

OncoSim

CERVICAL





Overview

OncoSim is a tool built using Canadian data, collaboratively by a team of clinicians, epidemiologists, statisticians, mathematical modellers, and health economists, all experts in their respective fields. Its projections have also been compared to real-world data. The tool helps researchers, policy advisors, and decision-makers project the impact of policy change and support resource allocation decisions related to cancer control. It helps fill information gaps when data is lacking or where clinical trials or practice experiments are not feasible.

Why OncoSim is a game changer

OncoSim is a free, web-based simulation tool that evaluates cancer control strategies. Combining data from the real world, expert opinion, and the published literature, OncoSim projects health and economic outcomes and attributes them to 27 risk factors, such as smoking and inadequate physical activity. It currently models four cancer sites (breast, colorectal, lung, and cervical) and related screening programs in detail, and it provides high-level projections for 28 other cancer sites. This unique and sophisticated tool is used by decision-makers across Canada to better understand the impact and value of cancer control investments.

Working for you

OncoSim has helped policy analysts, clinicians, researchers, and program managers assess and report on a variety of cancer control issues. Built for public sector use, OncoSim is available free on an online platform with 24/7 access. Users can export OncoSim's projections to a computer for reference, analysis, and presentation.

OncoSim-Cervical

OncoSim-Cervical is a mathematical simulation model of cervical cancer; it reflects disease progression and clinical treatment pathways consistent with current knowledge and evidence-based practice of cervical cancer in Canada. The model simulates human papillomavirus (HPV) infection and cervical cancer progression in two steps.¹ First, it simulates infectious disease spread of HPV through sexual interactions and detailed HPV vaccination strategies using an interactive-agent model. Next, detailed HPV infection rates from the interactive-agent model are entered into a Monte-Carlo microsimulation model, which simulates the pathway from HPV infection to the onset of cervical cancer among infected individuals and subsequent disease progression. The population in the microsimulation model replicates the Canadian population. The model projects outcomes, such as life-years and health care costs, at the provincial/territorial- and national-level. Examples of outputs related to cervical cancer screening include the number of cervical cancer screens, the number of invasive follow-up tests (e.g. biopsies), and costs associated with screening and follow-up.

Model input

The model was built using Canadian data, whenever available, from a wide range of sources including Canadian vital statistics, community health surveys, cancer registries, screening program databases, administrative databases, and peer-reviewed literature. The input was supplemented with expert opinion when necessary. Users can change the model input to answer specific policy questions.

HPV transmission and vaccination

OncoSim-Cervical includes six HPV groups (6, 11, 16, 18, other non-carcinogenic, and other carcinogenic) and two types of vaccine (bivalent and quadrivalent). To compare vaccination strategies, users can specify the vaccination program characteristics, such as target age, sex, program years, participation rate, vaccine type, vaccine efficacy, duration of protection, previous vaccination status in target population, and vaccination costs.

Screening

The model includes a historical overview of cervical cancer screening in Canada and a default future screening scenario. To compare screening strategies, users can specify the eligibility criteria for screening, modality of screening (e.g. cytology vs. HPV test), participation and compliance rates, vaccination status, the frequency of screening, the effectiveness of screening, follow-up protocols, pre-cancers and wart treatments, and healthcare costs.

Disease progression and quality of life

OncoSim-Cervical simulates disease progression and remission using the observed cervical cancer incidence rates and stage distribution in the Canadian Cancer Registry. The model assumes that individuals with cervical cancer have a lower health-related quality of life than the general population; health-related quality of life varies by stage and declines further during treatment.

Costs associated with cervical cancer

The model includes health care costs associated with cervical cancer from the perspective of the public payer: physician visits, laboratory services, hospitalization, chemotherapy, radiotherapy, and drugs. The default treatment costs were estimated through a costing exercise by a pan-Canadian oncology expert panel. Users can modify costs to reflect treatment patterns and costs in specific jurisdictions.

Questions the model answers

Using OncoSim-Cervical, users can estimate the economic burden of cervical cancer and the impact of interventions on cervical cancer-related outcomes. The model has been applied to compare cervical cancer screening and HPV vaccination strategies.¹⁻⁶

Validation

Work is ongoing to compare OncoSim-Cervical's projections with observed data in cervical cancer screening trials and more recent data in the Canadian Cancer Registry and cervical cancer screening programs.

References

1. Miller AB, Gribble S, Nadeau C, et al. Evaluation of the natural history of cancer of the cervix, implications for prevention. The Cancer Risk Management Model (CRMM) - Human papillomavirus and cervical components. *Journal of Cancer Policy* 2015; 4: 1-6.
2. Lacombe J, Gauvreau C, Memon S, et al. Exploring the health outcomes of various pan-Canadian cervical cancer screening programs using microsimulation modeling. *American Journal of Epidemiology* 2016; 184(1): 79.
3. Popadiuk C, Coldman A, Memon S, et al. Comparing the health and economic impacts of cervical cancer screening strategies using the Cancer Risk Management Model (CRMM). *Gynecologic Oncology* 2016; 141: 63.
4. Popadiuk C, Gauvreau CL, Bhavsar M, et al. Using the Cancer Risk Management Model to evaluate the health and economic impacts of cytology compared with human papillomavirus DNA testing for primary cervical cancer screening in Canada. *Current Oncology* 2016; 23 (Suppl 1): S56-S63.
5. Popadiuk C, Decker K, Gauvreau C. Starting cervical cancer screening at 25 years of age: the time has come. *CMAJ* 2019 January 7;191: E1-2.
6. Smith A, Baines N, Memon S et al. Moving towards the elimination of cervical cancer: modeling the health and economic benefits of increasing HPV vaccine uptake. *Current Oncology* 2019; 26(2): 80-84.

About the Canadian Partnership Against Cancer

The Canadian Partnership Against Cancer was created by the federal government in 2006 with funding through Health Canada to work with Canada's cancer community to implement the Canadian Strategy for Cancer Control to reduce the incidence of cancer, lessen the likelihood of Canadians dying from cancer, and enhance the quality of life of those affected by cancer.

OncoSim is led and supported by the Canadian Partnership Against Cancer, with model development by Statistics Canada, and is made possible through funding by Health Canada.

Production of this brochure has been made possible through a financial contribution from Health Canada. The views expressed herein represent the views of the Canadian Partnership Against Cancer.

Contact Us

Please direct questions and correspondence about OncoSim to:

Canadian Partnership Against Cancer
145 King Street West, Suite 900
Toronto, Ontario, Canada M5H 1J8

Telephone: 416-915-9222

Toll free: 1-877-360-1665

Email: oncosim@partnershipagaincancer.ca
www.oncosim.ca

