Building on the Legacy of Vaccines in Canada: Value, Opportunities, and Challenges

Executive Summary
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Executive Summary: Building on the Legacy of Vaccines in Canada: Value, Opportunities, and Challenges Series
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<th>Description</th>
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<tbody>
<tr>
<td>ACIP</td>
<td>Advisory Committee on Immunization Practices (United States)</td>
</tr>
<tr>
<td>AEFI</td>
<td>adverse events following immunization</td>
</tr>
<tr>
<td>AIDS</td>
<td>acquired immunodeficiency syndrome</td>
</tr>
<tr>
<td>AIVP ATG</td>
<td>Automated Identification of Vaccine Products Advisory Task Group</td>
</tr>
<tr>
<td>BGD</td>
<td>Biologics and Genetic Therapies Directorate</td>
</tr>
<tr>
<td>CAEFISS</td>
<td>Canadian Adverse Events Following Immunization Surveillance System</td>
</tr>
<tr>
<td>CATMAT</td>
<td>Committee to Advise on Tropical Medicine and Travel</td>
</tr>
<tr>
<td>CDR</td>
<td>Common Drug Review</td>
</tr>
<tr>
<td>CIC</td>
<td>Canadian Immunization Committee</td>
</tr>
<tr>
<td>CIHI</td>
<td>Canadian Institute for Health Information</td>
</tr>
<tr>
<td>CIHR</td>
<td>Canadian Institutes of Health Research</td>
</tr>
<tr>
<td>CIRID</td>
<td>Centre for Immunization and Respiratory Infectious Diseases</td>
</tr>
<tr>
<td>CROs</td>
<td>Clinical Research Organizations</td>
</tr>
<tr>
<td>CTA</td>
<td>Clinical Trial Application</td>
</tr>
<tr>
<td>DNA/RNA</td>
<td>deoxyribonucleic/ribonucleic acid</td>
</tr>
<tr>
<td>DTC</td>
<td>direct-to-consumer</td>
</tr>
<tr>
<td>EMEA</td>
<td>European Medicines Agency</td>
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<tr>
<td>FDA</td>
<td>Food and Drug Administration</td>
</tr>
<tr>
<td>F/P/T</td>
<td>federal/provincial/territorial</td>
</tr>
<tr>
<td>GAVI</td>
<td>Global Alliance for Vaccines and Immunization</td>
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<tr>
<td>GCP</td>
<td>Good Clinical Practices</td>
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<tr>
<td>GMP</td>
<td>Good Manufacturing Practices</td>
</tr>
<tr>
<td>GS1 (Canada)</td>
<td>Canadian Healthcare User Group (HUG)</td>
</tr>
<tr>
<td>GTIN</td>
<td>Global Trade Item Number</td>
</tr>
<tr>
<td>H1N1</td>
<td>hemagglutinin sub-type 1, neuraminidase sub-type 1 (of the influenza A virus)</td>
</tr>
<tr>
<td>Hib</td>
<td><em>Haemophilus influenzae</em> type b</td>
</tr>
<tr>
<td>HPFB</td>
<td>Health Products and Food Branch</td>
</tr>
<tr>
<td>HPV</td>
<td>human papillomavirus</td>
</tr>
<tr>
<td>IAVI</td>
<td>International AIDS Vaccine Initiative</td>
</tr>
<tr>
<td>ICH</td>
<td>International Conference on Harmonisation</td>
</tr>
<tr>
<td>IMPACT</td>
<td>Immunization Monitoring Program ACTive</td>
</tr>
<tr>
<td>InteVac</td>
<td>International Vaccine Centre</td>
</tr>
<tr>
<td>IPV</td>
<td>inactivated polio vaccine</td>
</tr>
<tr>
<td>JODR</td>
<td>Joint Oncology Drug Review</td>
</tr>
<tr>
<td>MMR</td>
<td>measles, mumps, and rubella (vaccine)</td>
</tr>
<tr>
<td>NACI</td>
<td>National Advisory Committee on Immunization</td>
</tr>
<tr>
<td>NDRS</td>
<td>Notifiable Diseases Reporting System</td>
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<tr>
<td>NDS</td>
<td>New Drug Submission</td>
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<tr>
<td>NFC</td>
<td>no-fault compensation</td>
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<tr>
<td>NIS</td>
<td>National Immunization Strategy</td>
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<tr>
<td>NoC</td>
<td>Notice of Compliance</td>
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<tr>
<td>OPV</td>
<td>oral polio vaccine</td>
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<tr>
<td>pCODR</td>
<td>pan-Canadian Oncology Drug Review</td>
</tr>
<tr>
<td>PEWG</td>
<td>Professional Education Working Group</td>
</tr>
<tr>
<td>PHAC</td>
<td>Public Health Agency of Canada</td>
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<tr>
<td>PLF</td>
<td>Progressive Licensing Framework</td>
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<tr>
<td>PMPRB</td>
<td>Patented Medicine Prices Review Board</td>
</tr>
<tr>
<td>PREVENT</td>
<td>Pan- Provincial Vaccine Enterprise</td>
</tr>
<tr>
<td>P/T</td>
<td>provincial/territorial</td>
</tr>
<tr>
<td>PWGSC</td>
<td>Public Works and Government Services Canada</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>research and development</td>
</tr>
<tr>
<td>RSS</td>
<td>reduced space symbology</td>
</tr>
<tr>
<td>SEBs</td>
<td>subsequent entry biologics</td>
</tr>
<tr>
<td>SR&amp;ED</td>
<td>Scientific Research and Experimental Development</td>
</tr>
<tr>
<td>U.S.</td>
<td>United States</td>
</tr>
<tr>
<td>VFC</td>
<td>Vaccines For Children</td>
</tr>
<tr>
<td>VIC</td>
<td>Vaccine Industry Committee</td>
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<tr>
<td>VIDO</td>
<td>Vaccine and Infectious Disease Organization</td>
</tr>
<tr>
<td>VLP</td>
<td>virus-like particle</td>
</tr>
<tr>
<td>VPD</td>
<td>vaccine-preventable diseases</td>
</tr>
<tr>
<td>VSEWG</td>
<td>Vaccines Safety Expert Working Group</td>
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<tr>
<td>VSWG</td>
<td>Vaccine Supply Working Group</td>
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<td>WHO</td>
<td>World Health Organization</td>
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www.biotech.ca/vaccines
Executive Summary

Foreword

Fuelled by exciting new advances in immunology and molecular biology, technology innovation continues to drive the discovery of leading-edge vaccines that will help transform the future of public health worldwide. To showcase the tremendous medical, social, and economic value of vaccines within the Canadian context, this comprehensive (10-part) policy paper series provides a unique, first-of-its-kind analysis of the rapidly evolving Canadian vaccine landscape. The series opens with a background primer on vaccine technology, and subsequently traces the remarkable history of vaccine development in Canada, bringing the reader forward to the 21st century via a detailed synopsis of current marketplace dynamics within the burgeoning vaccine sector. Collectively, these papers present an in-depth discussion of the significant value, opportunities and challenges across the entire vaccine development chain in Canada – from early-stage and clinical research, through to vaccine licensure, establishing national recommendations, identifying sustainable funding mechanisms, and encouraging an enabling infrastructure for vaccine manufacturing, education, surveillance, and immunization program implementation. Building on the impressive legacy of vaccines in Canada, the final paper of the series examines potential future directions, clearly articulating the need for novel collaborative approaches in further optimizing immunization programs across the country.

To ensure that Canadians reap the full benefits of existing and emerging innovative vaccines – and to help create an efficient, favourable policy environment – these papers propose a series of recommendations for government officials and other key immunization stakeholders in enhancing vaccine program development and accelerating patient access to lifesaving, cost-effective vaccine technologies. In this context, the recent outbreak of influenza A H1N1 serves as a serious wake-up call regarding the pressing need for all governments and immunization partners to work together in designing modern, supportive public policies (conducive to meeting both industry and public health objectives), not only to sustain vaccine research and development in Canada, but also to secure the longer-term capacity, viability and responsiveness of the domestic vaccine supply.

Finally, in addressing a recognized gap in the vaccine literature, this policy series also represents a cohesive, broad-based educational resource for immunization stakeholders, primarily in Canada (and abroad), with the goal of fostering critical partnerships across vaccine researchers, manufacturers, investment/funding organizations, government agencies and national advisory bodies, public health officials, health professionals, public and private payers, and the general public. Ultimately, the purpose of this series is to promote awareness of the true value of current and next-generation vaccines in preventing and treating a wide range of human diseases, and hence to stimulate dialogue regarding the need for improved governance and funding models to facilitate the adoption of timely, equitable immunization programs for the benefit of all Canadians.
I – Introduction to Vaccines: The Canadian Perspective

Vaccination is generally considered as one of the greatest public health achievements in industrialized countries during the 20th century, reducing morbidity and mortality from a broad range of vaccine-preventable diseases. Globally, over 5.9 million deaths are prevented annually through vaccination against nine major infectious diseases, including varicella, diphtheria, tetanus, pertussis, *Haemophilus influenzae* type b (childhood), hepatitis B, measles, polio, and tuberculosis. In Canada, immunization has saved more lives over the last 50 years than any other health intervention. Indeed, the decline in incidence and death from infectious diseases as a result of vaccination is considered one of the nation’s great triumphs of medical research and public health programming. In general, the ability of vaccination to increase disease resistance in both individuals and larger communities (through the phenomenon of herd immunity) speaks to the tremendous medical, social, and economic value offered by vaccine technologies.

Vaccines can be categorized into various classes: two major classes include traditional preventive vaccines and emerging therapeutic vaccines. A preventive vaccine is defined as a substance that is introduced into the body to prevent infection or to control disease due to a certain pathogen, which is a disease-causing organism, such as a virus, bacteria or parasite (Figure 1.1). The vaccine “teaches” the body how to defend itself against the pathogen by creating an immune response. Preventive vaccines work to protect an individual from infection or disease by introducing a small component or a non-harmful form of the pathogen (called the foreign antigen) into the body. The body produces an immune response to the pathogen by generating antibodies (via the humoral response), killer cells (via the cell-mediated response), or both. A small group of memory B-cells and T-cells remain in the body and can quickly initiate a strong immune response, i.e. by producing antibodies, and helping the production of killer T-cells or antibodies, respectively. The next time the real pathogen is encountered, the immune system remembers it and mounts a much larger, quicker response than it would have if the individual had never received the vaccine. This is known as “immune memory”. In contrast to preventive vaccines – which provide prophylactic protection by preparing the immune system to respond in case of future exposure to a specific pathogen – therapeutic vaccines are intended to treat an existing disease. Hence therapeutic vaccines can be administered after infection or disease onset, with the (typical) goal of enhancing the body’s immunity against a specific biological target, thereby reducing the burden of disease and/or enhancing quality of life.

The fundamental approach to making vaccines is to isolate or create an organism (or component thereof) that is unable to cause full-blown disease, but that still retains the antigens responsible for inducing the host’s immune response. This can be pursued in several ways, including the development of killed, inactivated vaccines; live, attenuated vaccines; subunit, acellular vaccines; conjugate vaccines; and the newer deoxyribonucleic or ribonucleic acid (DNA/RNA) vaccines and recombinant vaccines. Apart from their classification by manufacturing methods – and categorization into preventive versus therapeutic vaccine classes – vaccines can also be classified according to target population (e.g. vaccines for infants and children, adolescents and adults, and international travelers); see [www.phac-aspc.gc.ca/im/is-vc-eng.php](http://www.phac-aspc.gc.ca/im/is-vc-eng.php).

With regard to the history of vaccine development, the first vaccine introduced in Canada was the smallpox vaccine in the late 1800s, based on the pioneering work of English physician Edward Jenner over two centuries ago. Toronto-based Connaught Laboratories (currently sanofi pasteur) has played a leadership role in the development of the smallpox vaccine since the early 1900s, and is credited with making a critical contribution to the eradication of smallpox, both in Canada in 1962, and on a global basis as declared by the World Health Organization (WHO) in 1979.
Figure 1.1 – How Vaccines Work Against Viruses

Initially developed by French chemist Louis Pasteur, the rabies vaccine was introduced as the next vaccine in Canada in the early 1900s. This was followed relatively quickly by the introduction of several other vaccines prior to the late 1930s, including those against diphtheria, pertussis (whole-cell), tuberculosis, tetanus, yellow fever and influenza. Beginning in the 1950s, Canada once again gained an international reputation as a world leader, this time in global polio eradication efforts and vaccine development. Notably, by 1954, Connaught Labs had cultivated poliovirus for the inactivated polio vaccine (IPV) in sufficient quantities to supply one of the largest clinical trials ever conducted in vaccination history to date, involving roughly 1.8 million children in Canada, the US and Finland. Overall, Connaught’s development, production and global distribution of both IPV and the subsequent oral polio vaccine (OPV) have made an unparalleled contribution to the virtual elimination of poliomyelitis worldwide.

Since the introduction of the polio vaccine in the 1950s, the pace of development has accelerated, adding new vaccines against *Haemophilus influenzae* type b (Hib), hepatitis A and B, influenza, acellular pertussis, pneumococcal and meningococcal infection, and varicella to well-established vaccines for polio, measles, mumps and rubella. Several vaccines have also been approved within the past decade in Canada; these new vaccines target additional strains of bacteria that cause meningococcal disease, a broader range of serotypes of pneumococcal disease, as well as rotavirus, zoster/shingles, and clinical disease caused by human papillomavirus (HPV). Globally, a broad range of vaccines targeting over 25 infectious diseases are currently available, and the number of vaccine-preventable diseases continues to grow. New vaccine formulations or combinations, as well as a wide range of preventive and therapeutic vaccines, continue to be developed within the rapidly evolving field of vaccinology. Hence there is no reason to believe that the future of vaccines will be any less impressive than their remarkable past – in terms of saving lives and preventing suffering from devastating disease.

In general, there is broad agreement that vaccination is one of the most significant public health interventions of the past century – and both the medical and economic value of immunization are very well documented. For example, with the exception of clean, safe drinking water, no treatment has rivaled immunization in reducing mortality rates worldwide. Along with enormous improvements in sanitation and hygiene, immunization is also credited with the significant increase in life expectancy observed in the past century. While immunization provides immense medical benefits (both at the individual and societal level), immunization programs have been widely acknowledged as among the best investments in health, based on extensive analyses of both cost-savings and cost-effectiveness. However, despite the proven benefits of immunization, vaccines continue to be (mistakenly) undervalued and underutilized throughout the world. In industrialized countries, such underutilization is caused in part by underestimating the seriousness of vaccine-preventable diseases, underestimating the benefits of vaccination, and concerns regarding the side effects of vaccines. Overall, the world still falls short of realizing the full benefits of immunization, especially in the poorest developing countries, and for children – who are the most vulnerable to disease. These observations demonstrate the urgent need to better educate the public (and all relevant stakeholders) regarding the true value of vaccination. In summary, greater strides must be made by all members of the global immunization community to recognize and promote the fact that immunization programs are among the most successful and cost-effective investments in protecting public health.

Given that immunization plays a central role in public health programming in Canada (as in other countries), renewed initiatives to advocate the full value of vaccines will be critical in optimizing efforts to support the “common good”. Within the Canadian vaccine landscape, BIOTECanada’s Vaccine Industry Committee (VIC) is the recognized industry association and official voice representing Canada’s major vaccine developers and suppliers. The VIC aims to increase awareness regarding the value of vaccines to the Canadian health care system, while encouraging a more efficient, favourable vaccine environment – supported by consistent and sustained funding of immunization programs in Canada. To advance this core mission, VIC members actively engage with federal, provincial and territorial (F/P/T) governments to foster full access to existing and new vaccines for all Canadians. Thus, in the spirit of collaboration, the VIC has put forward the following recommendations for consideration by F/P/T governments and other key stakeholders. Notably, as part of its broader mandate, the VIC also promotes high-quality vaccine research and excellence in the development, manufacturing and distribution of vaccines, as described in subsequent papers.
Executive Summary

Federal/Provincial/Territorial Recommendations

1. To create an environment that adequately values and supports vaccines, government officials and policy makers at all levels must recognize and promote the fact that investment in immunization programs represents excellent value for money spent, with tremendous medical, societal and economic impact in improving public health.

2. In efforts to strengthen public trust, public health officials in particular (at all F/P/T levels) must exhibit greater conviction in defending the pivotal role of prevention and immunization programs within the public health system.

Stakeholder Recommendations

3. To help establish the importance and value of vaccination, stakeholders at all levels (including F/P/T government representatives, public health officials, policy makers, medical professionals, vaccine manufacturers and the general public) must take greater responsibility in becoming more knowledgeable (and educating others) regarding the various types of vaccines, their proven health benefits to both individuals and society, as well as their significant cost-effectiveness.

4. With regard to the role of industry players, vaccine researchers/developers and manufacturers should support decision-making processes for evaluating and recommending vaccines – and respond to inquiries from medical professionals, the media, the public and/or parents – by providing strong, accurate, and reliable data regarding the full benefits of vaccines, including endorsement of their profound positive effect on the Canadian population and the public health system as a whole.
2 – The Current Canadian Vaccine Environment

Vaccines are used extensively around the world as one of the most useful and cost-effective tools for reducing morbidity and mortality associated with infectious diseases. Currently, the vaccine sector represents an increasingly attractive market worldwide, characterized by strong growth prospects and increased research and development (R&D) activity. Several recent corporate deals, including Pfizer’s acquisition of Wyeth, also testify to the renewed interest in vaccines by traditional “big pharma” players.

Valued at approximately $US 16.3 billion in 2007, the global vaccine market is projected to increase at an annual rate of roughly 13-14 percent over the next several years – more than twice as rapidly as for traditional pharmaceuticals – and is expected to exceed $US 30 billion by 2013. While precise estimates vary, the global vaccine market has traditionally accounted for only a small portion of the global pharmaceutical market, currently representing approximately 2% of the overall pharmaceutical business. In Canada, annual vaccine sales are estimated at roughly $Cdn 450 million. Recent data from the Canadian Institute for Health Information (CIHI) regarding Canada’s total health care spending helps put vaccine spending into appropriate perspective; in 2008, vaccine spending represented a small percentage (4.0%) of Canadian public health expenses, and an extremely small fraction (<0.3%) of national health care expenditures.

Although vaccine spending represents only a tiny segment of Canadian health care expenses, vaccination programs are widely acknowledged as among the best investments in health, providing immense medical and economic benefits. However, vaccines continue to be (mistakenly) undervalued and underutilized in Canada, as in many other industrialized countries. Hence substantial work lies ahead to ensure that vaccines are adequately recognized and promoted in terms of providing excellent value for money spent.

In most developed countries, including Canada, successful incorporation of a new vaccine into a national immunization program requires addressing a broad set of issues, encompassing the following initiatives:

- establishing medical need, and demonstrating safety and efficacy (or immunogenicity) in clinical trials;
- obtaining marketing authorization (regulatory approval) for commercial launch;
- development of national recommendations for optimal use;
- securing funding to support vaccine program delivery; and
- providing necessary infrastructure for vaccine program implementation, via:
  - ensuring adequate vaccine supply and distribution capacity;
  - assuring education of (and acceptance by) the public and medical community;
  - establishing an appropriate infrastructure for vaccine distribution and delivery; and
  - monitoring vaccine use, safety and effectiveness through post-market studies.

Hence the process for introducing new vaccines is complex, and entails a series of actions involving multiple participants (Figure 2.1). Key stakeholders in the Canadian vaccine enterprise include vaccine companies; the research community; investment and funding agencies; government agencies and regulatory authorities; national/provincial advisory bodies; public health officials; medical societies; health professionals; public and private payers; and the general public. These stakeholders operate within the infrastructure and policy environment created by several federal and provincial government bodies. At the broadest level, the two key federal agencies that regulate the vaccine industry include Health Canada as the federal regulatory authority (through its Biologics and Genetic Therapies Directorate, BGTD), and the Public Health Agency of Canada (PHAC), which acts as the lead body in overseeing immunization evaluation and recommendation processes.

In general, the vaccine marketplace has a number of unique characteristics that require carefully designed policy strategies, i.e. to ensure longer-term stability and viability of the overall system of product development, introduction and supply. Canada’s current vaccine system needs significant improvement to protect the tremendous value and potential public health impact of both current and emerging vaccine technologies. Hence the following recommendations are put forward by BIOTECanada’s VIC for consideration by F/P/T governments and other key stakeholders. While these general recommendations are intended to support broad policy objectives for improving the effectiveness of immunization systems across the entire vaccine development chain in Canada, specific recommendations that address individual components of Canada’s vaccine infrastructure are presented independently in other papers, as indicated.
Executive Summary

Figure 2.1 – Process for Introducing New Vaccines into a National Immunization Program

<table>
<thead>
<tr>
<th>Process</th>
<th>Key Players (Canada)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research (Discovery &amp; Clinical Trials)</td>
<td>Manufacturers, Researchers, CROs, Grant Agencies, Investors</td>
</tr>
<tr>
<td>Regulatory Approval (Licensing)</td>
<td>Health Canada’s BGTD</td>
</tr>
<tr>
<td>National/Provincial/Territorial Recommendations</td>
<td>PHAC/CIRID, NACI, CIC, PIT Immunization Committees</td>
</tr>
<tr>
<td>Funding for Vaccine Purchase &amp; Delivery</td>
<td>F/P/T Govts, PWGSC, VSWG, Private Payers, Industry Associations (VIC)</td>
</tr>
<tr>
<td>Vaccine Program Implementation &amp; Infrastructure</td>
<td>Manufacturers, BGTD</td>
</tr>
<tr>
<td>Commercial Scale Production</td>
<td>Manufacturers, Medical Professionals, Advocacy Groups, PEWG, Public Health Officials, The Public</td>
</tr>
<tr>
<td>Education/Acceptance</td>
<td>Manufacturers, Public Health Officials, Pharmacies, Vaccinators, Vaccinees</td>
</tr>
<tr>
<td>Vaccine Distribution/Delivery</td>
<td>Manufacturers, PHAC, BGTD, VSEWG, Public Health Officials, Vaccinators</td>
</tr>
<tr>
<td>Post-Market Surveillance</td>
<td></td>
</tr>
</tbody>
</table>

Source: Author’s synthesis, Nora Cutcliffe BioPharma Consulting, 2009

Legend:

- BGTD: Biologics and Genetic Therapies Directorate
- CIC: Canadian Immunization Committee
- CIRID: Centre for Immunization and Respiratory Infectious Diseases
- CROs: Clinical Research Organizations
- F/P/T Govts: Federal/Provincial/Territorial Governments
- NACI: National Advisory Committee on Immunization
- PEWG: Professional Education Working Group
- PHAC: Public Health Agency of Canada
- PWGSC: Public Works and Government Services Canada
- VIC: Vaccine Industry Committee
- VSEWG: Vaccines Safety Expert Working Group
- VSWG: Vaccine Supply Working Group

Note: Subsequent papers in this policy series describe, in sequence, the necessary steps for successful incorporation of a new vaccine into a national immunization program – from early-stage and clinical research, through to vaccine licensure, establishing predictable procedures for national recommendations, identifying sustainable funding mechanisms, and encouraging an enabling infrastructure for vaccine manufacturing, education, surveillance, and immunization program implementation.
Federal/Provincial/Territorial Recommendations

1. In formulating appropriate immunization policy, government officials and decision makers at all F/P/T levels must recognize the unique (and potentially fragile) nature of Canada's vaccine industry, thus promoting and safeguarding the Canadian vaccine system from a business perspective.

2. In creating policies that impact the Canadian immunization system, government officials must acknowledge and defend the true value of vaccines as an important and cost-effective public health measure, while ensuring that all relevant strategies reflect the full medical, social, and economic benefits of immunization (Paper 1).

3. Policy approaches to developing an efficient vaccine marketplace should encourage long-term investment in R&D in the vaccine sector (Papers 3 & 7). These initiatives should assist in: driving future innovation in the development of lifesaving (preventive) and therapeutic vaccines; encouraging manufacturers to remain within the vaccine market; and ensuring continued vaccine supply.

4. Policy strategies to enhance the operation of the vaccine market should include harmonization of regulatory practices and removal of procedural barriers to the rapid adoption of new immunization programs. These strategies should include the development of less duplicative and more consistent evaluation/recommendation procedures – as well as predictable, sustained funding mechanisms – to support timely patient access to existing and breakthrough vaccine technologies (Papers 4, 5 & 6).

5. Policy approaches designed to maintain and improve immunization coverage rates as the primary public health benefit should also ensure adequate resources are in place for effective vaccine program awareness/education and implementation, including appropriate infrastructure for vaccine distribution and delivery across the country. In addition, adequate resources should be deployed to effectively monitor vaccine use, including safety and efficacy, through enhanced surveillance programs (Papers 8 & 9).

Stakeholder Recommendations

6. To help ensure vaccines remain one of the most important and cost-effective public health measures in Canada, stakeholders at all levels should work in collaborative partnership, not only to improve the effectiveness of immunization programs, but also to communicate the value of the effective immunization program to all Canadians.

7. In the context of protecting and improving the current Canadian vaccine enterprise, all relevant stakeholders should continue to engage in the discussion of common critical issues in immunization practice on the international stage. Canadian stakeholders should continue to seek best practices models that match those of the top immunization programs worldwide, i.e. with the goal of achieving optimal clinical outcomes and economic value through greater standardization and predictability within Canada's immunization system.
3 – Research and Development: Fostering Vaccine Innovation in Canada

In recent years, vaccine research and development (R&D) has been quietly undergoing a renaissance, particularly as health care authorities increasingly acknowledge the benefits and cost-effectiveness of vaccination. Canada continues to make significant contributions to vaccine R&D; these accomplishments have saved lives, decreased human suffering, and reduced health care costs, thus protecting the well-being of individuals and societies in Canada and around the world. Globally, renewed or expanded research efforts have been fuelled by several factors, including the lack of vaccines currently available for several major infectious diseases (e.g., malaria, hepatitis C, and acquired immunodeficiency syndrome, AIDS); concerns regarding emerging infectious diseases as well as recurring threats of bioterrorism and pandemic influenza (such as the outbreak of influenza A H1N1 in 2009/2010); the need for viable alternatives to antibiotics to help fight infection; and the recent growth and “blockbuster” revenues observed in the global vaccine market. Collectively, these factors underscore the crucial need for vaccine R&D to remain a priority, both in Canada and worldwide.

While recent innovation in vaccine research has been widely acknowledged, the unique characteristics and challenges of the vaccine R&D environment are less well recognized. Specifically – unlike traditional pharmaceuticals – vaccines are complex biological medicines, thus developing a new vaccine can take (on average) 15-20 years, costing in the range of $US 500-800 million, and may require clinical testing in 15-20 times as many subjects as for traditional pharmaceutical drugs. Since vaccine development usually takes longer and requires more capital than for other medicines, supportive public health policies that recognize the true value of vaccination are needed to attract and sustain adequate investment in new vaccines.

A diverse range of factors and criteria guide the R&D process, although initial priority setting is focused primarily upon selection of vaccines that target pathogens or diseases of major public health importance. The vaccine R&D process itself represents a broad continuum of investigative efforts, from basic and discovery research (including testing in animal/preclinical models) through to Phase I/II/III clinical trials in humans. As detailed in Paper 4, if a candidate vaccine is deemed effective in Phase III clinical studies, then an application for licensure is submitted to regulatory bodies such as Health Canada’s BGTD. Following regulatory approval, post-licensure trials (e.g. Phase IV studies) are often performed to assess long-term vaccine safety and effectiveness, e.g. under “real world” conditions.

Recent advances in immunology, genetic engineering and molecular biology techniques are enabling the application of a diverse range of new strategies in vaccine development, which in turn have advanced the ability of researchers to create both preventive and emerging therapeutic vaccines, or target new diseases, not thought possible before. Therapeutic vaccines – which are intended to treat existing disease – are currently being evaluated to treat a wide range of human disorders, including certain chronic infectious diseases (AIDS, hepatitis C), as well as non-infectious diseases such as cancer; metabolic disorders (hypertension, diabetes); neurodegenerative diseases (stroke, Alzheimer’s); and autoimmune diseases (multiple sclerosis, rheumatoid arthritis). Other recent advances in vaccine technology include the development of new combination vaccines, which target a series of diseases or multiple strains of a pathogen. In addition, new adjuvants (which enhance the immune response and hence may reduce the need for booster shots), and novel vaccine delivery methods (i.e. via oral, intranasal, transdermal, or intradermal routes) – that may help to minimize the pain and logistical constraints associated with current needle-based delivery – are also being evaluated.
At present, the leading vaccine companies in Canada include GlaxoSmithKline Canada, Merck Canada Ltd., Novartis Canada, Pfizer Canada (formerly Wyeth Pharmaceuticals Canada), and sanofi pasteur. Collectively, these companies are engaged in a broad range of R&D activities in Canada – encompassing basic, clinical, epidemiological, and outcomes-based research – to help build the body of evidence supporting the complete vaccine R&D life cycle. These leading vaccine manufacturers are also involved in many international research initiatives, e.g. through partnerships with the WHO, the Global Alliance for Vaccines and Immunization (GAVI), and the Bill and Melinda Gates Foundation. Smaller, emerging companies presently engaged in early-stage vaccine R&D in Canada include Amorfix Life Sciences Ltd., Bioniche Life Sciences Inc., Generex Biotechnology, Immunovaccine Inc., Medicago, PlantForm Corporation, TheraCarb Inc., and Variation Biotechnologies Inc.. The Canadian vaccine research community also encompasses a broad array of players at academic, hospital, and government laboratories and research institutions.

An important new non-profit organization within the Canadian vaccine research landscape is the Pan-Provincial Vaccine Enterprise (PREVENT), established in February 2008. Based at the University of Saskatchewan, PREVENT is one of 11 new Centres of Excellence for Commercialization and Research established through the Networks of Centres of Excellence program. PREVENT will leverage existing vaccine expertise through partnerships with other key Canadian research organizations and facilities, including the Vaccine and Infectious Disease Organization (VIDO) and the International Vaccine Centre (InterVac), both at the University of Saskatchewan, as well as the Canadian Center for Vaccinology in Halifax, and the British Columbia Centre for Disease Control in Vancouver. The broad goal of PREVENT is to help bridge the gap between basic science and licensed vaccines – and to accelerate patient access to essential new vaccines within the Canadian marketplace.

The 2008 Canadian Institutes of Health Research (CIHR) report entitled “Vaccines for the 21st Century” confirms Canada’s strong track record in leading vaccine R&D efforts. Current strengths exist in basic research (including development of methods for antigen delivery and enhancing immune responses to vaccines), as well as in the areas of epidemiology, vaccines for special populations, and vaccine evaluation research. At present, over 25 infectious agents or disease targets are under investigation in Canada. Notwithstanding these strengths, the CIHR report has also identified specific vaccine-related challenges in Canada, as follows: i) research efforts need to be better coordinated; ii) vaccine R&D is costly; iii) vaccines for many diseases and new formulation/delivery methods are needed; iv) the public lacks accurate knowledge regarding the safety and efficacy of vaccines; v) there is a gap between basic research and Phase I/II clinical trials; and vi) there are many clinical research questions that require public funding.

Since vaccines are widely recognized as essential tools in maintaining public health, an adequately supported R&D environment will be critical in enabling development of novel vaccine technologies to protect the future health of all Canadians. At present, key players involved in funding vaccine R&D in Canada (as in other industrialized countries) include vaccine companies, universities, research institutes, government agencies and private/public investors – all of whom need incentives to continue to invest in high-risk, innovative technologies. In essence, the availability of R&D funding depends largely upon sales revenues, which are typically a function of the prevailing vaccine policy environment, including licensure, recommendation, and reimbursement mechanisms. Thus in order to fuel the vaccine innovation cycle, enhanced and sustained R&D investments, as well as supportive public policies, are urgently required. Moreover, since vaccine innovation contributes to the national economy by stimulating job creation, the vaccine sector should be actively supported and promoted by stakeholders across all levels of the research community, the business/investment community, and government.
In general, policy mechanisms that aim to promote investment in R&D by reducing the burden of research risks and costs (e.g. via grant funding or tax incentives) are referred to as “push” strategies. In contrast, “pull” strategies encourage R&D investment by helping to ensure adequate return on investment (e.g. by strengthening demand volumes or product pricing, or through favourable procurement policies), particularly in uncertain markets – i.e. for vaccines targeting diseases linked to poverty, bioterrorism or other emerging threats, in Canada or abroad. Overall, enhanced “push” and “pull” policies are required to encourage greater investment in R&D in the vaccine sector. Finally, to foster continued stability and future innovation in vaccine research, long-term partnerships among industry players, government agencies, public health authorities, and policy makers will also be crucial. Such collaboration should span across academic, public and private sector researchers, and should ideally involve philanthropic organizations. The collective efforts of all relevant stakeholders will be required to enable new vaccines to become fully developed and accessible to the populations in need as efficiently as possible, thus ensuring that vaccination remains one of the world’s most important and cost-effective public health measures.

In the spirit of such collaboration, and to help maintain the recent momentum in vaccine R&D, the following recommendations are put forward by the ViC for consideration by F/P/T governments and other key stakeholders.

Federal/Provincial/Territorial Recommendations

1. In view of the unique (complex, lengthy, risky and costly) nature of the vaccine R&D environment, F/P/T government policy approaches to developing an efficient vaccine marketplace should aim to encourage long-term investment in R&D in the vaccine sector.

2. Government officials at all F/P/T levels need to establish and promote policies that will expand incentives for vaccine research by removing barriers for developers/manufacturers to risk investment capital to discover vaccines needed in Canada and worldwide.

3. Both “push” and “pull” investment incentives should be further developed to more aggressively encourage future investment in vaccine R&D, i.e. by effectively decreasing research costs and increasing vaccine demand, respectively.
   - Current “push” strategies, including grant funding and tax incentive programs (e.g. Canada’s Scientific Research and Experimental Development, SR&ED, program), should be expanded or enhanced to attract additional funding for vaccine research in Canada.
   - “Pull” strategies should also be advanced to promote investment in vaccine R&D (via strategic procurement policies, guaranteed-purchase agreements and/or stockpiling) to help offset market uncertainty, e.g. for vaccines targeting diseases of poverty, bioterrorism or other emerging threats.

Stakeholder Recommendations

4. To maintain and build upon the recently renewed interest in vaccine R&D, it is essential that stakeholders at all levels, including researchers, government agencies, public health authorities, industry representatives, and investors seek to align common interests in fostering long-term innovation in the vaccine sector.

5. To maximize the health benefits of novel vaccines for all Canadians – and to successfully develop new vaccines that target diseases endemic in the developing world (e.g. malaria, tuberculosis, AIDS) – it will be critical to cultivate long-term collaborative research-oriented agreements among relevant stakeholders, both within Canada and on the international stage.

6. To better coordinate vaccine research efforts in Canada, the CIHR and its partners should organize and facilitate vaccine research workshops and facilitate communication among vaccine researchers, foster linkages among all stakeholders, and establish a vaccine research network.

7. Partnerships across Canadian stakeholder groups (e.g. including funding organizations, industry, academic institutions, and governments) – established primarily to drive vaccine R&D – should also be leveraged to promote potential new sources of funding, while encouraging academic and corporate scientists to focus their research activities.

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8. To help bridge the gap between basic science and Phase I/II clinical trials (e.g. to gain insight regarding preclinical vaccine development), academic researchers should partner with industry, potentially through an industry-funded strategic initiative under the direction of the CIHR.

9. In the specific context of clinical research, Canadian researchers must strive to remain internationally competitive to continue to attract industry sponsored pre-licensure vaccine clinical trials to Canada.
   • Clinical trialists should consistently provide excellent value in executing clinical studies.
   • Canadian vaccine clinical study sites should meet the research standards of all major regulatory agencies, e.g. Health Canada, the U.S. Food and Drug Administration (FDA) and the European Medicines Agency (EMEA).
4 – Pathway to Access: Health Canada Oversight

The first key milestone for introducing emerging vaccines into a national immunization program is vaccine licensure (regulatory approval). Thus, overlaid upon the complicated process of developing new vaccine technologies (summarized in Paper 3), stringent regulatory requirements govern procedures for vaccine clinical research, production, and market launch, as described in this paper. At present, the Canadian regulatory environment for new drugs (including complex biologics such as vaccines) is rapidly evolving, particularly as recent advances in medicine and technology underscore the need for a modern regulatory system that can assess novel products in a timely manner – while maximizing patient safety.

Vaccines are highly complex, large-molecule compounds based on living organisms with inherent variability, and hence are more difficult to characterize than traditional pharmaceuticals and other less complex biologics – including therapeutic proteins such as insulin or erythropoietin. Vaccines are also unique in that they are typically administered to large populations of otherwise healthy individuals (including infants and children) to protect against potential future disease. Thus the risk-benefit ratio for vaccines rightly emphasizes the importance of patient safety, and as such, vaccines are held to exacting quality and safety standards, with lower tolerance for adverse events in today’s risk-averse society. The resulting strict regulatory oversight of vaccines impacts every step in the production cycle, from initial testing of cell lines to the testing and subsequent surveillance of the final product. As part of this tight regulatory control, increasingly stringent compliance standards have led to higher development costs, as well as greater capital requirements for production facilities – while also lengthening the time-to-market for new vaccine technologies (which may take 15-20 years from initial discovery through to licensure).

The Biologics and Genetic Therapies Directorate (BGTD) is the federal program within Health Canada’s Health Products and Food Branch (HPFB) that is responsible for ensuring the safety, efficacy and quality of all biologics, including vaccines for human use. Thus all vaccines authorized for sale in Canada must be reviewed and approved by the BGTD, including careful oversight of preclinical and clinical research programs conducted by vaccine manufacturers. All vaccines produced for human trials in Canada must be manufactured according to internationally recognized Good Manufacturing Practices (GMP). Vaccine developers (sponsors) are required to file a Clinical Trial Application (CTA) for approval by the BGTD prior to initiating clinical trials in Phase I, II and III. In addition, sponsors must conduct all clinical trials – including certain post-licensure trials (e.g. Phase IV studies) that assess long-term vaccine safety and effectiveness – in accordance with the principles of Good Clinical Practices (GCP).

When a manufacturer has generated sufficient scientific and clinical evidence regarding the safety, immunogenicity, efficacy, and quality of a vaccine candidate, an application for licensure known as a New Drug Submission (NDS) is filed with the BGTD. If, after reviewing the NDS, conducting on-site evaluation(s), and completing independent sample testing of at least three lots of vaccine, the BGTD concludes that the benefits of the product outweigh its risks (and any risks can be managed), then the vaccine will be approved for sale in Canada. Within the past few years, reductions in the number of submissions in backlog have been observed, and the BGTD has been successful in meeting its target review time of 300 days for most biologics (including vaccines) and 180 days for those products that meet the criteria for priority review status.

Following regulatory approval, Health Canada continues to monitor the safety and effectiveness of vaccines on an ongoing basis, e.g. through stringent post-market surveillance and lot release programs. Other key elements of the post-licensure regulation of vaccines include Health Canada oversight of post-market changes, as well as inspection and enforcement activities. Overall, with this level of pre- and post-licensure regulation, vaccines used in Canada are highly effective and safe, and have demonstrated excellent value in terms of protecting public health and contributing to the greater “public good”.

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As many new drugs (including vaccines) are expected to be submitted for review by Health Canada within the next few years, it is essential that Canada’s regulatory review process undergoes appropriate modernization to reflect evolving science, values and practices across the country’s dynamic health care landscape. With the publishing of its Blueprint for Regulatory Renewal in October 2006, and the subsequent tabling of Bill C-51 in April 2008 as the legal groundwork for regulatory modernization within this context, Health Canada has recently taken on the challenge of modernizing Canada’s regulatory system for health products for the first time in 40 years.

As one major initiative under the recently proposed Blueprint, Health Canada is modernizing the regulatory process for drugs through a project called the Progressive Licensing Framework (PLF) – currently referred to under the auspices of “Legislative and Regulatory Modernization” – which is intended to provide a mechanism for the continuous monitoring and reassessment of a drug’s safety, quality and effectiveness throughout its life cycle. However, following the Second Reading and debate of Bill C-51 in June 2008, the proposed legislation officially expired when Parliament was dissolved for a federal election in the Fall of 2008. Thus, as of April 2010, many issues remain unresolved, and the industry awaits further clarification regarding specific procedures and practices (e.g. for individual drugs or product classes) to be introduced under the PLF. The government has communicated to Canadians that it remains committed to moving forward with modernizing the legislation, and Health Canada will continue to consult with stakeholders to obtain input and feedback on the key elements of modern regulatory frameworks.

As another element of recent modernization efforts, Health Canada has undertaken an independent evaluation process to specifically review the current regulatory framework for vaccines, beginning in 2006. The initial phase of this project revealed several weaknesses, including the current “patchwork” of outdated product-specific and general regulations, and the lack of vaccine-specific guidance documents – particularly in light of modern vaccine technology and manufacturing processes. In addition, there was strong consensus regarding the need for harmonization of regulatory policies that govern vaccine use with international standards and best practices, i.e. to help reduce overall vaccine development costs, to minimize delays in regulatory approvals, and to stimulate investment in future research. However, to underscore the inefficiencies in achieving these important goals, it should be noted that, as of April 2010 – approximately four years after formal evaluation efforts were initially undertaken by Health Canada – relevant stakeholders are still awaiting further communication from the federal regulatory authority regarding recent progress and the current status of the modernization project for vaccine regulation in Canada.

Yet another key challenge on the regulatory horizon will be to determine how the emerging class of therapeutic vaccines (which are being developed to treat existing disease, rather than provide prophylactic protection) will be regulated by Health Canada. Based on current international models, it appears likely that therapeutic vaccines will be regulated as other biologics by the BGTD. In particular, the recent FDA approval (in April 2010) of Provenge, the first therapeutic cancer vaccine to enter the U.S. market (as developed by U.S.-based Dendreon Corp. to treat prostate cancer), has heightened the sense of urgency surrounding the need to develop clear regulatory and governance policies for therapeutic vaccines in Canada. As a preliminary step, agreement on definitions and potential sub-classes of therapeutic vaccines will be imminently required – especially given the fast pace of technology advancement.

Overall, significant work lies ahead in terms of modernizing Canada’s regulatory regime for pharmaceuticals and biologics, including vaccines. Close coordination across many individual processes – including advancement of the life cycle approach to regulation of health products, updating the vaccine regulatory framework, and continued development of guidelines and/or regulations pertaining to emerging therapeutic vaccines and subsequent entry biologics (SEBs) – will be critical in the context of Canada’s broader modernization mandate. As proposed amendments are further debated and finalized, it is critical that decision makers recognize the unique, complex characteristics of vaccines, and maintain open dialogue in working towards regulatory policies that ultimately support timely patient access and efficient immunization program implementation. To this end, the VIC has put forward the following recommendations for consideration by F/P/T governments and other key stakeholders.
Federal/Provincial/Territorial Recommendations

1. To maximize the medical, social, and economic benefits of vaccines for all Canadians, regulatory policies should, at all levels, aim to remove any procedural barriers to the rapid adoption of new immunization programs in Canada, including the development of less duplicative (national) regulatory licensure and (F/P/T) evaluation/recommendation procedures (see Paper 5).

2. In finalizing and implementing its proposed PLF as a key element of a modernized regulatory regime for pharmaceuticals and biologics, Health Canada should provide well-defined guidelines that address a life cycle approach that is relevant to the individual drug (or vaccine) and its specific benefit-risk profile – rather than to mandate a single, rigid life cycle approach across all products.

3. With regard to modernizing the regulatory framework for vaccines, Health Canada should develop forward-looking regulations and vaccine-specific guidance documents that reflect the rapid advancement in vaccine technology, clinical research and manufacturing processes, e.g. including: i) the development of combination, therapeutic and/or cancer vaccines; ii) future use of biomarkers as surrogate endpoints for vaccine efficacy; and iii) modern process validation and lot testing methods.

4. With respect to emerging therapeutic vaccines, Health Canada should provide early opportunities for collaborative, transparent discussions with vaccine manufacturers regarding appropriate definitions and mechanisms to guide their regulation, ideally in close alignment with international standards.

5. In general, Health Canada’s regulatory policies that govern vaccine use should be harmonized with regulatory standards of the International Conference on Harmonisation (ICH), and aligned where possible with best practices of leading regulatory agencies worldwide (e.g. in the United States and European Union).

Stakeholder Recommendations

6. Stakeholders at all levels, including F/P/T government officials, regulatory and public health authorities, vaccine manufacturers, academic researchers, health care professionals, and the general public should actively engage in transparent dialogue, thus supporting vaccine manufacturers in meeting the strict (and rapidly evolving) regulatory requirements of Health Canada, while also satisfying increasing patient demands in terms of understanding vaccine safety and effectiveness.
5 – Pathway to Access: Improving the Evaluation and Recommendation Process

In most developed countries, including Canada, the introduction of a new vaccine as part of a national immunization program is a complex process that goes far beyond regulatory approval, as summarized in Paper 4. National advisory committees are typically involved to provide official recommendations based on systematic evaluation of clinical trial data, disease characteristics, and other supporting information regarding the new vaccine. These official recommendations can have a dramatic impact on vaccine demand, i.e. by directly encouraging health care and insurance providers (as well as consumers) to utilize a particular vaccine product, and/or by influencing immunization policy. Hence the development of national recommendations is considered crucial to the overall acceptance and use of new vaccines; such recommendations also play a vital role in realizing the full value of innovation in vaccine technology.

In Canada, current evaluation and recommendation procedures that ultimately support the adoption of public vaccine programs have significant drawbacks; these mechanisms can still be characterized as lacking in harmonization and transparency, resulting in unacceptable duplication, inequities and delays. Unfortunately, such inconsistencies and delays can mean that Canadians suffer and or die needlessly due to vaccine-preventable diseases. Canada needs an efficient, predictable process for evaluating and recommending vaccines – including participation at all F/P/T levels – for both existing and new public immunization programs. This paper examines the current Canadian landscape for vaccine evaluation and recommendation, including potential solutions for future direction, and thus lays the groundwork for exploring funding issues (see Paper 6) as the next step along the continuum of implementing successful vaccination programs.

Within Canada’s current national immunization system, once a vaccine has been approved by the BGTD, it is then subject to the scrutiny of National Advisory Committee on Immunization (NACI). Initially established in 1964, NACI is the national expert body that provides scientific recommendations for vaccine use in Canada – using evidence-based methods to assess whether the vaccine should be used, and to target groups that will most benefit from inoculation. Unlike NACI, the Canadian Immunization Committee (CIC) is a much newer committee comprised of vaccine program representatives from the federal, provincial and territorial ministries of health; its first meetings were held in 2003. While the fundamental objective in creating the CIC was to implement and meet the goals of the National Immunization Strategy (NIS, described below), the CIC was also established to develop national goals and targets for immunization programs, and for making continued, collaborative progress in promoting the harmonization of immunization schedules across Canada.

Although vaccine recommendations are made at the national level, decisions regarding the integration of new vaccines into publicly-funded immunization programs are primarily a provincial/territorial responsibility, based on the priorities and deliberations of P/T advisory committees. Ultimately, since each jurisdiction defines the list of publicly-funded vaccines and immunization schedules, Canada is presently characterized as having a fractured immunization program, often termed a “patchwork quilt”. Discrepancies exist not only in the numbers of age-related cohorts covered, but also in terms of the timing of announcements for program implementation. Overall, the multi-step process currently required for vaccine program implementation in Canada introduces undesirable disparities and delays in patient access to innovative vaccine technologies. Moreover, concerns have been expressed regarding potential overlap across the BGTD, NACI, and CIC mandates, including potential misallocation of scarce resources.
In an effort to end the inconsistencies and gaps observed in vaccine coverage across the country, the NIS was introduced in 2003 by the federal government. Initially, in February 2003, the federal government allocated $Cdn 45 million over five years to assist with NIS development (including preliminary infrastructure and resources), with the key objectives of improving access to recommended vaccines and reducing the incidence of vaccine-preventable diseases. Subsequently, the 2004 federal budget promised a further $Cdn 300 million over the three year period from 2004-2007 under the NIS – through the Canadian Immunization Trust Fund – to support the introduction of four newly recommended vaccines (acellular pertussis, meningococcal C conjugate, pneumococcal conjugate and varicella) across all provinces and territories. Under NIS funding, virtually all jurisdictions successfully introduced these four vaccines by 2006. Although the NIS has moved closer to its goals of ensuring equitable access (particularly to childhood and adolescent vaccines), improving immunization rates, and thus reducing vaccine-preventable diseases, there remain many challenges for the federal government ahead, especially in terms of demonstrating its leadership in harmonizing immunization policy, and providing a model for F/P/T cooperation towards improved health.

Ultimately, the long-term success of the NIS will depend on multiple factors, including jurisdictional perspectives on NACI recommendations (and alignment with CIC recommendations) and the relevance and effectiveness of the CIC itself. The latter has been assessed as part of initial (internal) NIS evaluation by the PHAC, which has acted – since its inception in 2004 – as the lead body in overseeing immunization evaluation and recommendation processes in Canada. Notably, from a programmatic standpoint, the CIC created the first (pilot) joint NACI/CIC working group in early 2006 to develop comprehensive operational plans specifically for HPV vaccine programs in Canada. However, recommendations of this joint NACI/CIC working group were not publicly issued until mid-2008, a full two years after Health Canada approval of the HPV vaccine, and more than a full year after NACI recommendations had been released in February 2007. Subsequently, in January 2010, the CIC issued recommendations “in concurrence with NACI” for a second vaccine – quadrivalent (A, C, Y, W-135) meningococcal conjugate vaccine – more than three and a half years following vaccine licensure in May 2006, and more than two and a half years after the initial NACI statement in May 2007. Unfortunately, the CIC review and recommendation process thus appears to have introduced further uncertainty and delays in vaccine program development in Canada. In addition, it still remains unclear whether joint CIC-NACI working groups will continue to be established for other newly recommended (or future) vaccines, subsequent to NACI review.

For each vaccine approved in Canada since 1998, it has taken from 6-30 months to complete the NACI review/recommendation process to date, and it can take much longer (up to six years) for the adoption of a new vaccine into a publicly-funded, nationally accepted immunization program. Clearly, this is too long to wait for publicly-funded immunization programs that can prevent patient morbidity and mortality, even if the vaccine is licensed and available through the private system. Overall, from both a disease prevention and health economics perspective, there is great motivation to accelerate the NACI review process in attempt to compress the timelines required for patient access to innovative vaccine technologies.

In working towards this goal, the VIC holds the view that NACI should continue to work with manufacturers to formally define points of engagement for two-way dialogue and information sharing both pre- and post-licensure, i.e. to improve both the timeliness and appropriateness of NACI statements. Other avenues for enhanced NACI/industry collaborations could also include joint development of an appeal mechanism for NACI recommendations and/or full disclosure methods for NACI member affiliations (including potential conflicts of interest) – to ensure greater transparency, accountability and credibility of the scientific-based NACI review process.

At present, substantial work is urgently required to develop and implement optimal mechanism(s) for efficient review and recommendation of approved vaccines in Canada. To this end, and in the spirit of collaboration, the VIC has put forward the following recommendations for consideration by F/P/T governments and other key stakeholders.
Federal Recommendations

1. To facilitate the timeliness of vaccine adoption and patient access to new immunization programs, NACI should issue recommendations on the use of new vaccines within 90 days of Health Canada approval. This will require enhanced NACI/industry collaboration, including ongoing dialogue, and formal definition of points of engagement (e.g. during clinical development, pre-licensing and pre-NACI release) for data presentation/submission to NACI as recommendations are being developed.

2. To minimize duplicative, bureaucratic efforts in evaluating and recommending new vaccines, the federal government should aim for increased efficiencies (and minimal redundancy across BGTD/NACI/CIC mandates), including the provision of adequate financial and human resources. Canadian immunization authorities (including NACI/CIC officials) should also endeavour to leverage the substantial financial/human resources currently in place in other developed countries, e.g. through more frequent, formal collaboration with the U.S. Advisory Committee on Immunization Practices (ACIP) and/or other national vaccine advisory bodies.

Provincial/Territorial Recommendations

3. To minimize disparities and gaps in Canada's immunization programs, the provinces and territories should aim to work towards a national immunization schedule that is followed across the country.

Stakeholder Recommendations

4. To discuss common critical issues in immunization, a meeting of all relevant stakeholders (including F/P/T government and public health officials, regulators, policy makers, medical professionals, vaccine manufacturers/developers and researchers, investors, payers, and the general public) should be convened on a regular basis – potentially by the PHAC, in conjunction with the VIC. Urgent matters that require transparent dialogue encompass, but are not limited to, the following topics:

• The current vaccine recommendation environment and its inherent inadequacies in efficiently and equitably protecting the Canadian public;

• Potential new approaches or models for enhancing the efficiency of expert committees and vaccine recommendation procedures in Canada, including the development of cohesive (and consistently implemented) decision-making criteria, and transparent communication systems; and

• The development of standards and best practices for vaccine recommendation procedures that match the best immunization programs of other developed nations.
6 – Pathway to Access: Toward Sustainable Funding

On the global stage, immunization programs have been widely recognized as among the best investments in health, based on extensive analyses of both cost-savings and cost-effectiveness. Vaccines are also known to offer additional economic benefits, through reduced hospitalization and/or decreased need for expensive treatment (resulting from infection), and through improved workplace productivity (by reducing absenteeism). Thus vaccines play a pivotal role in the sustainability of health care systems, while helping to realize the full economic growth potential of a population free of disease. Although the economic benefits of immunization are very well documented – and cost-effectiveness is greater than that of virtually any other preventive or therapeutic health care intervention – vaccines continue to be (mistakenly) undervalued and underutilized throughout the world. Greater strides must be made to recognize and promote the fact that vaccines provide excellent value for money spent, specifically in terms of their broad medical, social, and economic impact.

In Canada, the current vaccine financing system is a mix of public and private sector effort, which funds the purchase and administration of recommended vaccines for children, adolescents and adults. Most childhood immunization programs are publicly funded, whereas public funding is currently more limited for adolescents and adult immunization. In general, limited financing and the lack of timely funding decisions represent dominant barriers in achieving access to recommended vaccines across all age groups. In recent years, the growing number and cost of new vaccines have created a crisis within the vaccine reimbursement landscape, with increased stress on the both public and private provider systems. In particular, as for other countries, there is significant apprehension that the Canadian funding system may not be capable of keeping pace with newly approved/recommended vaccines in the near-term future.

Since health care in Canada is primarily a provincial or territorial responsibility, funding of immunization programs has been determined historically by provincial/territorial ministries of health. Hence each province and territory has a separate schedule; there is no national immunization schedule that is followed (and funded) across all jurisdictions. From 2003 forward, the federal government has played an increasing role in promoting the adoption and harmonization of vaccine programs across the country. Two major federal initiatives have included the launch of the NIS in 2003, and the creation of the PHAC in 2004.

Unquestionably, tremendous progress has been made since 2003 in achieving equitable access to newly recommended vaccines across Canada. As described in Paper 5, under the NIS, $Cdn 300 million in federal funding has been injected to support immunization programs for four new vaccines (acellular pertussis, meningococcal C conjugate, pneumococcal conjugate and varicella), as recently recommended by NACI. Subsequently, in 2007, the federal government committed an additional $Cdn 300 million (over three years) to finance HPV vaccine programs in Canada, thereby extending previous federal funding for national vaccination programs under the NIS. However, this funding recently expired in March 2010, and a permanent federal trust fund to help finance existing and emerging innovative vaccines has not yet been announced.

Thus, despite recent advances, significant work lies ahead in terms of achieving timely, equitable access to vaccines by all Canadians, and there remains an urgent need for predictable, sustained funding mechanisms for new vaccination programs. Furthermore, the bureaucratic, duplicative nature of the CIC structure (as introduced under the NIS) has been publicly exposed during the recent experience with introducing the quadrivalent HPV vaccine, Gardasil, in Canada. Although the introduction of the high profile HPV vaccine was initially considered as a test case for the new NACI/CIC partnership in overseeing national immunization issues, many questions have been raised regarding whether this joint public health structure is accomplishing its goals in promoting a harmonized, nationally coordinated approach to adopting immunization programs in Canada. Moreover, the “second-step” CIC review conducted more recently for the quadrivalent meningococcal vaccine, Menactra – with CIC recommendations released in January 2010, more than three years following vaccine licensure – also appears to have added further complications, by introducing new misunderstandings, barriers or delays that may hinder patient access to innovative vaccines. In general, the recent Canadian experiences with introducing the novel quadrivalent HPV and meningococcal vaccines have indicated that the current Canadian system for funding and implementing vaccination programs is not yet working at optimal efficiency; continued and improved leadership – particularly at the national level – is still urgently required.
Overall, Canada’s funding mechanisms for new vaccines can still be characterized as lacking in harmonization and transparency, resulting in unacceptable duplication, inequities, and delays in patient access. Another overarching concern is that a larger trust fund for other new and/or forthcoming vaccines has still not been established. Thus it remains unclear how the system will be able to accommodate newly licensed vaccines (e.g. targeting additional strains of bacteria that cause meningococcal disease, a broader range of serotypes of pneumococcal disease, as well as rotavirus, zoster/shingles, and clinical disease caused by HPV) and other novel vaccines on the near-term horizon.

As the Canadian vaccine environment continues to undergo rapid change, several other issues remain unsettled and/or under consultation. For example, debate continues on the topic of whether vaccines should be exempt from Patented Medicine Prices Review Board (PMPRB) guidelines on excessive pricing. Both BIOTECCanada and the VIC maintain the position that vaccines, which undergo a competitive tendering process, should not be regulated like other traditional pharmaceuticals. As a second pivotal issue, it is currently unknown whether emerging therapeutic vaccines will be integrated into public health programs, as is presently the case for traditional preventive vaccines, or whether public provincial drug plans (formularies) will be responsible for assessing and funding these vaccines, as for other therapeutic treatments.

In the latter case, therapeutic vaccines could potentially be reviewed (subsequent to Health Canada approval) by the Common Drug Review (CDR) process, or by procedures under the interim Joint Oncology Drug Review (JODR) – now called the pan-Canadian Oncology Drug Review (pCODR) mechanism – quite apart from the current NACI deliberation system for preventive vaccines. Hence collaborative discussions among all stakeholders (including vaccine manufacturers, public health officials and those affiliated with CDR and pCODR procedures) should be held as early as possible to begin to define the most efficient route(s) of evaluation and reimbursement to ensure timely, equitable patient access to these new therapeutic products. Once the relevant parameters and guidelines have been established, adequate clarity and warning will be required in time for vaccine manufacturers to engage in two-way dialogue with the appropriate advisory/review bodies. This example underscores the imminent need for decision makers at many levels to reassess potential recommendation, financing and reimbursement models in Canada, i.e. to accommodate next-generation vaccines. Furthermore, it will also be important for federal and provincial officials to consider best practices for vaccine program financing and implementation in other countries (including the Vaccines for Children Program, VFC, in the United States), to help achieve optimal clinical outcomes and economic value in the future through standardized immunization programs.

In addressing the key challenges currently faced within the vaccine reimbursement environment in Canada, the highest level goal is to ensure equitable access to all recommended vaccines without financial barriers. To achieve this goal, Canada needs a predictable process and sustained financial support at the F/P/T levels for both existing and new public vaccine programs, including emerging vaccine technologies. Hence the VIC has put forward the following recommendations – in the spirit of collaboration – for consideration by F/P/T governments and other key stakeholders. In continuing to build upon recent successes in improving vaccination programs, stakeholders at all levels must intensify efforts to enhance the existing immunization funding infrastructure for the benefit of all Canadians.
Executive Summary

Federal Recommendations

1. Federal funding for immunization programs should be renewed (potentially in the form of a sustainable, permanent trust fund of $Cdn 100 million per year minimum, and tied to the expansion of the NIS goals) to ensure new vaccine technologies can be incorporated into public vaccine programs.

2. With the imminent launch of therapeutic vaccine technologies in Canada, Health Canada should work in a transparent manner with manufacturers and other relevant stakeholders (including members of NACI, and those affiliated with CDR and pCODR procedures) to determine the most appropriate route(s) of evaluation and reimbursement for therapeutic vaccines.

Provincial/Territorial Recommendations

3. The provinces/territories should work towards an agreement with the Federal government to establish sustainable, standardized mechanisms and funding to ensure the adoption of new, recommended vaccines by public health programs within six months of Health Canada approval.

4. Notwithstanding Recommendation 3 (and as a contingency strategy), the provinces and territories should endeavour to reach consensus across all jurisdictions with regard to the creation of (and adherence to) a standardized, timely, consistent system for funding public immunization programs.

Stakeholder Recommendations

5. A meeting of all relevant stakeholders (including F/P/T government and public health officials, regulators, policy makers, medical professionals, vaccine manufacturers/developers and researchers, investors, payers, and the general public) should be convened on a regular basis – potentially by the PHAC, in conjunction with the VIC. Urgent matters that require transparent dialogue encompass, but are not limited to, the following topics:
   - The current vaccine funding and delivery system and its inherent flaws in equitably protecting the Canadian public;
   - Best practices in other countries for vaccine financing and reimbursement; and
   - Potential new models to encourage predictable, sustained funding mechanisms and efficient delivery for recommended vaccines in Canada.
7 – Pathway to Access: Manufacturing, Supply, and Procurement Systems

Earlier papers in this policy series have underscored the tremendous value of vaccines, current marketplace dynamics and promising research opportunities, as well as the challenging regulatory, recommendation and funding environment within which vaccines are brought to market in Canada. This paper focuses on subsequent steps along the pathway to market access, including large-scale production and vaccine procurement systems – as crucial elements in ensuring adequate vaccine supply and timely delivery to end-users. Securing access to a stable supply of recommended vaccines plays a fundamental role in assuring high levels of vaccination coverage for children, adolescents and adults, both in Canada and abroad. Clearly, since global demand for vaccines continues to outstrip supply, the security of vaccine supply remains a critical issue for all jurisdictions.

Today’s vaccine manufacturing environment can be characterized as complex, costly, and highly regulated, particularly given the inherently variable nature of vaccines as biological entities. The production of a single lot of vaccine can take one to two years, with significant time (up to 70%) spent on quality and manufacturing controls to ensure the highest vaccine safety standards. In addition, building a new facility to increase production capacity also results in long lead times of three to five years, and may cost in the range of $US 100-600 million. Overall, long production lead times represent a fundamental challenge (and substantial risk) in vaccine manufacturing, and weigh heavily on production plans and facility investment decisions well in advance of regulatory approval. The recent outbreak of novel influenza A H1N1 – first identified in April 2009, and declared as a Phase 6 pandemic alert by the WHO on June 11, 2009 – provides a timely example that highlights the difficulties of dealing with capacity constraints and compressed lead times for a rapid response and large-scale vaccine production.

In general, balancing vaccine supply and demand is viewed as a delicate, difficult task; uncertainties in the timing and magnitude of both supply-side constraints and demand-side drivers represent significant challenges for manufacturers in producing adequate vaccine supply. Taking this perspective, and in response to persisting concerns regarding the fragility of the domestic and international vaccine supply, a variety of proposals have been put forward to minimize future shortages. These strategies include both “push” and “pull” mechanisms (as detailed in Paper 3) to encourage continued investment in vaccine R&D, and to help ensure continued vaccine supply. Other proposals to strengthen the vaccine supply include subsidizing idle manufacturing capacity that could be used in emergencies, use of foreign suppliers during temporary shortages, and use of more accurate forecasting methods to predict vaccine demand. Active implementation of such proposals should facilitate “connecting the dots” in achieving crystal-clear recognition that a secure vaccine supply plays a vital role in the delivery of predictable immunization programs – to help meet a range of fundamental public health objectives.

In the context of vaccine supply issues, critical attention must also be paid to cold chain management (to keep vaccines within an appropriate temperature range) throughout the distribution and storage process. In particular, temperature fluctuations or extremes may negatively affect vaccine stability, potency, safety or efficacy, and may also contribute to waste – because compromised vaccines may need to be destroyed. Notably, the VIC has recently proposed to work in partnership with the provinces/territories and Health Canada to provide available vaccine stability data to vaccine users, i.e. while continuing to use the vaccine product monograph as the principal guidance document for stability information.
Another essential component of the Canadian vaccine supply chain is the underlying infrastructure for vaccine delivery, which relies on multiple distribution channels. Since vaccine delivery for publicly-funded immunization programs is primarily administered by the provinces and territories, manufacturers generally distribute vaccines to end-users by shipment from corporate facilities in Canada to provincial/territorial depots within the public health system. Vaccines are then shipped to regional or local health authorities, which in turn distribute product to individual health care facilities. Specifically, for publicly-funded programs, vaccines are administered mainly through provincial/territorial public health clinics and offices, physician-based practices, school-based clinics, hospital-based influenza programs, and elderly drop-in centres. In contrast, privately-funded vaccines are typically delivered from manufacturers’ facilities to group purchasing organizations and/or individual health care providers at pharmacy-based clinics, travel clinics, or physician-based practices. For most vaccines currently on the market, it takes several months from final manufacturing steps (including lot release) to delivery to the end-user.

In Canada, procurement procedures for purchasing vaccines are complex and cumbersome. Essentially, after overcoming significant R&D, regulatory, recommendation and financing challenges (as summarized in Papers 3, 4, 5 and 6), manufacturers must also engage in competitive contract negotiations as one of the final major steps prior to delivering vaccines to Canadians. Within the current F/P/T bulk purchasing program, Public Works and Government Services Canada (PWGSC) acts as an agent of the Vaccine Supply Working Group (VSWG) to manage vaccine tenders/contracts on behalf of all jurisdictions. The tender process has traditionally been based on a “winner take all” strategy, in which all sales for a given vaccine are awarded to the lowest price bidder. More recently, in efforts to promote security of the vaccine supply, there has been a trend towards dual-supplier contracts, in which up to two suppliers provide the required vaccine doses for all regions. Such dual awards – now very common in Canada – can be implemented when advisory committees consider competitor vaccines similar enough to be fully “interchangeable”. Apart from the (public) F/P/T bulk purchasing program, other procurement systems in Canada include direct contracts between individual jurisdictions and vaccine suppliers, and private sector mechanisms.

At present, Canada’s vaccine procurement environment has several limitations which are cause for concern among vaccine manufacturers. First, the current vaccine procurement framework tends to treat vaccines as low-tech commodities; it does not adequately recognize vaccines as high-value biotechnology products, with proven impact in disease prevention. Second, within the public sector, the government acts as a single powerful buyer with significant bulk purchasing power – placing downward pressure on price. This primary price focus has driven vaccine prices in Canada to among the lowest in the developed world, thus reducing industry profit margins, and discouraging potential new entrants into the Canadian vaccine market. In addition, the strong price emphasis fails to recognize other important social values, e.g. by limiting Canada’s contribution to maintaining subsidized pricing structures for the world’s poorest nations.

In addition, other parameters within the current procurement environment – specifically those pertaining to contractual design – can contribute directly to vaccine waste. These factors may include one or more of the following constraints: i) insufficient lead time for initial vaccine delivery, optional contract extensions, and optional quantities; ii) mandatory return policies; and iii) the lack of appropriate/unique cold chain clauses for individual vaccines. By encouraging vaccine waste, the current procurement system effectively increases production costs and decreases production capacity for manufacturers. More importantly, from a public health perspective, vaccine waste is associated with the opportunity cost of missed vaccination for individuals in other jurisdictions, who may go without the benefits of immunization. Moreover, since worldwide demand for vaccines exceeds supply, both government and industry players have a moral obligation to protect global vaccine supplies by minimizing waste.
Since vaccine procurement is a shared responsibility across manufacturers, federal government agencies and P/T public health authorities, all stakeholders should aim to work in partnership to improve current policies through appropriate procurement reform. Collectively, all partners in immunization must work towards enhancing the effectiveness and efficiency of vaccine procurement systems for the benefit of Canadians – by creating an environment conducive to meeting both industry and public health objectives in implementing vaccine program strategies. Given that very little progress has been made over the past several years (particularly in terms of improving vaccine forecasting by several P/T jurisdictions), increased efforts must be made towards the development of a revitalized, fair procurement process, i.e. to help secure a more reliable, robust vaccine supply, and to achieve the common goal of providing timely patient access to high-value vaccines. In the spirit of such collaboration, the VIC has put forward the following recommendations for consideration by key F/P/T government stakeholders.

Federal/Provincial/Territorial Recommendations

1. In view of long production lead times, and the complex, costly, and highly regulated nature of the vaccine manufacturing environment, policy approaches to developing an efficient vaccine marketplace should encourage long-term investment in Canadian-based innovation, R&D and manufacturing capacity within the vaccine sector. Such initiatives, including both “push” and “pull” strategies, should assist in preventing manufacturers from exiting the vaccine market, and ensuring continued supply of existing and emerging high-value vaccines (see also Paper 3).

2. Regarding vaccine pricing, increased recognition is required by designated users regarding the true value of the vaccine supply chain – and that lowest price does not necessarily deliver greatest value.
   - Implementation of more favourable pricing structures for vaccines (including appropriate tender-based evaluation criteria) could stimulate the economy by encouraging R&D to create innovative vaccine products, while fostering future job creation and a more robust tax revenue base.
   - Pricing barriers that stand in the way of competitive market profitability – including strict regulation of patented vaccines by the PMPRB – should be removed, or undergo reform, to help strengthen the vaccine enterprise, i.e. by encouraging companies to continue to risk investment capital to build future production capacity.

3. In working towards an optimal, modern, fair and transparent vaccine procurement system, the following revisions should be made to specific terms/conditions in improving current PWGSC/VSWG contract design (and ideally also for direct contracts with individual jurisdictions, where appropriate).
   - With regard to contractual obligations (e.g. mandatory requirements): i) users should allow sufficient lead time (six months minimum) for initial vaccine delivery, contract extensions, and volume increases for optional quantities, i.e. to ensure manufacturers can adjust supplies to meet global demand; and ii) users should be required to pay for minimum quantities, regardless of usage, i.e. to encourage better program planning and more accurate demand forecasting.
   - With respect to minimum return policies, the VSWG should work in close cooperation with the VIC to reduce the need for vaccine returns, i.e. by developing methods to ensure that vaccine quantities ordered are indeed utilized – thus minimizing vaccine waste.
   - Regarding cold chain supply management, policies and procedures should also be put in place to educate and monitor relevant stakeholders/users regarding storage and handling requirements, with the goal of mitigating losses due to vaccine waste.
   - In the event of inability to supply vaccine, the contract should limit financial liability to the amount specified in the contract during the period of inability to supply, and the manufacturer should be allowed to terminate a contract with six months notice (for a long-term interruption).
4. To ensure the effectiveness, efficiency, value and success of Canada's publicly-funded immunization programs, continued efforts are required to further improve and enhance Canada's vaccine procurement system by building collaborative partnerships across key stakeholders (including manufacturers, federal government agencies, P/T public health authorities, and academia).

- The VIC has proposed to establish a dedicated working group – with representatives from the PHAC, the VSWG, provinces/territories, the BGTD, and industry – to address supply chain management issues, with particular emphasis on strengthening terms and conditions pertaining to vaccine forecasting and procurement lead times, cold chain requirements and product stability guidelines.

5. Continued efforts should be made by F/P/T policy makers to explore and consider alternative vaccine procurement systems currently in place in other developed countries, i.e. to identify key lessons and best practices that merit consideration in the context of the current Canadian vaccine landscape.
8 – Vaccines Matter: Talking to Canadians

As highlighted in previous papers, vaccination has saved more lives in Canada in the past 50 years than any other medical intervention, with tremendous medical, societal and economic value in improving public health. However, the effectiveness of existing and new immunization programs depends heavily on their acceptance by the public, which is becoming increasingly challenged by concerns regarding vaccine safety. Thus, in addition to strong vaccine recommendations by NACI and other advisory bodies – as well as adequate vaccine funding and efficient procurement systems – comprehensive, coordinated education programs that target the public (and health care providers) are urgently required in Canada to improve vaccine knowledge, attitudes, and coverage rates, and hence to reduce the incidence of vaccine-preventable disease.

Ironically, vaccination programs have recently become, to some degree, the victim of their own success. Specifically, the near disappearance of (and lack of direct experience with) target diseases such as polio or measles have led to increased complacency towards immunization, and vaccination rates have thus dropped – with frequently reported resurgence of vaccine-preventable disease. Other factors have also contributed to the recent emergence of the “anti-vaccine movement” that questions the need for vaccines and their general safety, including growing mistrust of government and public health officials, and the proliferation of electronic communications, which can rapidly propagate inaccurate information. Simultaneously, the balance has shifted away from recognizing the true benefits of vaccination towards increased suspicion of adverse effects resulting from immunization. Overall, the current complacency and growing opposition towards vaccination underscore the urgent need to improve immunization awareness and education programs, particularly in terms of achieving target immunization rates.

Unfortunately, public misconceptions regarding vaccination tend to persist, despite the large body of scientific evidence against them. In particular, several international studies using a variety of epidemiological methods have produced consistent evidence that there is no association between thimerosal (a mercury-containing preservative used in some vaccines) and autism. Indeed, in early 2010, *The Lancet* – the prestigious journal which originally published (in 1998) the controversial research allegedly linking the measles, mumps, rubella (MMR) vaccine to autism – issued a formal, full retraction of this study and its conclusions from the public record. Furthermore, there is no valid evidence to support a causal relationship between whole cell pertussis vaccine and brain damage, or hepatitis B vaccine and multiple sclerosis or leukemia. Broadly speaking, there remains a strong need for effective vaccine education and advocacy programs to help overcome resistance to vaccine acceptance; such programs are required to promote greater public confidence in immunization as the single most effective and safe public health intervention, especially when weighed against the health risks associated with many serious vaccine-preventable illnesses.

In Canada, as in many other developed countries, national immunization coverage rates are significantly lower than target rates for several vaccine-preventable diseases, both in children (e.g. pertussis, rubella) and adults (e.g. influenza, invasive pneumococcal disease). Such suboptimal vaccination rates help reiterate the requirement for increased public awareness regarding immunization. In addition, recent survey data have indicated that although Canadians generally hold positive views of vaccines (i.e. with respect to vaccine importance, efficacy, and the need for continued research), many respondents have demonstrated insufficient knowledge (especially regarding safety issues), uncertainty, or negative attitudes towards vaccination.
Unsurprisingly, several of these themes have also been echoed in the context of the recent influenza A pandemic, and the so-called “epidemic of confusion”. For example, results of several surveys conducted in the summer and fall of 2009 indicated that Canadians were relatively reluctant to receive the H1N1 vaccine. These surveys, as well as other earlier studies, suggested that potential hesitancy to receive the vaccine may have been based on the perceived low risk of being infected (or lack of knowledge regarding the potential seriousness of H1N1 disease), as well as the need for additional information regarding vaccine safety and effectiveness. Interestingly, and perhaps unexpectedly (given previous survey data and perceived levels of public confusion), the overall H1N1 coverage rate achieved in Canada – initially estimated at 45% by the PHAC in the Spring of 2010 – has been reported to be among “the best in the world”. Notably, this rate still fell below initial target coverage rates; the PHAC had strongly recommended H1N1 vaccine for all Canadians over six months of age without contraindication(s). In general, since virtually all theories of “behaviour change” focus on knowledge as a necessary factor in adoptive behaviour, educational efforts directed towards the Canadian public may be expected to improve vaccine receptivity and in turn, increase overall immunization coverage rates. A key takeaway point that emerges from surveys/studies regarding immunization awareness and beliefs is that enhanced, timely public education regarding vaccine safety and effectiveness will be required to promote positive attitudes, and to maintain support for future immunization programs in Canada.

Having unambiguously argued the case for the need to improve immunization education programs in Canada (based on currently held misconceptions, suboptimal coverage rates, and insufficient knowledge regarding vaccines), it is pertinent to review relevant avenues for education program delivery. In this context, it is well recognized that health care professionals, including physicians, nurses and pharmacists (as well as medical/professional associations), play a critical role in educating the public regarding the value and benefits of immunization – and that their recommendations strongly influence vaccine uptake. Hence it is imperative that front-line immunization providers are equipped with the latest evidence-based information to address public concerns. In addition, effective risk communication skills need to be developed to help create informed decision-making partnerships between individual health professionals and parents/patients, i.e. within an open, respectful atmosphere that acknowledges individual perception of risk. At present however, a diverse, uncoordinated array of professional education programs and resources is available for Canadian vaccine providers; more consistent and cohesive training programs are urgently required.

Public health officials at the national, jurisdictional and local levels also hold influential positions in guiding and educating the public on immunization issues. Although several Canadian public health experts are regarded as exemplary advocates of immunization, on the whole, public health officials have recently been criticized in terms of their inability to effectively communicate the importance and benefits of vaccination – particularly during the 2009/2010 H1N1 influenza vaccine campaign. While conflicting recommendations across provinces/territories (regarding the timing and nature of flu vaccine requirements across various target groups) caused considerable confusion during the 2009/2010 season, an overarching longer-term concern is that mixed messages may also lead to broader erosion of trust in Canadian public health authorities. Hence the H1N1 outbreak serves as an important reminder that Canadians require timely, clear direction regarding the safety and value of immunization, i.e. as a prerequisite for rebuilding trust in future vaccination programs. Overall, publicly-funded officials have an obligation to stand up for science, which unequivocally indicates that lack of vaccination is associated with even greater risks. With regard to the PHAC, it should also be noted that – despite recent progress of the Professional Education Working Group (PEWG) in developing its new educational tool, “Immunization Competencies for Health Professionals” – little visible progress has been made to date under the NIS in advancing knowledge development and dissemination to support public education.
In addition to the vital roles played by health professionals and public health officials, several modern media tools are currently recognized as powerful mechanisms for influencing parents and patients; such tools encompass print media, radio, television, film, and the Internet. Recently, direct-to-consumer (DTC) advertising has become an increasingly popular means of educating the public regarding vaccines. Notably, the information presented in a DTC advertisement should be intended primarily to inform individuals of the availability of a vaccine and its recommended use, and to direct patients to appropriate sources that have greater capacity to deliver educational content, including complete risk-benefit information. Finally, since school-based immunization programs are an effective means of delivering routine vaccines to children and adolescents, educational leaders (including school principals, teachers, nurses and guidance counselors) also play an integral role in disseminating immunization information to both parents and their children.

Since immunization is a collective responsibility across government and public health authorities, health care providers, industry players, and families, all stakeholders must work together to develop (and realize the full benefits of) well-structured educational programs to help protect the Canadian population. In the spirit of achieving the shared goal of improving patient health through enhanced education, the following recommendations are put forward by the VIC for consideration by F/P/T governments and relevant stakeholders.

Federal/Provincial/Territorial Recommendations

1. To achieve one of the most fundamental goals in public health, Canadian public health authorities at all levels should seek to maintain and strengthen public trust in immunization programs.

2. Policy approaches designed to maintain and improve immunization coverage rates as a primary public health objective should ensure adequate resources and infrastructure are in place to deliver effective vaccine program awareness/education programs across the country.

3. Initial goals and recent progress of the NIS should be reevaluated, particularly in terms of advancing knowledge development to support public education programs.

Stakeholder Recommendations

4. Stakeholders at all levels, including F/P/T government officials, public health authorities, vaccine manufacturers, researchers, and health care professionals, should work towards the development of a comprehensive, coordinated framework for communicating with the public and other health providers regarding the benefits (both individual and community) and potential risks of vaccination.

5. All stakeholders need to take greater responsibility for educating and reassuring the public regarding the stringent regulatory measures currently in place to ensure extremely high standards of quality and safety in the research and development, manufacturing, licensing, and use of vaccines in Canada.

6. With specific regard to health care providers – who act as trusted information sources for parents and patients – there is a need for enhanced professional education in the field of immunization in Canada.

7. Improved communication plans aimed specifically at the public are needed to help overcome negative perceptions of vaccines, and to renew the motivation for vaccination – ideally through enhanced recognition that vaccines represent a worthwhile, responsible public health intervention.

- Appropriate risk communication strategies should be used to present timely, accurate, understandable, evidence-based information regarding vaccines and immunization programs.
- An informed decision-making partnership between a health professional and parent/patient is required to facilitate two-way messaging in an open, respectful atmosphere that acknowledges individual perception of risk (which, in turn, may help modify attitudes or behaviour).
8. Since vaccines can only be administered by a health care professional in Canada, and given that the primary purpose of a DTC advertisement is to inform the public regarding the availability of a vaccine and to direct parents/patients to additional education resources, the VIC proposes that fair balance requirements could be met in the following ways:

- Fair balance requirements should be adapted and applied to specific media formats, taking into consideration differences in the time of exposure and the volume of information that can be conveyed to (and understood by) the intended audience.
- For broadcast media formats that have limited information capacity (e.g. television and radio ads), fair balance could be achieved by including brief statements to: i) explain that not everyone may be eligible to receive (or be fully protected by) a given vaccine; ii) warn of the possibility of side effects; iii) recommend a consultation with a health care professional; and iv) refer to another source of additional, complete, and balanced information regarding vaccine risks and benefits.
9 – Ensuring Vaccine Safety and Effectiveness for Canadians

Immunization is currently considered a cornerstone of public health practice in Canada. Fortunately, given the tremendous potential for immunization in terms of contributing to “public good”, currently available vaccines have a favourable safety record; most side effects are minor and serious complications are rare. Yet the continued success of immunization programs in Canada requires a comprehensive, effective and efficient vaccine safety system, including ongoing pre- and post-licensure testing and regulatory controls, as described in Paper 4, as well as vigilant post-market assessment of adverse events following immunization (AEFI), summarized herein. While manufacturers typically conduct Phase IV studies to evaluate vaccine safety and/or efficacy - and are also required by law to report serious AEFI following vaccine delivery to users – the majority of post-market vaccine safety reporting is conducted by health providers and public health authorities, as part of the extensive PHAC surveillance framework.

The term “surveillance” is defined as the systematic ongoing collection, collation and analysis of data, with timely dissemination of information to those who require it in order to take action, i.e. to improve prevention or control of relevant conditions. Within the context of immunization, effective surveillance systems permit monitoring of: i) the epidemiology and burden of vaccine-preventable diseases (VPD); ii) vaccine coverage; and iii) post-market vaccine safety, including AEFI. Hence, it should be emphasized that post-licensure safety initiatives represent but one arm of an even broader set of surveillance systems to support immunization programs in Canada. Operating in concert, these surveillance networks have the potential to provide critical intelligence, not only to support the rationale for introducing new vaccination programs, but also to gauge their subsequent impact on disease incidence and burden, and to evaluate vaccine safety in the post-marketing phase. Such information ultimately guides vaccine policy – to help optimize the safety, effectiveness, value and success of immunization program planning and delivery.

Since disease surveillance falls within Canada’s federal mandate, most VPD are under surveillance by one or more national systems, including the Notifiable Diseases Reporting System (NDRS) coordinated by the PHAC. The NDRS is a passive (voluntary) surveillance system used to monitor more than 40 notifiable infectious diseases, encompassing numerous VPD. At present, disease surveillance in Canada is very complex, since multiple programs exist at the national, P/T, and regional/municipal levels; this system is characterized by substantial gaps, delays, and inconsistencies in data reporting. Significant improvement will be required in the existing disease surveillance infrastructure, i.e. to help generate accurate, timely data regarding VPD occurrence – as a basis for public health decision-making.

With regard to surveillance of vaccine coverage rates in Canada, information is currently derived from a variety of sources, including immunization surveys (typically conducted every second year), as well as through vaccine registries, which are used to manually record data from patient records. At present, only five of Canada’s P/T jurisdictions have fully functional vaccine registries; the remaining jurisdictions are in the process of implementing or evaluating potential options – including consideration of data standards to ensure compliance with the pan-Canadian public health surveillance system known as Panorama (part of Canada Health’s INFOWAY). Overall, considerable variation currently exists in the frequency and type of data collected across P/T vaccine registries, and it remains extremely challenging to determine uptake rates for childhood or adult vaccines. Significant time and effort, as well as substantial future resources will be needed to develop a nationwide system of registries that can accurately track vaccination status across the country.
As one major avenue for advancing vaccine registries in Canada, the development of a standardized vaccine bar coding system is anticipated to facilitate future data entry, i.e. by dramatically increasing the speed, accuracy and completeness of recording vital immunization information. More broadly, vaccine bar coding would also permit real-time inventory management, thus helping to reduce supply shortages, and could also improve patient compliance and safety, e.g. by facilitating scheduling for multi-dose immunizations and/or accelerating appropriate follow-up for patients who experience AEFI. Building on previous work initiated by the PHAC, the Automated Identification of Vaccine Products Advisory Task Group (AIVP ATG) – as co-chaired by the VIC – has recently conducted a cost-benefit analysis to assess potential bar coding options. The ATG has proposed a step-wise implementation strategy, beginning with the introduction of a bar code to provide non-variable data (specifying the manufacturer and product tradename) on the primary vaccine package (vial); manufacturers could work towards implementing such a standard, on a voluntary basis, within 18-24 months.

In addition to surveillance activities conducted to monitor disease incidence and vaccine coverage (e.g. through surveys and registries), significant efforts are undertaken in Canada to ensure the safety of approved vaccines, and to rapidly detect any safety signals of concern. Such post-market safety surveillance of preventive vaccines is overseen primarily by the PHAC, with input from the BGTD, as well as vaccine manufacturers. Specifically, two distinct systems are in place to support voluntary and mandatory surveillance of approved vaccines; these networks are known as the Canadian Adverse Events Following Immunization Surveillance System (CAEFISS), and IMPACT (Immunization Monitoring Program ACTive), respectively. Notably, the IMPACT system documents AEFI through 12 pediatric hospitals across the country. Recent findings from these surveillance programs clearly document the rarity of harm from immunization, and overwhelmingly support the argument that the vast, vast majority of those immunized do not suffer any negative effects. In general however, since Canada's current surveillance systems are limited by a lack of timely, standardized, and complete reporting methods (across local, P/T and national levels), analysis of case-specific AEFI rates requires extremely cautious interpretation.

While serious AEFI are rare and far outweighed by the benefits of immunization, Canada currently has no national program in place to compensate those injured by vaccines. Many calls have been made for a no-fault compensation (NFC) system, which could rapidly provide financial support to individuals who have experienced documented vaccine-related harm (i.e. while undergoing an intervention that contributes to the greater public good), without having to go through the expensive traditional litigation process. Such calls for a national NFC scheme are driven by the need for patient access to fair compensation within an ethical, just, and socially responsible system. In tailoring a unique national program, Canada should draw upon best practices in other jurisdictions, including Germany, the United States, the United Kingdom, and Québec – which introduced a provincial NFC program in the mid-1980s. Notwithstanding the existence of a provincial NFC system in Québec, the development of a national NFC system is anticipated to present significant challenges, particularly given that health care in Canada is primarily the responsibility of individual provinces and territories, each of which may have distinct jurisdictional priorities or concerns.

Overall, as the number of available vaccines and the complexity of P/T immunization schedules continues to grow, Canada needs to strengthen its capacity to collect, investigate, share, and respond to information in a timely fashion (e.g. across local/regional/national levels and among distinct surveillance networks) – through the continued development of a comprehensive, standardized, and robust vaccine-related surveillance infrastructure. To achieve this ambitious goal, and to ensure vaccine safety and effectiveness for all Canadians, close cooperation will be required among many partners, including front-line health providers, manufacturers, regulators, and public health officials at all levels of government. In the spirit of such collaboration, and for the sake of fairness to individuals and the health of the broader population, the VIC has put forward the following recommendations for consideration by F/P/T governments.
Federal/Provincial/Territorial Recommendations

1. To enhance Canada's capacity to evaluate the (baseline) health and socio-economic burden of vaccine-preventable diseases, and to permit accurate, timely assessment of the public health benefits of subsequent vaccination, F/P/T governments should allocate significant additional funds/resources to strengthen Canada's multi-faceted (but currently fragmented) disease surveillance infrastructure.
   • Given that the NACI review process for new vaccines relies heavily on epidemiology data for vaccine-preventable diseases, the availability of current, standardized, comprehensive (national) disease surveillance information will also facilitate (and minimize delays in) evidence-based decision-making and recommendations for emerging vaccine technologies in Canada.

2. To compel jurisdictions to rapidly share epidemiologic and other disease surveillance information, both routinely and during disease outbreaks/threats, more formal data-sharing agreements (i.e. to establish clear, formal legal obligations) should be implemented across F/P/T governments – following the example of an agreement signed between the federal government and Ontario in 2008.

3. To improve Canada's ability to track immunization coverage in a timely, accurate manner, federal leadership and additional investment by F/P/T governments will be required to further develop vaccination registries, including the finalization of data standards to ensure compliance with the immunization registry module of the pan-Canadian Panorama surveillance system.

4. To facilitate future data entry into vaccine registries (i.e. via electronic scanning), the development of a standardized bar coding system for vaccines will be required in Canada. The VIC, in collaboration with the AIVP ATG, recommends a step-wise implementation strategy for such a system, beginning with the early adoption of a bar code on the primary vaccine package with non-variable data only. In this case, a linear bar code, using reduced space symbology (RSS), would encode the Global Trade Item Number (GTIN), which identifies the manufacturer and product tradename. Vaccine manufacturers could work towards implementing such a bar code on a voluntary basis within a reasonable timeframe, e.g. 18-24 months.

5. To ensure the successful implementation of vaccine bar coding standards in Canada, the PHAC/AVIP should continue to work collaboratively (e.g. through the AIVP ATG) with manufacturers, BGTD, GS1 Canada (the Canadian Healthcare User Group, HUG, that designs and implements global standards for use in supply chain management), P/Ts, and end-users (health practitioners, hospitals, and patient associations) to address the requirements of all relevant stakeholders across a wide range of immunization settings.

6. To support timely, accurate, systematic, and comprehensive reporting of AEFI – and thus to permit rapid detection of any safety signals of concern – additional F/P/T government funds/resources should be deployed to strengthen Canada's post-marketing safety surveillance infrastructure, including enhancement of the current CAEFISS and IMPACT networks.
   • Improvements should be made in information sharing and communication speed (from local to P/T and national levels) to permit timely, efficient analysis of aggregate data.

7. To protect individuals who have suffered vaccine-related injuries (as well as to provide a more secure legal environment for vaccine innovation, and to help protect the vaccine supply), Canada should establish a national NFC program similar to those that exist in other jurisdictions worldwide.
   • In tailoring a compensation scheme uniquely for Canada, the current U.S. and Québec NFC systems could serve as useful comparative models, from which to draw lessons regarding the optimal national legal structure – including consideration of appropriate financing schemes, claim criteria, adjudication procedures and litigation rights.
Executive Summary

10 – Injecting Success: The Future of Vaccines in Canada

Since the discovery of modern vaccination more than 200 years ago, vaccines have proved to be one of the most significant and cost-effective public health interventions. It is widely believed that this “success story” will continue into the foreseeable future; current estimates suggest there are approximately 150-200 vaccines in the clinical-stage development pipeline worldwide, and intensified interest and investment in vaccine R&D are anticipated to generate a three-fold increase in available vaccines over the next few decades. Already, recent advances in vaccine technology have enabled the development of leading-edge preventive and therapeutic vaccines, as well as new adjuvants, and novel delivery methods (i.e. via oral, intranasal, transdermal, or intradermal routes) – all of which are expected to play a role in transforming the future of global public health.

Given the recent boom in vaccine technology on the international stage, it is anticipated that new vaccines will have a significant impact on the delivery of immunization programs and the epidemiology of vaccine-preventable diseases in Canada in the near-term future. Indeed, several new vaccines have been approved since mid-2006 and are currently offering new disease prevention opportunities for Canadians. These new vaccines target rotavirus, shingles, additional strains of bacteria that cause pneumococcal disease, and clinical disease caused by HPV – primarily cervical cancer.

Many innovative vaccine technologies are also in development by global pharmaceutical and Canadian-owned companies, with several vaccine candidates currently in preclinical and clinical trials. Across the country, the pipeline is bulging, and continued innovation is anticipated to generate a new wave of preventive vaccines (e.g. against hepatitis A & B, and AIDS) as well as cutting-edge therapeutic vaccines (e.g. targeting breast, ovarian and prostate cancers, and prion-mediated diseases such as Lou Gehrig's and Alzheimer's disease). Canadian companies are also advancing proprietary virus-like particle (VLP) and synthetic peptide technologies to provide safe, efficacious alternatives to conventional influenza vaccines; these development efforts are to be applauded, particularly given the importance of securing rapid and sufficient vaccine supply to protect against pandemic influenza strains – as underscored during the recent H1N1 outbreak. While Canada continues to make strong contributions to the development of next-generation vaccines, collectively, these research initiatives are poised to extend the current benefits of immunization – particularly to adolescent and adult populations. In addition, on the international horizon, impressive advances are being made in targeting leading global killers, especially those endemic in developing countries, such as pneumonia, malaria, tuberculosis, AIDS, dengue, and rotaviral disease.

As technology innovation continues to drive the discovery of revolutionary new vaccines and delivery methods, the range of immunization program options also widens, with the consequent need for updated, improved governance and funding systems. At present, emerging vaccines are being introduced by manufacturers, yet the interval between Health Canada approval and immunization program implementation is undesirably long (e.g. three to six years), including lengthy reviews by NACI and the CIC. In addition, patient access to recently approved vaccines is currently impeded by a lack of sustained federal funding for public sector programs. Unfortunately, the net result is that Canadians are denied timely, consistent access to approved vaccines – and thus left at unnecessary risk, due to lack of optimal protection from vaccine-preventable diseases. Overall, despite well-recognized successes in decreasing the incidence of infectious diseases, Canada's current immunization system can still be characterized as lacking harmonization and transparency, resulting in unacceptable duplication, inequities and delays.

In particular, the recent Canadian experience with introducing the novel quadrivalent vaccines Gardasil (which targets HPV-related clinical disease) and Menactra (which targets meningitis) – both licensed in 2006 – serves as a convincing platform to articulate the need for improvement in reshaping our national immunization landscape. Significant work lies ahead, primarily in terms of achieving predictable recommendation procedures and sustainable funding mechanisms for immunization programs in Canada – two necessary cornerstones in realizing equitable and timely access to vaccines across the provinces and territories. Overall, Canada's system for national vaccination programs currently stands at a crossroads; we face an urgent need to revamp our immunization framework, including a major overhaul of the current public health infrastructure for vaccine adoption. In addressing this critical call to action, patient needs must placed explicitly at the forefront, with a clear vision by all stakeholders in terms of providing consistent, timely access to new vaccine innovations developed both in Canada and abroad.
Given the urgent need for reform within Canada's national immunization system, it has been suggested – particularly by BIOTECanada's VIC – that federal and P/T public health officials should do more to consider international best practices for immunization program development. In taking preliminary steps towards this end, the PHAC hosted an International Forum in December 2008, with the key goal of evaluating immunization systems in other higher income countries, i.e. to shed light on best practices (for vaccine recommendation, funding, procurement and program-related research) that might be adaptable to Canada's decentralized health governance system. To build on the major themes and challenges identified during this International Forum – and in working toward an improved vaccine environment conducive to meeting both industry and public health objectives – the VIC has clarified its vision for streamlining vaccine program development and funding mechanisms in the form of an illustrative flow chart (Figure 10.1).

The recommendations for potential future models presented in Figure 10.1 are intended to complement and help crystallize the broad range of VIC recommendations presented in previous papers in this policy series (particularly Papers 5 & 6). This schematic figure, still considered an early work-in-progress, presents VIC recommendations regarding target review times to support full (national) immunization program implementation, beginning with authorization by Health Canada's BGTD, and focuses primarily on: i) medical/scientific review by NACI and the Committee to Advise on Tropical Medicine and Travel (CATMAT); ii) program recommendations by the CIC (or a new F/P/T structure); and iii) program funding by federal and P/T governments. Specifically, for each new vaccine, the VIC recommends that a NACI statement should be issued within 90 days of BGTD approval. This will require enhanced NACI/industry collaboration, including ongoing dialogue, and formal definition of points of engagement (e.g. during clinical development, pre-licensing and pre-NACI release) for data presentation/submission to NACI as vaccine recommendations are being developed.

In this context, it is noteworthy that CATMAT provides the PHAC/NACI with ongoing medical, scientific, and public health advice relating to tropical infectious disease and health risks associated with international travel – and hence makes immunization-related recommendations regarding the prevention and treatment of infectious diseases that may be encountered by travelers outside Canada.

As introduced in Paper 6, the VIC also recommends that the federal government should create a permanent trust fund (e.g. $Cdn 100 million per year minimum) to provide predictable financial support for publicly-funded immunization programs. Using such a sustained trust fund as a significant financing base, the federal government should play a leadership role in working collaboratively with P/T jurisdictions to establish a sustainable funding mechanism(s) to ensure adoption of new, recommended vaccines into public sector programs within another 90 days following NACI recommendations (i.e. within six months subsequent to vaccine licensure). Moreover, to accelerate vaccine adoption, clear policies should be established to link national recommendations to F/P/T funding decisions. Overall, coordinated, efficient recommendation processes, and timely, predictable F/P/T financial support for innovative vaccines will be essential in ensuring a strong future immunization infrastructure in Canada.

To help improve Canada's vaccine evaluation and recommendation framework, the VIC intends to share its preliminary recommendations (based on the concepts proposed in Figure 10.1) with the BGTD, PHAC, NACI, CIC, and all relevant stakeholders in 2010. Indeed, the VIC has included its proposed vision (flow chart) as a key element of a detailed response to a large-scale immunization review and survey being conducted by the PHAC (i.e. the Public Health Network Council, the CIC, and NACI) in the Spring/Summer of 2010. Notably, the ultimate goal of this review/survey initiative is to determine optimal structures, processes, and roles for the efficient development of timely, evidence-based immunization recommendations in Canada – while building on the strength of the current system. In addition to providing industry input as part of this PHAC review process, the VIC will also continue to engage stakeholders in the development of new models for vaccine funding, i.e. by building support for sustainable financing solutions across F/P/T governments and target patient/advocacy groups. After receiving initial feedback from individual stakeholder groups, the VIC plans to modify and disseminate its recommendations more widely, with the broad goal of building Canada's capacity to develop and adopt innovative vaccines.
Figure 10.1 – VIC Vision for Vaccine Program Development and Funding

Proposed Process to Achieve Equitable and Timely Access to Immunization Programs across Canada

In essence, the VIC aims to provide a stimulus to move forward by taking tangible steps towards developing future models to enhance vaccine governance, funding and timely patient access – to help ensure Canada remains among those leading countries with equitable, sustainable immunization systems that keep abreast of evolving public health needs. In proposing such models, the VIC will continue to proactively argue the case that immunization programs provide excellent value for money spent, particularly in terms of their broad medical, societal and economic impact. The VIC will also continue to advocate for greater financial support of immunization resources across all F/P/T decision makers, and intends to work in partnership with the PHAC and F/P/T jurisdictions to help shape a reinvigorated National Immunization Strategy (NIS).
Conclusion

The first decade of the 21st century has been deemed as the most productive in the history of vaccine development, with the arrival of a broad range of lifesaving vaccines to protect against a host of infectious diseases. On the global horizon, many novel “high-performance” (safer, more effective) vaccines and delivery technologies – as well as next-generation therapeutic vaccines to treat diseases that today seem unconquerable – are also anticipated to emerge from an exceptionally rich pipeline. Indeed, it is widely believed that we are entering into a “new golden era of vaccinology”, and there is every reason to believe that immunization will continue far into the future as a vital mainstay of public health, with an ever-expanding roster of new disease prevention and treatment opportunities. As key contributors to the dynamic vaccine development landscape, Canada’s scientists and companies continue to lead efforts to improve health worldwide, through commercialization of cutting-edge vaccine technologies. Yet the accelerated growth and bright prospects of the Canadian vaccine sector have been accompanied by a new set of complex challenges, particularly in terms of adapting to rapid change, and in formulating optimal strategies for vaccine program development and delivery within the public sector.

Despite recent successes in decreasing the incidence of vaccine-preventable diseases, Canada’s current immunization system is still considered fragile (with undesirable duplication of efforts, inconsistencies, and delays); major reform is urgently needed to safeguard its tremendous value and potential public health impact in the near- and longer-term future. In addressing this call to action, unlocking the full promise of vaccination will demand significant attention to developing alternative future models for: i) efficient immunization governance (including predictable recommendation procedures); ii) permanent/sustainable funding mechanisms; and iii) and fair, transparent procurement systems. Overall, an updated immunization system is needed to support timely access to innovative vaccines, placing patient needs explicitly at the forefront. Furthermore, to facilitate vaccine program adoption, renewed investment and bold leadership across all F/P/T levels will be required in advancing enhanced policy frameworks that ensure effective oversight, consensus-building, and sharper focus on accountability.

Collectively, in leveraging past achievements in improving Canada’s vaccination system, all relevant stakeholders will be required to develop innovative collaborative approaches to strengthen the existing immunization infrastructure, with the goal of securing the quality, harmonization and sustainability of national vaccination programs as critical cost-effective solutions in protecting public health. While the recent H1N1 outbreak has yielded valuable lessons – in retrospect – that may help shape the future of immunization practices in Canada (including the need for continued vaccine R&D momentum, increased production capacity, and improved communication plans to rebuild public trust), the imminent arrival of therapeutic vaccines also underscores the need to proactively develop appropriate new models for recommendation, financing and procurement of keenly anticipated groundbreaking vaccine technologies.

In the spirit of collaboration, and under the broader VIC mandate to work with key immunization partners in creating an enabling vaccine environment in which Canadians are ensured full, timely access to existing and emerging vaccines, the VIC has put forward the recommendations contained herein for consideration by F/P/T governments and other stakeholders. These recommendations are proposed to help realize an ideal future vision – that when the next breakthrough vaccine arrives in Canada, patient access will not be hindered by undesirable discrepancies or delays in implementing an equitable, nationally coordinated immunization program. Ultimately, in building upon Canada’s current immunization foundation, and working towards a modern, more efficient paradigm in vaccination program oversight, it remains incumbent upon each stakeholder group to do its part (in open consultation with other participants) in advancing the Canadian vaccine enterprise to the next level of success.
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