immigration introduce new agents into the model, while emigration and death remove people from the system. The rate of each process is estimated from recent historical trends.

2.1.2 HEALTH

Building upon the overall demographic trends, the health of the population is determined by estimating the incidence and remission (if relevant) of each of the diseases in the analysis. The incidence (or remission) can be dependent upon the age and sex of the individual in the model, as well as other risk factors such as smoking or other comorbid conditions. In addition, the risk of death for each agent in the system is altered according to their health profile. The agent-based approach allows for the full tracking of comorbidities allowing individuals to exist in the system with multiple diseases simultaneously.

2.1.3 SPECIALIST AND HOSPITAL UTILIZATION

The simplified service utilization model that was constructed as part of phase one was expanded in order to focus on hospital discharges and hospital lengths of stay for the population, the number of specialist consultations that are generated from GP referrals and the CCM and non-CCM population. Specifically, RACE decreased the number of GP referrals that resulted in specialist consultations by 60%, and Integrated Monitoring for Chronic Conditions reduced hospitalization days by 40% and the number of hospitalizations by 39% for those patients with chronic comorbid conditions. Taking a conservative approach, this analysis assumed that the Clinically Integrated Program can only prevent 40% of the hospital visits and that the intervention is only applied to 50% (1.5% of the population) of the CCM group. This assumption is based on feedback from SMEs that suggests that uptake could be difficult across different areas. In addition, these assumptions feed in turn into the broader assumption of a 50% implementation rate across the country and a five year ramp up period, for both EXTRA intervention projects studied in this report.

2.2 DATA COLLECTION

2.2.1 POPULATION DEMOGRAPHICS

The overall demographic trends are based on Statistics Canada data. The recent trends in birth, death, and migration rates over the last 10 years are assumed to continue over the next 30 years to establish a baseline demographic projection. The complete list of data inputs used can be found in Appendix B.

2.2.2 DISEASE AND RISK FACTORS

The Life at Risk Multi-Disease Simulation includes a number of major diseases that are found to drive the demand for specialist visits, and hospitalizations. These major diseases were included to estimate what service utilization could look like over the next 30 years by taking into account disease demographics occurring in the population. The input of diseases data and key assumptions of the base model were obtained from a variety of data sources that had Canada specific data including Statistics Canada (Canadian Community Health Survey), Canadian Cancer Registry, PHAC disease surveillance data, and a variety of epidemiological health studies. The diseases included in the analysis are:

- Cancer - Lung (C34), Breast (C50), Prostate (C61), Colorectal (C18; C19; C20; C26), Skin (C43; C44), Others (Remainder of C00-C99; D00-D48)

- Respiratory - Asthma (J45), - COPD (J44)
- Cardiovascular - Angina (I20), Other Ischemic Heart Disease (I24; I25), Myocardial Infarction (I21;I22), Cerebrovascular (I60-I69), Hypertension (I10-I15)
- Musculoskeletal – Rheumatoid Arthritis (M05; M06), Osteoarthritis (M15; M19; M47), Back Pain (M54), Osteoporosis (M80; M81; M82)
- Endocrine – Diabetes Type 1 (E10), Diabetes Type 2 (E11-E14), Thyroid (E00-E07)
- Mental Disorders - Mood Disorders (F30-F39), Anxiety Disorders (F40; F41), Psychotic (F20-F29) Conduct (F91), ADHD (F90), Dementia (F00-F07), Substance Use Disorders (F10-F19)
- Digestive – Crohn's Disease (K50), Colitis (K51; K52), Peptic Ulcers (K25; K27)
- Genitourinary – Urinary Incontinence (N39)
- Nervous – Alzheimer's Disease (G30), Migraine (G43), Parkinson's Disease (G20), Epilepsy (G40), Multiple Sclerosis (G35), Other (Remainder of G00-G99)External Causes – Motor Vehicle Accidents (V00-V99), Unintentional Falls (W00-W19), Other (Remainder of V00-V99; W00-W99; X00-X99; Y00-Y89)

This set of diseases accounts for approximately 85% of all causes of death in Canada.

Identified from a wide range of data sources, the key risk factors included into the base model are: smoking (by duration, severity, and time since cessation), obesity, heavy drinking, injury, stress, hypertension, socioeconomic factors (income), physical inactivity and co-morbid health conditions. The inclusion of these risk factors is important to the development of our model to account for the underlying factors that can also affect the onset and prevalence of disease in order to estimate the demand for specialists and hospitalizations over time. This involved a review of the literature to identify data on risk factors that are found to be significantly associated to the onset and mortality from diseases included into the model. Data on relative risk estimates have been obtained from a variety of research studies including: meta-analyses, systematic reviews, peer-reviewed journals, longitudinal studies and have been incorporated into the model.

The complete list of disease and risk factors data sources used can be found in Table 2 in Appendix B.

2.2.3 GP REFERRALS TO SPECIALIST CONSULTATIONS AND ASSOCIATED COSTS

Utilization data on specialist's consultations and number of GP assessments was obtained from the CIHI National Physician Database (NPDB). The initial estimate on the fraction of GP referrals that result in specialist consultations was taken directly from the RACE project that referenced data from Forrest et al. (2002). The analysis conducted by Forrest et al. in 2002 was based on a prospective cohort study evaluating FPs referrals decisions which found that 5% of FP office visits result in a referral to a specialist. However, given that this number was based on a U.S. study, an additional literature review was undertaken. The review identified that between 3.9% and 7.5% of patient visits to a GP/FP in Canada result in a referral to a specialist or a subspecialist consultant (CFPC/RCPSC Conjoint Discussion Paper, August 2006). These two numbers were used to conduct a sensitivity analysis in order to investigate the dependence of the conclusions upon the fraction used. Therefore, three possible GP-Specialist referral rates were investigated:

- 3.9 % of GP visit result in specialist consultations: Low referral rate scenario,
- 5% of GP visit result in specialist consultations: Moderate referral rate scenario, and
- 7.5% of GP visit result in specialist consultations: High referral rate scenario.

As shown in Section 3, the overall conclusions were insensitive as to whether the US value or Canadian value is used, though the exact numerical values do change. The evaluation report on RACE reported that the implementation of this project amounted to cost savings of up to $200 per call depending on speciality area. However, it must be noted that the intervention project took place in Providence Health Care and as such, costs may vary across health regions in Canada. Therefore, given the uncertainty of costs savings that could be achieved, a conservative estimate of $50 of direct cost savings was assumed within this analysis.

The specialist utilization data were not disease-specific. Instead, the overall health of the population (by age and sex), as measured in annual prevalence-years of illness, was used to drive specialist consultations.

2.2.4 HOSPITAL DISCHARGES, HOSPITAL LENGTH OF STAYS AND ASSOCIATED COSTS

Utilization data on hospital use was obtained from the Canadian Institute for Health Information (CIHI). For each of the diseases included in the model, the data on hospital length of stay and discharges

included the estimated hospitalization rates, days utilized and discharge fiscal year broken down by age and sex for both the CCM population and non-CCM population. The discharge data from CIHI was used as a proxy for hospital admissions and included data on discharge date and time and discharge disposition. Prior to the intervention project, the EXTRA project investigators found that about 3% of the CCM population uses about 50% of the health care resources (Laframboise et al., 2012). The CCM population's comorbidity's level chosen to account for 3% of the population at the start of this analysis is as follows: almost 0% of the 0-35 age group, 2% of 35-70, and 20 % of the 70+. Within this analysis, the impact of the EXTRA intervention was assumed to affect only half of this population (1.5% of the CCM population). Data on the costs associated with hospitalizations was also obtained from CIHI. The data included median costs of each disease included in the model. An upper bound on mean cost per hospitalization derived from total expenditures gives roughly $20,000 but this includes contributions from other sources than per patient costs alone. Additionally, a report from CIHI on "The Cost of Hospital Stays: Why Costs Vary" states that multipliers from age, comorbidity and so on can raise these costs. It is also likely that there will be costs incurred secondary to the intervention implementation which are hard to estimate. For example, it is known that diverting people from hospitals can result in additional costs elsewhere in the healthcare system, although these are expected to be considerably lower than the costs associated with hospitalization. Therefore, given the uncertainty of actual costs, a conservative assumption of a net savings of $5,000 per visit is assumed to be a reasonable one for the purpose of this analysis.

As with the specialists, note that the hospitalization utilization data were not disease-specific. Instead, the overall health of the population (by age and sex), as measured in annual prevalence-years of illness, as well as number of co-morbidities, were used to drive hospitalization discharges and length of stays.

For additional information on data sources please refer to Appendix C.

3 RESULTS

The results are divided into two sections. The first examines future specialist's consultations, total hospital length of stay and hospital discharge rates if the current trends were to continue with no interventions. These baseline results, presented in Section 3.1, establish the benchmark against which the impact of the EXTRA intervention projects can be measured. Section 3.2 examines the impact of the EXTRA intervention on hospital discharges rates, hospital length of stay and specialists consultations as a result of GP referrals in Canada.

3.1 BASELINE RESULTS

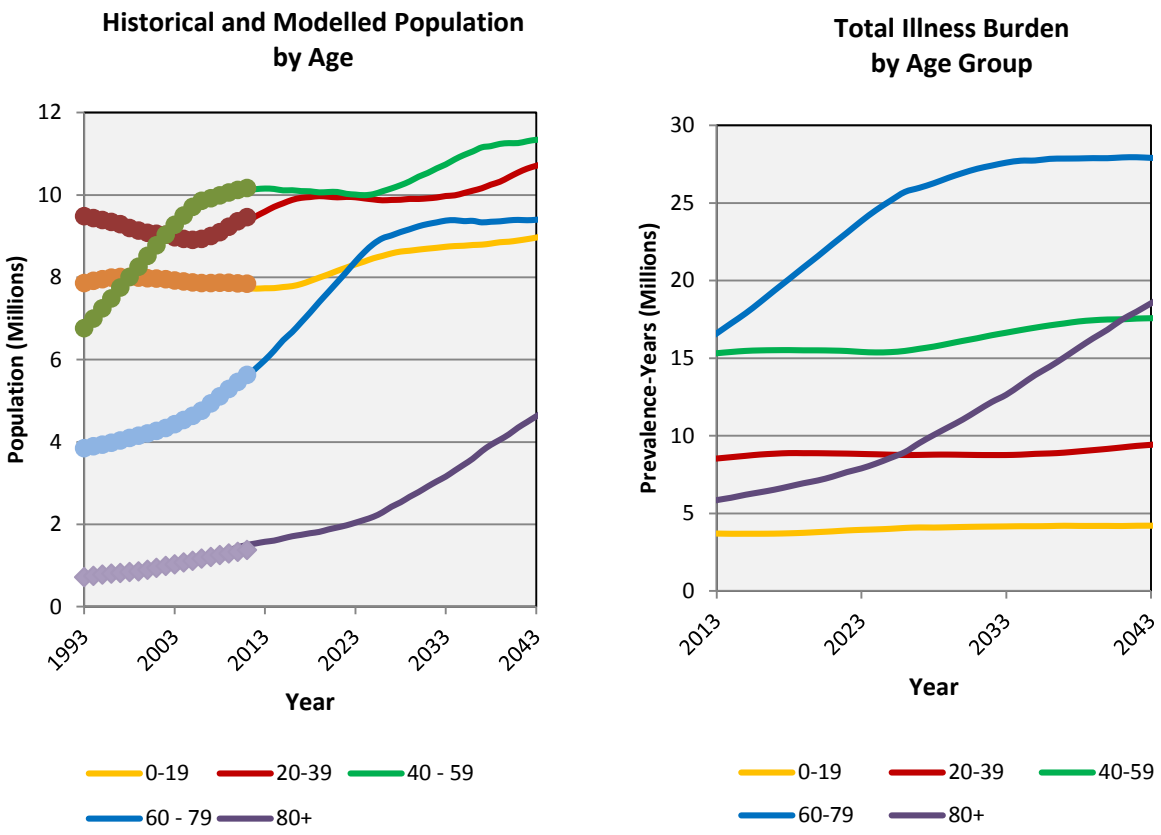
The baseline results consist of three parts. The first is the validation of the model structure through the reproduction of historical observations. The second examines the expected specialist utilization and costs if the trends were to remain the same over the next 30 years. The third examines the expected hospital length of stay and hospital discharge rates, and costs if the trends were to remain the same over the next 30 years.

3.1.1 DEMOGRAPHIC RESULTS

In order to validate the demographic results, the simulation is started 20 years in the past in 1993, and run 30 years into the future until 2043. As shown in Figure 1, the model is accurately able to reproduce the historical observations. In Figure 1 (left), the points indicate the historical values while the lines show the modelled results. In addition, the population projection falls within the range of moderate growth projection from Statistics Canada.

An important feature to note in the figures is the rapid increase in the number of people over 60 years old expected in the next 30 years. The right hand graph in Figure 1 demonstrates that the annual burden of illness as measured in prevalence-years grows significantly over the next thirty years, and is driven by the increase in the 60+ population (blue line). This aging population will place a much greater burden on the healthcare systems in Canada. Overall, the total population in Canada would increase from 35 million in 2013 to 45 million by 2043. The 30% increase is driven largely by immigration.

Figure 1 Historical and modelled population and total illness burden by age.



3.1.2 GP REFERRALS TO SPECIALIST CONSULATATIONS

Based upon the disease and demographic modelling, the annual number of specialist visits could increase significantly at a rate that is greater than the population growth rate. Figure 2 shows the growth in the number of GP referrals that would result in specialist consultations in the next 30 years, given that the current trends continue. Based upon the demographic and disease modelling, the analysis found that:

- Based on the low rate scenario, GP referrals could generate approximately 6.7 million specialist consultations in 2043;
- Based on the moderate rate scenario, GP referrals could generate approximately 8.6 million specialist consultations in 2043; and
- Based on the high rate scenario, GP referrals could generate approximately 12.9 million specialist consultations in 2043.

Figure 2 Number of GP referrals to specialist consultations for by assumption on referral rate

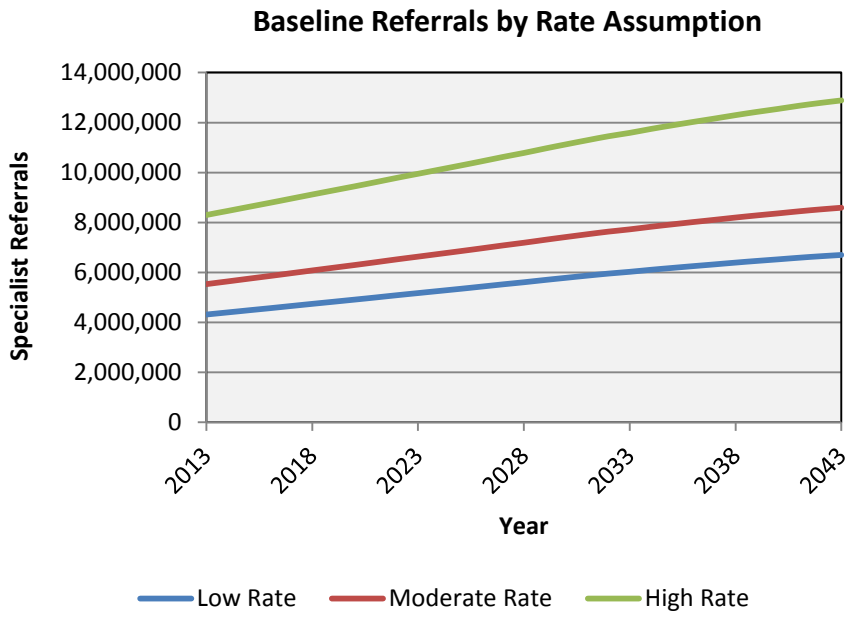
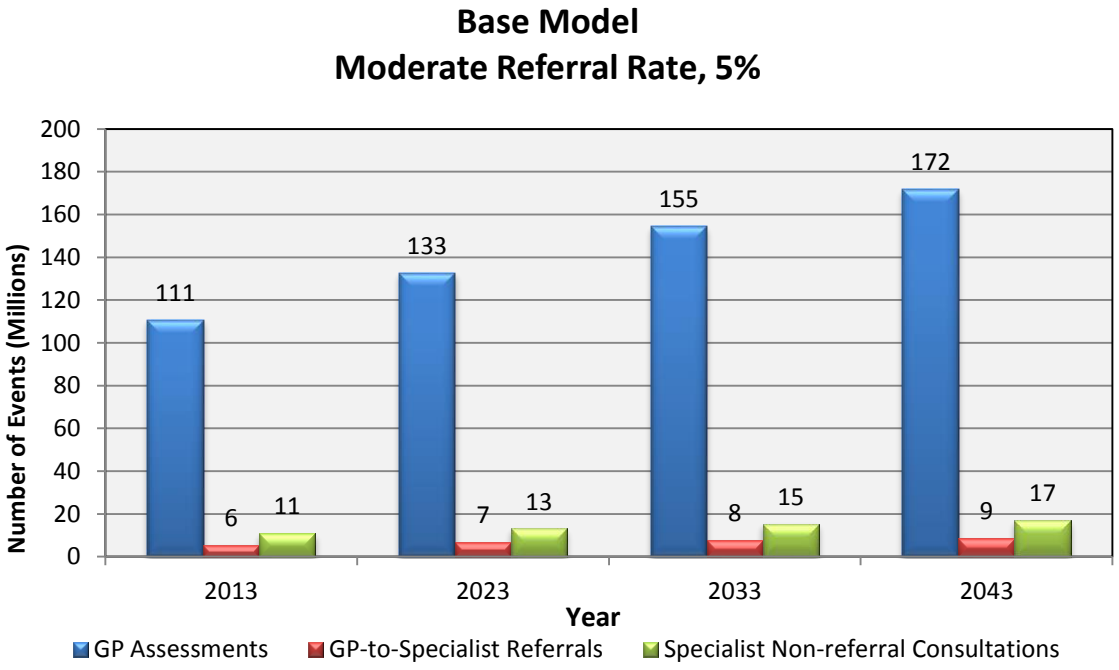


Figure 3 shows that based on the moderate referral rate scenario, the 5% of GP referrals that result in specialist consultations amounts to 34% of the total specialist consultations by 2043. The key factor driving the growth in GP referrals that result in specialist consultations at higher rates than the overall population growth rate is the aging of the population, and the associated increased risk of illness. It is important to note that only about one third of specialist consultations result from GP referrals; the remaining two thirds are non-referred specialist consultations (e.g. follow-ups, direct referrals from patients, etc.) This sets an upper limit on the effect of any referral-based intervention.

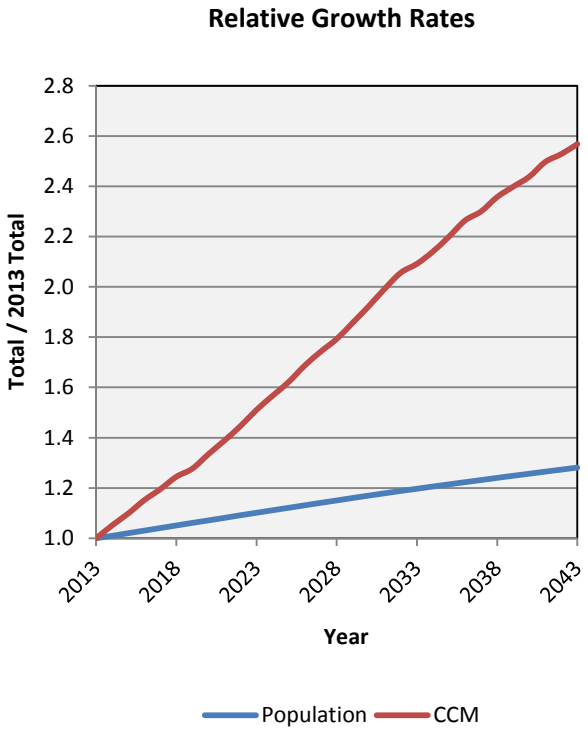
Figure 3 Number of GP and specialist visits from 2013 to 2043



3.1.3 HOSPITAL LENGTH OF STAY AND HOSPITAL DISCHARGE RATES

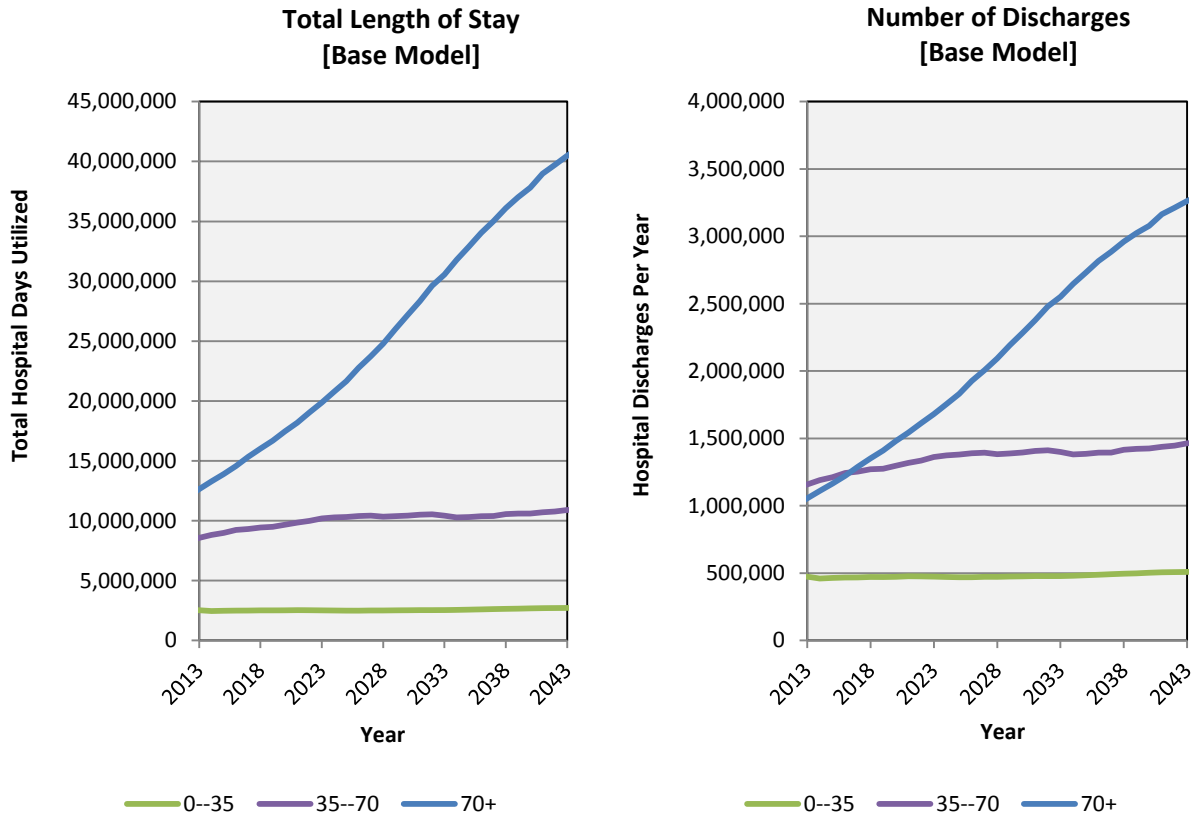
Based on the demographic and disease modelling, the number of Canadians with chronic comorbid (CCM) conditions is expected to increase from 1 million annually in 2013 to 2.6 million by 2043 (see Figure 4). This 160% increase in the number of people with chronic comorbid conditions is significantly greater than the 30% growth in the population over the same period. The key factor driving the high CCM population than the overall population growth is the aging of the population, and the associated increased risk of multiple chronic conditions. This growth will have an impact across the healthcare system, but the highest concentration of costs and growth in utilization will be at the acute end of the continuum.

Figure 4 Relative growth rates of the chronic comorbid population and the total population



As a result of the increase of the CCM population, we can expect to see a significant increase in health care resource use. Figure 5 shows that the total hospital length of stay could more than double from 24 million in 2013 to 54 million by 2043. As the CCM population is predominantly elderly, as shown in Figure 4, the number of hospital discharges almost doubles, from 2.7 million today to 5.2 million in 2043.

Figure 5 Total length of stay (left) and number of hospital discharges (right) by age



3.2 INTERVENTION RESULTS

The intervention results of the EXTRA intervention projects on reducing specialist consultations, hospital length of stay and hospital discharges, and the resulting reductions in costs if they were to be implemented across Canada are presented below. The assumption that the healthcare system in Canada was to fully implement the interventions and would do so immediately is a very strong assumption. Therefore, for the purpose of this analysis, the results are based on the assumption of a 5 year ramp-up period (referred to as the implementation period, from 2014-2019) under each scenario, at the end of which we also assume that only 50% intervention coverage is reached across Canada.

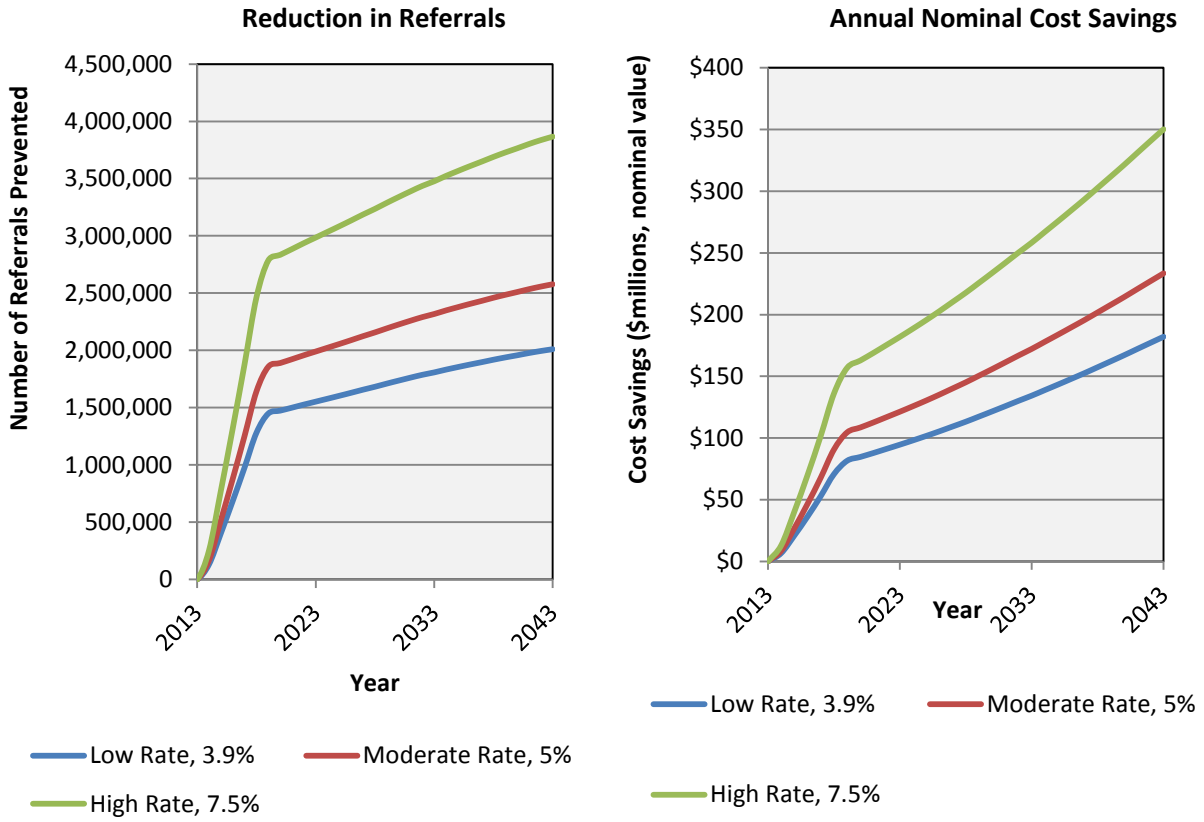
3.2.1 GP REFERRALS TO SPECIALISTS CONSULTATIONS AND COSTS

The impact of expanding the RACE project to Canada could reduce the average number of GP referrals that result in specialist consultation by roughly 2 million annually in the moderate-rate scenario. Figure

6 shows the annual reduction in number of GP referrals to specialist consultation and annual cost savings under each scenario. Specifically, implementing RACE could result in

- A reduction of approximately 2 million referrals in 2043 and an annual cost savings of $182 million dollars (nominal value) in 2043 in the low rate scenario,
- A reduction of approximately 2.6 million referrals in 2043 and an average annual cost savings of $233 million dollars (nominal value) in 2043in the moderate rate scenario, and
- A reduction of approximately 3.9 million referrals in 2043 and an annual cost savings of $350 million dollars (nominal value) in 2043 in the high rate scenario.

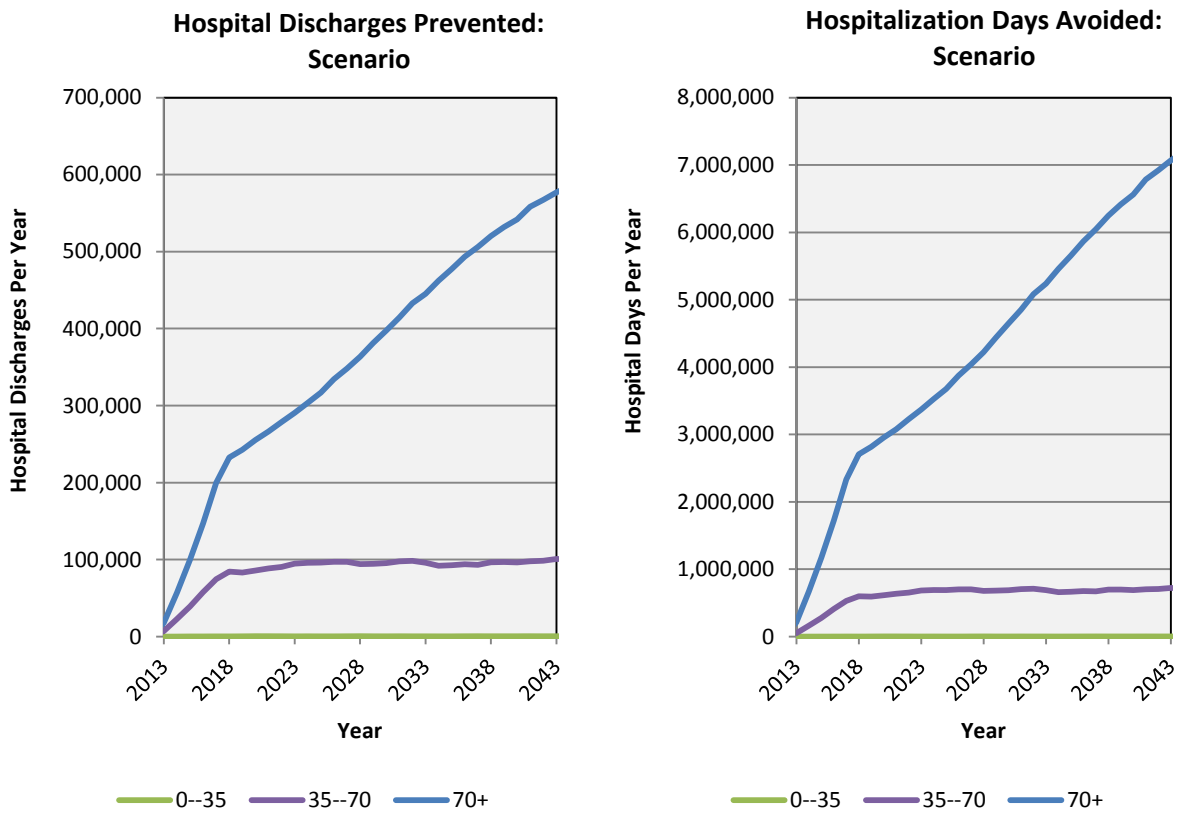
Figure 6 Reduction in the number of GP referrals to specialist consultations and resulting cost savings for each scenario



3.2.2 HOSPITAL LENGTH OF STAY, HOSPITAL DISCHARGES AND COSTS

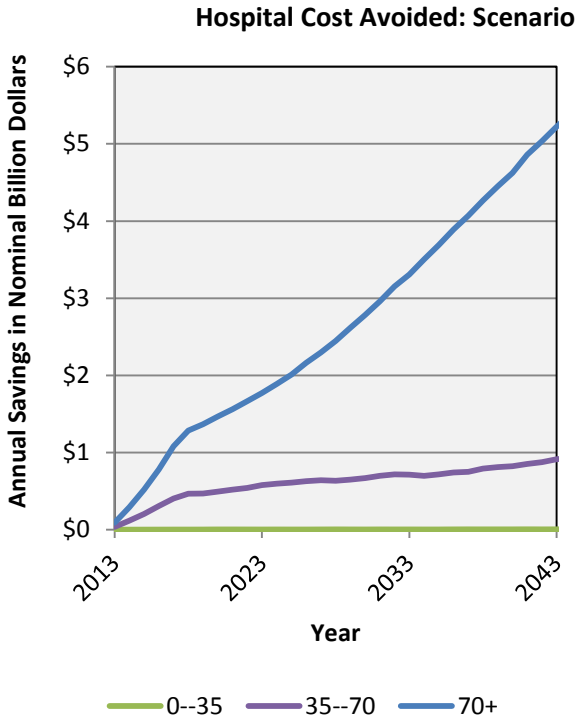
Based on the outcomes from the EXTRA intervention Project, the impacts on hospitalization length of stay and number of hospital discharges is shown in Figure 7. The annual number of discharges that could be prevented across all age groups could reach 680,000 by 2043. The annual number of hospital days avoided could reach almost 7.8 million days annually in 2043.

Figure 7 Number of Discharges prevented and Hospitalization days saved



The combined reduction in hospital length of stay and hospital discharges could have a significant impact on costs to the health care system. Figure 8 shows the annual costs that could be avoided in nominal values. Based on the assumptions of a net savings of $5,000 in 2013 by hospital discharges avoided and total hospital days avoided, the average annual savings could reach $1.8 billion dollars (present value) over the next 30 years.

Figure 8 Annual costs avoided due to reduction in hospitalizations

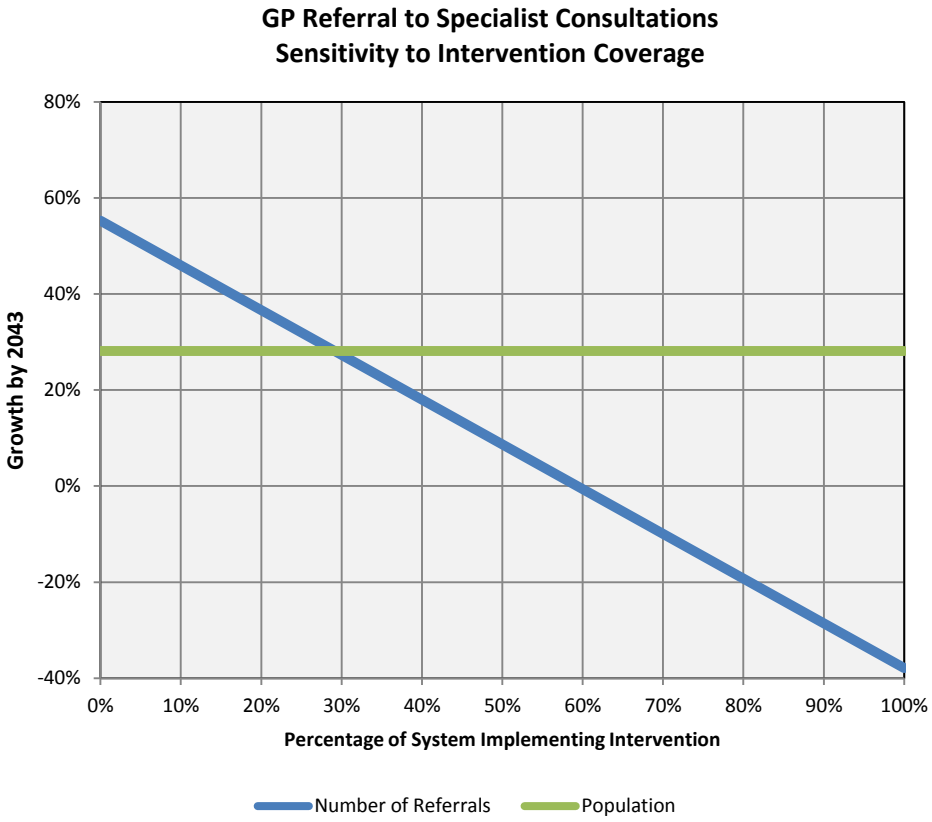


3.2.3 SENSITIVITY ANALYSIS

GP Referrals to Specialist Consultations

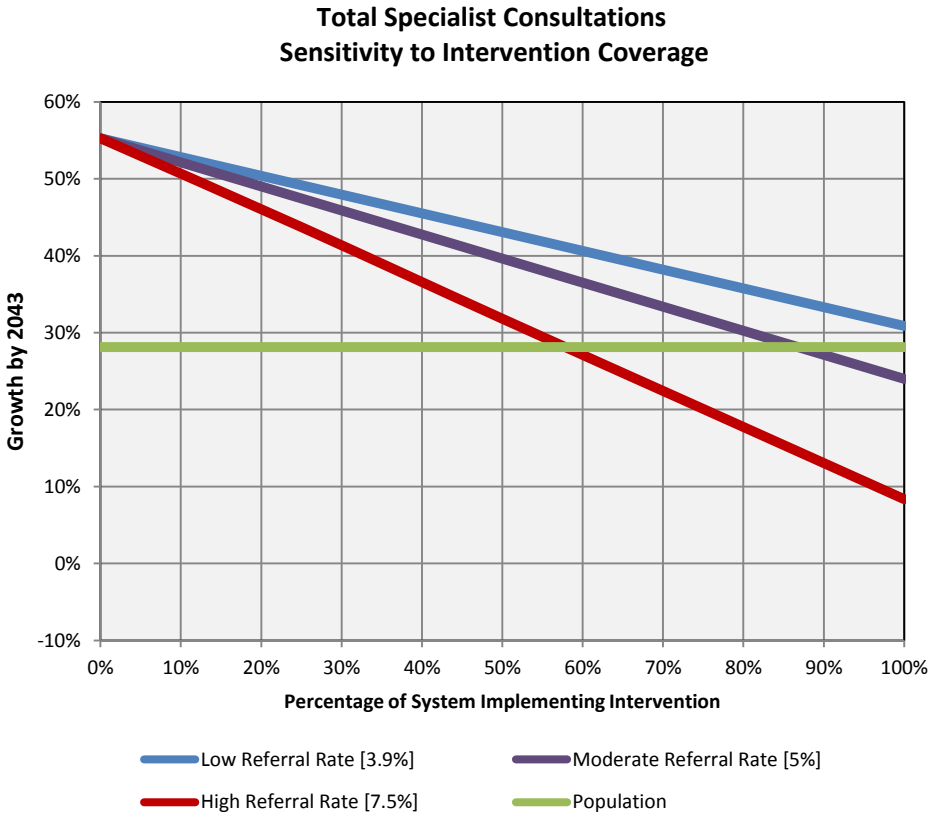
In order to understand the dependence of the impact of the RACE intervention (based on all three referral scenarios), a sensitivity analysis to the percentage of the system implementing the intervention was conducted. Figure 9 shows the total growth in specialist's consultations that result from GP referrals only as a function of the percent of the system implementing the combined intervention. To establish a point of reference, the growth in the population over the same period of time is also shown. In order to reduce the growth rate in total GP referred specialist consultations to the growth rate in the population, the RACE intervention must be implemented at least 30% successfully across all referrals. Therefore, in order to achieve a significant reduction in GP referrals that result in specialist consultations, the RACE intervention does not need to be implemented completely. Even if 30% of the healthcare systems were to implement the intervention, significant reductions could be achieved with the corresponding direct cost savings.

Figure 9 The sensitivity of the growth in GP Referral- Specialist Consultations to the fraction of the system implementing RACE when all assessments are considered



Additionally, to understand the dependence of the impact of the EXTRA intervention projects on specialist's consultations as a whole, a sensitivity analysis to the percentage of the system implementing each intervention was conducted. Figure 10 shows the total growth in specialist consultations, within each referral-rate assumption scenario, as a function of the percentage of the system implementing the intervention. To establish a point of reference, the growth in the population over the same period of time is also shown. In order to reduce the growth in specialist consultations to rates similar to the population growth, the RACE intervention must be implemented in at least 60% of the cases under the high referral assumptions and 90% in the moderate referral assumptions. Under the low referral rate scenario, specialist consultations as a whole would be growing at a much faster rate than the other two scenarios. No level of coverage would suffice to reduce the growth rate to the population growth rate. However, even partial coverage would result in significant cost savings.

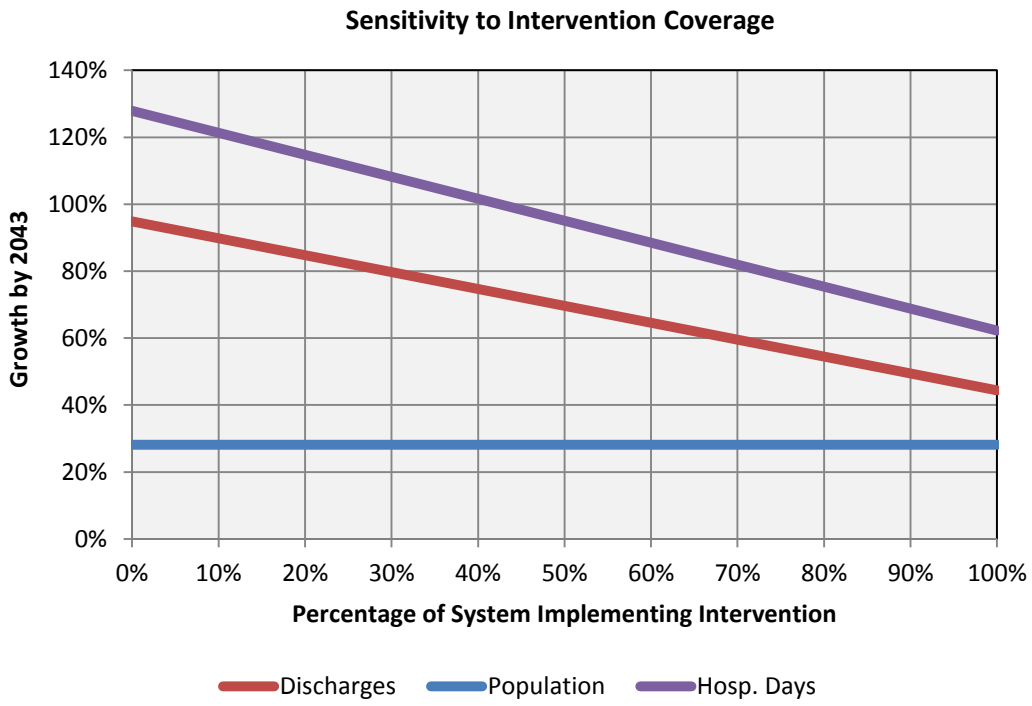
Figure 10 The sensitivity of the growth in number of specialists visits to the percent of the healthcare system implementing the combined intervention



Hospitalization Utilization

Similar to the previous section, in order to understand the dependence of the impact of the intervention project, a sensitivity analysis to the percent of the system implementing each intervention was conducted. Figure 11 shows the total growth in discharges and hospitalization days as a function of the percentage of the system implementing the intervention. The results show that no level of coverage would suffice to reduce the growth in hospital discharges or hospital days used to the growth of the population. The reason for this can be attributed to the growth of the CCM population which is the target of the EXTRA project. The CCM population is expected to increase from 3% to 6% of the total population by 2043 and a corresponding large increase in utilization is expected. However, it is important to note that even partial coverage of the system can substantially decrease the burden placed on the healthcare system as a result of the CCM population

Figure 11 The sensitivity of the growth in total discharges and hospital days to the fraction of the system implementing RACE



4 CONCLUSIONS

If the current trends continue, the number of specialist consultations, hospital length of stays and hospital discharges could increase much faster than the rate of population growth. Over the next 30 years (2013 to 2043), the annual number of specialist consultations as a result of GP referrals could increase from 5.5 million in 2013 to more than 8.6 million referrals in 2043 (in the moderate referral rate scenario). The number of individuals with multiple chronic conditions could increase by 160%, from 1 million to 2.6 million. This is an increase from 3% of the population in 2013 to 6% of the population in 2043, which is significantly greater than the overall population growth of 30% over the same period. The increase in this population could contribute to an increase in hospital length of stay by 125%, from 24 million days annually to 54 million days annually and a significant increase in hospital discharges by 92%, from 2.7 million in 2013 to 5.2 million in 2043.

Implementation of the EXTRA intervention projects across the country could provide a means to help reduce the growth of specialist consultations, hospital length of stays and hospital discharges, and the resulting costs. Implementing the RACE intervention in about 60% of the health care system in the high rate scenario, or in about 90% of the healthcare system in the moderate rate scenario would reduce the growth rate of specialist consultations to rates comparable to the population growth. No level of coverage would suffice to reduce hospital discharges or hospital days used to the growth rate of the population as a result of the expected increase in the CCM population and resulting increase in healthcare resource use. However, it is important to note that the burden placed on the hospital system can still be significantly alleviated with implementation of the EXTRA project.

An average of 2 million specialist consultations could be avoided annually based on the moderate referral scenario over the next 30 years. If each consultation avoided saved the health care system $50, the average annual savings over the next 30 years is $86 million dollars (present value) in the moderate referral rate scenario. Furthermore, the total number of hospital discharges prevented and hospital stay days avoided annually could reach 680,000 and 7.8 million, respectively, in 2043. If the combined reduction in hospital length of stay and hospital discharges saved the healthcare system a net of $5,000, the savings could reach an average of $1.8 billion dollars (present value) per year over the next 30 years.

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B OVERVIEW OF MODELLED EXTRA INTERVENTION PROJECTS

B.1 COLLABORATIVE MANAGEMENT OF PATIENTS WITH CHRONIC, COMPLEX, CO-MORBID CONDITIONS [1]

Objective

The challenges of chronic disease management are a problem that has plagued the Canadian health care systems for decades. Results from a self-reported survey conducted by CCHS showed that about nine million Canadians have at least one of seven chronic health conditions and the same survey showed that people with chronic health conditions use health care services more often and more intensely (Health Quality of Ontario report, 2012). As a result, chronic diseases are considered key drivers of health care utilization. The need for effective management of these conditions is necessary to minimize the costs to the healthcare system that arise as a result. It has been reported that patients with one or more chronic conditions uses approximately 55% of specialist consultations (Health Council of Canada, 2007). The same survey conducted by the health council of Canada in 2007 found that "One-third of adults with chronic conditions (33%) who visited an emergency department in the last 12 months report that their last visit was for a condition that could have been treated by their primary care provider if he/she had been available." Further studies have shown that a significant amount of these specialist consultations that take place in the ED are unnecessary and can take place in the primary care setting. However due to fragmentation of services between primary care and secondary care, these consultations usually require visits to the ED (Kvamme et al., 2001). This project sought to begin to address some of the problems that contribute to the challenges of chronic disease management such as lack of access to specialist in a timely manner that lead to ED visits that could have been avoided.

Intervention and Project Outcomes

The intervention project involved a shared care program through the initiation of a telephone advice line that allowed family physicians to consult specialists when the need arose. The telephone advice line, known as the RACE (Rapid Access to Consultative Expertise) advice line is a model of share care that

[1] Wilson, M., Barr, S. Collaborative Management of Patients with Chronic, Complex Co-morbid Conditions: Final Intervention Project Report. May 1st 2012.

allows family physicians to call one number, and choose from a selection of specialty services which allows them to be routed directly to the specialist's cell phone or pager for advice (Wilson et al., 2012). Initial results and feedback from participants indicated that there was increased knowledge transfer, enhanced care experience and a potential for control of per capita cost of health care through the reduction of unnecessary consults or emergency visits. The numbers showed that about approximately 78% of calls were answered within 10 minutes. In order to evaluate project outcomes, physicians were asked to fill in surveys and the results were as follows:

- 62% of 161 calls avoided a face-to-face consultation with a specialist; and
- 32% of 150 calls avoided a visit to the emergency department.

The potential for improvement of population health as access to care is enhanced was another outcome from this project, based on the results collected. Increased knowledge transfer was reported by family physicians as a result of the RACE initiative.

B.2 THE CHALLENGES OF CHRONIC CONDITIONS: INTEGRATED, INTENSIFIED CLINICAL MONITORING AND PROACTIVE FOLLOW-UP OF STRATIFIED ''CHRONICALLY ILL POPULATION'' [2]

It is known that "high-demand" patients, those vulnerable populations who suffer from complex co morbid chronic conditions, have been found to consume a disproportionate amount of health care services in Canada. A study done by CIHI found that seniors with three or more chronic conditions reported three times more health care resource use, including ED visits which amounted to 13.3 million visits per year at the time of the study (CIHI, 2011). An article by Hiver in 2008 reported that 3% of the Laurentides population uses 50% of hospital beds. The main objective of this project done at the CSS des Sommets (Laurentians, Quebec) was to identify 200 of those persons at risk of repetitive ED visits and hospitalizations, have a resolute, coordinated and proactive response to a patient case bringing together various clinical departments and community resources in order to maximize efficiency of services with the aims of

[2] Rapport final du projet d'intervention. FORCES-EXTRA. 2008. Les défis de la chronicité : le suivi clinique intégré et intensifié de clientèles cibles, France Laframboise, Inf., M.Sc., Mentor : Jean Mireault, Md, M.Sc.

- Improving the overall wellbeing of "high consumers";
- Increasing patient's autonomy in terms of managing their well-being;
- Promoting a relevant and timely use of health services;
- Improving disease symptoms by proactive clinical interventions;
- Preventing and reducing acute episodes of chronic conditions and further complication;
- Optimizing drug management; and
- Reducing emergency hospital visits by maximizing primary care in the community.

Intervention and Project Outcomes

The intervention project involved:

- Redefining the specific needs and preferences of these chronically ill patients;
- Reconfiguring the care and services that they are offered; and
- Intensely monitoring these vulnerable patients who require a complex combination of healthcare services.

The "Défi Santé" project was able to reduce the total bed occupancy by 10% in just nine months after implementation. In 2012, emergency visit rates, hospitalizations and interventions in CLSC rates dropped by 58%, 39% and 10% respectively. An increase in the overall well-being, moderate physical activities and social activities of enrolled patients was also reported. Currently, family physicians are taking an active interest in following these "high-demand" patients and are seeking to manage their conditions efficiently. Since then, many Quebec health organisations have been following their vulnerable chronically ill population with the results of 40-60% decrease in the numbers of emergency visits, 50-70% decrease in hospitalisation days and a sensitive increase (0-10%) in community professional services[3] with those stratified patients.

[3] CSSS Papineau, CSSS Pierre-de-Sorel, CSSS Alphonse-Desjardins, CSSS Nord de Lanaudière, etc.…2009-2013. See slide in appendix.

C DATA SOURCES AND ASSUMPTIONS

Table 1 Statistics Canada Data Sources

Quantity	Description	CANSIM Table
Population	The population of Canada by age and sex from 1971 to 2012.	051-0001
Births	The number of births in Canada by sex from 1971 to 2012	051-0013
Deaths	Number of deaths in Canada by age and sex	051-0002
Immigration	Immigration into Canada by age and sex	051-0012
Emigration	Emigration from Canada by age and sex	051-0012
Risk Factors	Risk Factors by age and sex from 2003-2011	105-0501
Retirement	Retirement by age, sex, class of worker	282-0051
Wages	Wages by age, sex, industry type	282-0072
Wages	Wages by age, sex	202-0407
Employment	Employment by age, sex, province	282-0002
Employment	Employment by age, sex, province, industry	282-0008

Table 2 Disease Data Sources

Property	Data Source	Diseases
Mortality	CANSIM Tables 102-01573, 103-1563, 103-1561, 103-1569, 102-0503, 102-0524 to 102-0526, 102-0529 to 102-0534, and 102-0540.	Cancers, Respiratory System Disorders, Cardiovascular System Disorders, Musculoskeletal System Disorders, Endocrine System Disorders, Mental Health Disorders, Digestive System Disorders, Genitourinary System Disorders, Nervous System Disorders, External Causes (motor vehicle accidents, unintentional falls, other)
Prevalence	Statistics Canada (CCHS) CANSIM Table 105-0503, PHAC Canadian Chronic Disease Surveillance System: Hypertension in Canada (2010), ICES Canadian Cardiovascular Disease Atlas (2006), PHAC using Statistics Canada (CCHS) 2009/10 data, PHAC Health Aging Survey (2008-2009), Statistics Canada (CCHS) PUMF CD (2010), CIHI, Rising Tide Report (Smetanin P *et al.,* 2008), The life and economic burden of arthritis in Canada (Smetanin P *et al.,* 2010), The life and economic impact of major mental illnesses in Canada (Smetanin P *et al.,* 2012), The life and economic impact of lung disease in Canada (Smetanin P *et al.,* 2011).	Respiratory system disorders, Cardiovascular System Disorders, Musculoskeletal System Disorders, Endocrine System Disorders, Mental Health Disorders, Digestive System Disorders, Genitourinary System Disorders, Nervous System Disorders
Incidence	Statistics Canada CANSIM Table 103-0550, The life and economic impact of lung disease in Canada (Smetanin P *et al.,* 2011), ICES Canadian Cardiovascular Disease Atlas (2006), PHAC Canadian Chronic Disease Surveillance System: Hypertension in Canada (2010), The life and economic burden of arthritis in Canada (Smetanin P *et al.,* 2010), The life and economic impact of major mental illnesses in Canada (Smetanin P *et al.,* 2012), Rising Tide Report (Smetanin P *et al.,* 2008).	Cancers, Respiratory System Disorders, Cardiovascular System Disorders, Musculoskeletal System Disorders, Endocrine System Disorders, Mental Health Disorders, Digestive System Disorders, Genitourinary System Disorders, Nervous System Disorders.

Table 3 Risk Factor Prevalence Data Sources

Property	Data Source	Risk Factor
Prevalence	CTUMs	Smoking status and history
	Statistics Canada (CCHS) CANSIM Table 102-0501	Second hand smoke exposure, obesity (body mass index), physical inactivity, alcohol consumption, fruit and vegetable consumption, stress, socioeconomic status

Table 4 Specialist and Hospitalization Utilization Data

Property	Description	Data Source
Hospital Length of Stay	Hospital Length of Stay in Ontario and Alberta by age and sex	Canadian Institute for health Information
Hospital Discharges	Hospital Discharges in Ontario and Alberta by age and sex	Canadian Institute for health Information
Specialists visits	Total Number of Assessments and Consultation by province	National Physician Database, Canadian Institute for Health Information
General Physicians visits	Total Number of Assessments and Consultations by province	National Physician Database, Canadian Institute for Health Information