

# EpiNORTH

The Northwest Territories' Epidemiology Newsletter

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## Vitamin D: Improving Northern Exposure

*Northern Nutrition Association*

Vitamin D is in the media limelight, where links between Vitamin D and disease conditions are made almost daily. Vitamin D has not been discussed in EpiNorth since 1998 but in light of recent attention, it seems timely to revisit it. It has only been 34 years since fluid milk was fortified with Vitamin D in order to support bone health,<sup>1</sup> however Vitamin D's role in bone health is likely the tip of the iceberg. This article will look at risk factors, roles of Vitamin D, current conflicting recommendations, and ideas for next steps involving the health sector.

### Risk factors Associated with Inadequate Vitamin D

Ultra violet (UV) light exposure is considered the principal source of Vitamin D for humans.<sup>2</sup> Humans synthesize Vitamin D when bare skin is exposed to UVB rays.<sup>3</sup> Exposure to sunlight is influenced by geographical latitude, cloud coverage, skin pigmentation, clothing and the use of sunscreen. Because ozone blocks UVB rays, Vitamin D synthesis is possible year-round close to the equator. At northern latitudes, as sunlight travels through the earth's atmosphere at an increased angle of penetration, UVB intensity is weak, especially during the winter.<sup>4</sup>

As a result, people in the North may be particularly vulnerable to inadequacies. Studies have shown that as far south as Edmonton, AB (52° north), from October to May, Vitamin D<sub>3</sub> (active form of Vitamin D) skin production is almost nonexistent. Even in northern summers May to October, skin may be covered due to cooler temperatures or prevention of insect bites. Darker skin pigmentation decreases Vitamin D production and requires 10 - 20 times more exposure to sunlight to make the same amount of Vitamin D as light skinned adults.<sup>5</sup>

Vitamin D also comes from natural food sources, fortified foods and supplements. The most significant natural sources include fatty and cold water fish such as; char, lake trout, seal liver, fish liver, arctic sea mammal fats (such as muktuk), sea mammal livers and cod-liver oil.<sup>6</sup> In-land traditional foods like caribou kidney, caribou liver, muskox fat and whitefish contain moderate sources of Vitamin D.<sup>6</sup>

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## HOW TO REACH EPINORTH

Letters to the editor and articles are welcome but may be edited for space, style and clarity. Please contact the Managing Editor for article guidelines. All submissions must be sent electronically.

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## Editor's Notes:

*Janet Hopkins, Managing Editor, EpiNorth, Department of Health and Social Services*

*EpiNorth's* mandate is to provide quality information on disease patterns and trends and health determinants relevant to the people of the NWT. The newsletter is also intended to provide an opportunity for all those involved in health promotion, disease prevention and disease control activities to share their experience and exchange information with regard to new initiatives, best practices and program evaluations.

The current issue of *EpiNorth* contains four articles:

1. The Northern Nutrition Association provides an article that discusses the risk factors, roles of Vitamin D, current conflicting recommendations, and ideas for next steps involving the health sector currently recommended to optimize the health of NWT residents.
2. Lisa Hall, Public Health Project Support, Department of Health and Social Services and Dr. Andrew Kotaska, Obstetrics/Gynecology, Stanton Territorial Health Authority provide an article on how improved knowledge of the role of HPV in cervical cancer is now being incorporated into screening recommendations for the new NWT Cervical Cancer Screening Guidelines.
3. Lisa Hall, Public Health Project Support, Department of Health and Social Services, Marcia Campbell, Cancer Screening Program Coordinator, Stanton Territorial Health Authority, Dr. Tom Guzowski, Stanton Territorial Health Authority and Anthony Leamon, Chronic Disease Epidemiologist, Department of Health and Social Services provide us with the information that although the mortality rate due to colorectal cancer in the NWT is among the highest in the country, colorectal cancer is "preventable, treatable and beatable".
4. A report providing statistical analysis and showing the decline in cases of chickenpox since the implementation of the NWT Varicella Vaccination Catch-Up Program is provided by Dawn Smith, HSS Summer Student, Wanda White, Communicable Disease Specialist and Maria Santos, NWT Epidemiologist, HSS.

Helen MacPherson, Senior Disease Registry Officer, provides an update on the Incidence of Disease in the NWT.

As always we invite your comments or suggestions regarding articles that appear in *Epi-North*.

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Some studies have shown that traditional foods are not consumed as much as in the past.<sup>7,8,9,10,11</sup> For example, a study from Barrow, Alaska (latitude 71.3°N), showed that Vitamin D intakes are low, especially among those not consuming a traditional diet.<sup>12</sup> Fortified food sources of Vitamin D include milk, margarine, breakfast cereal, enriched flour and many brands of yogurt.

Pregnant women and breastfed infants can also be at increased risk. During pregnancy, maternal Vitamin D levels are thought to determine infant Vitamin D status at birth and may even program childhood bone development.<sup>13</sup> Studies indicate Vitamin D inadequacy of many pregnant women and newborns within Aboriginal and First Nations populations,<sup>14,15</sup> and exclusively breastfed babies are at risk as breast milk is not a sufficient source of Vitamin D to offset inadequate sunlight exposure.<sup>16</sup> Obesity is another risk factor for Vitamin D inadequacy.<sup>17</sup> One study indicates that this is likely due to Vitamin D being sequestered in excess adipose tissue and therefore having limited bioavailability in those who are obese.<sup>12,18</sup>

## Roles of Vitamin D

The role of Vitamin D in bone health is well established. Vitamin D is essential for promoting intestinal calcium absorption and maintaining healthy serum concentrations of calcium and phosphorus, which enables bone mineralization. Without Vitamin D, only 10–15% of dietary calcium and about 60% of phosphorus is absorbed.<sup>19</sup> Vitamin D inadequacy impairs bone tissue mineralization, causing bone softening. This manifests as rickets in children and osteomalacia in adults.<sup>3,20</sup> Vitamin D inadequacy prevents children from attaining peak bone mass and in adults, this leads to progressive loss of bone which increases the risk of osteoporosis.<sup>21</sup>

Recent research has explored the role of Vitamin D in non-skeletal functions that involve regulating cell growth, immunity and metabolism.<sup>22</sup> In the past, it was believed that only the kidneys had the ability to convert Vitamin D to its active form; it is now known body tissues such as the breast, brain, prostate, pancreas and colon have receptor sites for Vitamin D and can respond to the active Vitamin form, 25(OH)D. Vitamin D interacting with these receptors may result in a variety of biological responses that influence disease processes.<sup>17</sup>

Vitamin D inadequacy has been associated with asthma, autoimmune diseases such as multiple sclerosis (MS) and rheumatoid arthritis, abnormal muscle function, inflammatory bowel disease, dental caries, resistance to

tuberculosis, diabetes, and certain types of cancer including colorectal, breast and non-Hodgkin's lymphoma.<sup>17</sup> Clinical deficiencies have been associated with congestive heart failure and blood levels of inflammatory factors including C-reactive protein and interleukin-10.<sup>23</sup> Correcting for frank deficiencies has resulted in normalization of blood pressure.<sup>18</sup> Vitamin D also affects various stages of the lifecycle. Research suggests that fetal health and infancy is affected by Vitamin D intakes and the likelihood of developing chronic diseases later in life.<sup>17</sup>

Such evidence linking Vitamin D and chronic disease is prompting experts to consider higher recommendations than previously considered. The current Adequate Intake (or recommended average daily intake level) of 200 IU/day for adults is based on intakes needed to prevent rickets. This requires a maintained serum 25(OH)D level of 30 nmol/L,<sup>24</sup> whereas a serum 25(OH)D of 90–100 nmol/L has been viewed as optimal to prevent chronic diseases such as MS, cancer and impaired muscular function.<sup>19</sup> To achieve higher serum values, higher dietary intakes are necessary. Independent of sun exposure, dietary intakes of 1600 – 2000 IU/day may be needed to raise serum levels from 30 nmol/L to 90–100 nmol/L.<sup>19</sup>

## Vitamin D Recommendations – A Review

The Northwest Territories, Pan-Territorial, Canadian and International recommendations indicate a number of different values, likely reflecting specific conditions or geographic locations. A brief review follows:

### NWT

In 2007, the NWT approved Clinical Practice Guidelines for Vitamin D supplementation for infants and children less than 2 years. According to these recommendations, breastfed infants and children less than 2 years should be supplemented with 400 IU/day from May to September and 800 IU/day from October to April. For artificially fed infants, children less than 2 years of age as well as children older than 2 years who do not drink Vitamin D enriched milk, supplementation of 400 IU is recommended from October to April.

### Pan-Territorial and Alaska

An informal survey north of 60 indicates that Nunavut has Vitamin D supplement recommendations for prenatal women and infants (the NWT Clinical Practice Guidelines are based on those from Nunavut). Nunavut is currently looking at their Vitamin D

recommendations.<sup>25</sup> Information was not available from the Yukon at this time. In Alaska, supplementation recommendations exist for breastfed infants and infants receiving less than 1 litre of formula per day.<sup>26</sup>

## Canada and the United States

There is considerable variation in Vitamin D recommendations, as indicated in *Table 1*.

**Table 1: A Comparison of Vitamin D recommendations - Canada and the US**

Organization	Population Groups - Adequate Intake Levels (IU/day)						
	Infants	1-8 years	9-18 years	19-50 years	51-70 years	>70 years	Pregnancy and lactation
Institute of Medicine (IOM) <sup>15</sup>	200	200	200	200	400	600	200
Health Canada <sup>27,28</sup>	400 (breastfed)	200	200	200	400	400	200
American Academy of Pediatrics <sup>16</sup>	400	400	400				
Canadian Cancer Society <sup>17</sup>			1000	1000	1000	1000	
Canadian Dermatology Society <sup>16</sup>					1000 supplement	1000 supplement	
Canadian Pediatric Society <sup>18</sup>	400 (800 for infants in northern communities during winter)						2000
Osteoporosis Canada <sup>29</sup>					400	800	400

Table adapted from: Dietitians of Canada. Current Issues – The Inside Story. Vitamin D: Current Dilemmas. May 2008.

## European Circumpolar Countries

Recommendations in circumpolar countries use Dietary Recommended Intakes from the US, Canada and the United Nations University. All Nordic Countries use the same recommendations. These countries state that meeting dietary requirements is important at northern latitudes<sup>27</sup> and suggest that sun exposure (legs, arms, face) for 6–8 minutes, 2–3 times a week should be able to meet Vitamin D recommendations.<sup>23</sup>

**Table 2: Vitamin D Recommendations – Circumpolar Europe**

Country	Population Groups (IU)							
	3mths	9mths	5 yrs	10yrs	15 yrs	25 yrs	50yrs	70 yrs
Iceland		400	400	400	400	400	400	600
Nordic: Sweden, Finland, Norway, Denmark		400	300	300	300	300	300	400
Russian Federation	400	400	100	100	100	100	100	100

Source: Doets EL, et al. Current micronutrient recommendations in Europe: towards understanding their differences and similarities. *European Journal of Nutrition* 47, Suppl 1(2008):17–40.

Given the research that links Vitamin D and chronic disease, current recommendations may be considered too low by many experts. In May 2010, the Institute of Medicine (IOM) is scheduled to release updated recommendations for Vitamin D and calcium for Canada and the US.<sup>28</sup> The IOM Committee will examine current evidence of adequacy in US and Canadian populations using systematic evidence-based reviews; determine an Estimated Average Requirement; update current Dietary Recommended Intakes and identify research gaps.

## Next Steps

In light of media attention, questions from the public and what is emerging about the benefits of Vitamin D, the Northwest Territories health sector may be interested in collaborative action to address adequate intakes of this important nutrient. It was noted in the IOM description of activities that no particular focus has been placed on northern population groups. We have contacted the IOM Vitamin D and Calcium Review Committee regarding the need for recommendations specific to northern latitudes.

We also are considering the following areas as next steps:

- Increased awareness that would highlight the benefits of optimal Vitamin D intakes for the prevention of bone related conditions. Between July 2002 and June 2004, there were 150 reports of rickets among children living in Canada. Of these, 104 were confirmed to be due to Vitamin D deficiency. Of children older than 1 year, the incidence rates were highest among those in the north<sup>3</sup> (Yukon Territory, Northwest Territories and Nunavut).
- Increased awareness that would highlight the benefits of Vitamin D for the prevention of chronic diseases throughout the lifecycle. According to the Health Status Report (2005), rates of chronic diseases linked to inadequate intakes of Vitamin D are on the rise in the NWT. Other conditions related to Vitamin D are also problematic, such as tuberculosis and dental diseases.
- Continued promotion of traditional, natural and fortified food sources of Vitamin D perhaps with the Department of Health and Social Services, health organizations and other territories through a pan-territorial approach.
- Continued promotion of current NWT recommendations for infants as per the NWT Clinical Practice Guidelines<sup>20</sup>
  - ◆ breastfed infants and children < 2 years:
    - 400 IU/day May to September
    - 800 IU/day October to April
  - ◆ artificially fed infants and children < 2 years who don't drink Vitamin D enriched milk:
    - 400 IU from October to April
  - ◆ children > 2 years who do not drink Vitamin D enriched milk:
    - 400 IU from October to April

- Consideration of Vitamin D supplementation for other groups at risk including older children and adults who do not drink milk or fortified soy beverages, those on limited incomes and adults over 50 years of age.<sup>29</sup>

Standardization of recommendations for Vitamin D for all age groups is an important issue for health professionals across the NWT. Given issues of food insecurity and poor dietary intakes as well as the many other confounding factors that affect Vitamin D status in the North, collaborative promotional efforts are needed.

The May 2010 IOM Review will provide expert guidance on Vitamin D. Following the release of their recommendations, or even sooner, the Northern Nutrition Association suggests that NWT health professionals meet to discuss Vitamin D and develop standardized recommendations applicable to our geographic and cultural demographic in order to protect and optimize the health of the NWT residents we serve.

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## New NWT Cervical Cancer Screening Guidelines

Lisa Hall – Public Health Project Support, Office of Chief Public Health Officer, Department of Health and Social Services

Dr. Andrew Kotaska – Obstetrics/Gynecology, Stanton Territorial Health Authority

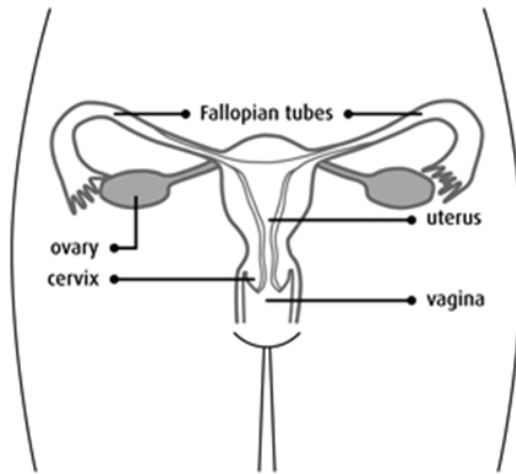
Cervical cancer is the 13th most frequently diagnosed cancer for Canadian women.<sup>1</sup> It is among the top five cancers affecting women in the NWT, constituting 4% of all cancer diagnoses.<sup>2</sup> Where cervical cancer screening programs have been established in communities, a significant reduction in cervical cancer incidence rates has followed.<sup>3</sup> Even with the documented success of screening programs, some women remain unscreened. Approximately 50% of the women who are diagnosed with cervical cancer each year have never been tested, and another 10% have not been tested within the five-years before diagnosis.<sup>4</sup>

With rapidly evolving technologies and new research around the Human papillomavirus (HPV), revised cervical cancer screening guidelines have been developed for the NWT. These guidelines are based on up-to-date evidence and outline specific changes to our current screening methods. The guidelines have modified the age for onset of screening and recommend that annual screening is no longer necessary for all women. In addition, HPV-related technologies have provided new insight and will assist with the screening process.

### What is Cervical Cancer?

Cervical cancer develops in the cells of the cervix. The cervix is the lower part of the uterus which forms the neck of the uterus, opening into the vagina (*Figure 1*).<sup>5</sup> Before cervical cancer develops, cells of the cervix change and become abnormal. This change is called dysplasia of the cervix, and is a common change occurring in many women. Dysplasia is a precancerous condition that usually does not develop into cancer. However, if left untreated, dysplasia can eventually lead to cervical cancer.<sup>6</sup>

Figure 1: Diagram of female reproductive organs



### Human papillomavirus (HPV)

Human papillomavirus has a significant impact on the development of cervical cancer. High-risk papillomavirus types are present in over 95% of cervical cancers.<sup>7</sup> Cervical cancer occurs through a series of four steps:<sup>8</sup>

- HPV transmission
- HPV persistence
- Development of precancer in persistently infected cells
- Invasive cervical cancer

While HPV infections are present in almost all cervical cancer cases, infection with the virus does not necessarily result in cervical cancer. In fact, most women have likely been infected with at least one type of HPV at

some point in time,<sup>9</sup> and 90% of cervical infections with cancer-related HPV are cleared spontaneously within two years.<sup>10</sup>

The prevalence of HPV is highest among sexually active young women,<sup>11</sup> with about 50% of women in their early twenties and younger acquiring a HPV infection within three years of sexual debut.<sup>12</sup>

### Vaccinating Against Cervical Cancer

The HPV types most commonly linked to cancer are HPV16 and HPV18.<sup>13</sup> Together they are responsible for over 70% of cervical cancers.<sup>8</sup> The NWT has recently launched a HPV Vaccine Program targeted toward school-age girls that protects against these two types of HPV. The vaccine being used is the Gardasil™ vaccine, which should be administered intramuscularly in the deltoid muscle as 3 separate 0.5 ml doses, according to the following schedule:

- First dose:** At elected date
- Second dose:** 2 months after the first dose
- Third dose:** 6 months after the first dose

The vaccine also protects against HPV6 and HPV11, which are associated with the development of 90% of genital warts cases.<sup>14</sup>

The HPV vaccine will be offered to all Grade 4, 5, and 6 girls beginning in the 2009-2010 school year. A catch-up program will also be implemented over the next five years as outlined in *Table 1*.

**Table 1: HPV Vaccine Catch-up Program Schedule**

School Year	Grade
2009-2010	11 and 12
2010-2011	10 and 11
2011-2012	9 and 10
2012-2013	9
2013-2014	9

The vaccine is also to be made available upon request to all girls who may have left school up to the age of eighteen. A parent or guardian must sign a consent form for girls under fourteen years of age. As HPV is so widespread and difficult to prevent in those who are sexually active, vaccination presents a new option for the prevention of HPV infection.

Another benefit of prophylaxis with the HPV vaccine is the subsequent reduction in the number of tests required to investigate abnormal Pap test results. A reduction in number of treatments for cervical abnormalities would also be beneficial, as some

treatments have associated adverse effects. For example, loop electrosurgical excision procedure (LEEP) is a treatment for cervical intraepithelial neoplasia.

Women who have undergone a LEEP procedure are at higher risk for preterm births, and are more likely to deliver infants with low birth weight.<sup>15</sup> The HPV vaccine will not only reduce the number of cervical cancer cases, but also avoid potentially harmful long-term consequences related to treatment.

### Risk Factors

HPV is the main risk factor for developing cervical cancer. HPV can lead to precancerous cells in the cervix, and is spread through intimate sexual activity with a partner of either gender. This includes intercourse, as well as any digital or oral sexual activity involving the genital area. *Table 2* outlines other risk factors for both HPV infection and cervical cancer.

**Table 2: Risk Factors for HPV Infection and Cervical Cancer**

Risk Factors	
<b>Sexual Partners</b>	Multiple partners or a partner with multiple partners is the most consistent risk factor for HPV infection <sup>16</sup>
<b>Irregular screening</b>	Not receiving regular Pap tests is related to a higher risk of cervical cancer <sup>4</sup>
<b>Immune System</b>	Immunosuppression or immune deficiency (HIV/AIDS, transplantation, long-term steroid use) results in a higher risk of HPV infection and HPV is more likely to persist <sup>10</sup>
<b>Smoking</b>	Smoking has been found to be positively associated with HPV infection <sup>17</sup> Smoking also greatly increases the risk of cervical cancer, especially for women with persistent HPV infection <sup>18</sup>
<b>Sexual Activity</b>	A young sexual debut increases risk of HPV infection <sup>16</sup>
<b>Contraceptives</b>	An association has been found between oral contraceptive use and HPV infection <sup>9</sup>
<b>Condom Use</b>	Women whose partners use condoms are at a lower risk of acquiring HPV infection <sup>19</sup>
<b>Medication</b>	Women whose mothers took diethylstilbestrol when pregnant have a 1 in 1000 risk of developing clear-cell adenocarcinoma of the vagina or cervix <sup>10</sup>
<b>Parity</b>	Among women with persistent HPV infection, high parity (the number of times a woman gives birth) increases the risk of cervical cancer by at least two-fold <sup>18</sup>
<i>Some women still develop cervical cancer without any of these risk factors.</i>	

### Screening Tests

#### Papanicolaou (Pap) Test

The Pap test is a screening test for precancerous changes of the cervix.<sup>20</sup> It is able to detect abnormal changes early to allow for more effective treatment. An abnormal Pap

**Colposcopy is done when a Pap test result shows abnormal changes in the cells of the cervix.**

test must be followed by another Pap test at a later date, colposcopy, or cervical biopsy for confirmation of the results.<sup>10</sup> Exact course of action depends on the specific result of the Pap test, age of the patient, and their medical history.

Health care providers in the NWT use liquid-based cytology (LBC) for Pap tests. A sample of cervical cells is collected using a cytobrush. The sample is placed immediately in a liquid fixative medium, and sent to the laboratory where a slide is prepared for examination.<sup>10</sup> The immediate fixation serves to reduce sampling errors.<sup>20</sup>

### HPV testing

HPV testing detects HPV DNA within cervical cells. It focuses on the HPV strains that are known to be cancer-causing, or "high-risk". A major advantage of using LBC is it allows for HPV testing on the same sample, giving the health care provider a more complete picture of the patient's health. For women over twenty-one years of age, HPV testing can triage the patient into a high-risk group, affecting the health care practitioner's course of action.<sup>21</sup> As HPV is associated with over 95% of cervical cancers,<sup>7</sup> its absence is very reassuring. HPV testing can reduce repeat testing and women's concerns over Pap test results.<sup>10</sup>

HPV testing is only useful in specific clinical circumstances, as even high-risk HPV infections are common and usually clear spontaneously. The complete clinical practice guidelines outline the specific use of HPV testing in the NWT. Routine HPV testing is not beneficial.

### Colposcopy

Colposcopy is performed to follow up abnormal Pap test results. A colposcope shines a light onto the cervix and can magnify the cervix by 2-60 times.<sup>22</sup> If a health care provider notices abnormal areas during colposcopy, a biopsy may be performed. This involves removing a small piece of abnormal tissue from the cervix for examination under a microscope. Biopsy is usually required for a definitive diagnosis of cervical cancer.<sup>5</sup>

### Screening Recommendations

The updated guidelines recommend that cervical cancer screening begins three years after the onset of intimate sexual activity, or at age twenty-one, whichever occurs earlier. Intimate sexual activity includes intercourse, as well as digital or oral sexual activity involving the genital area, with a partner of either gender.

Women who have never been sexually active have a low probability of developing cervical cancer.<sup>21</sup> However, any intimate sexual activity, as defined under Screening Recommendations, can transmit the HPV virus. If there is any doubt whether a woman has ever had intimate sexual contact, Pap screening should be initiated.

Individuals younger than twenty-one years of age and those who haven't been sexually active for three years are not screened. Cervical cancer is rare in women under twenty-one years of age and is a disease that progresses very slowly.<sup>10</sup> Progression from HPV infection to precancer usually takes five to ten years, and the development of invasive cervical cancer may take years longer.<sup>8</sup> Furthermore, HPV infections in women who have recently become sexually active are likely to clear spontaneously.<sup>10</sup> Waiting until women are twenty-one years of age or have been sexually active for three years will avoid the potential harms of overscreening, while still allowing abnormal changes to be detected at a pre-invasive stage.<sup>10</sup>

If a woman's first Pap test result is negative, the test should be repeated annually until there are three consecutive normal tests. At this point, the Pap test should be performed every two years if results remain normal.

If a Pap test result is positive, course of action depends on the cytological result. For mild abnormalities, follow-up processes depend on the woman's age and medical history. For example, presence of HPV along with an abnormal result may place the woman in a high-risk category, referring her for colposcopy, whereas absence of HPV allows her to return to routine screening. Referrals for colposcopy are automatically made for any severe abnormalities detected by the Pap test.

Women age sixty-nine and older may discontinue screening if they have had three or more normal Pap tests in the last ten years, and have no history of cervical cancer, high-grade squamous intraepithelial lesions (HSIL), or glandular lesion. If no prior screening has been done, the woman should have three annual Pap tests, and then discontinue screening if the results are normal. Cervical cancer among older women is rare, and exists almost entirely among unscreened or under screened women.<sup>10</sup> For women age sixty-nine or older, the benefits of cervical cancer screening is minimal.

### Special Considerations

While it is safe for women with negative screening histories to be screened every two years, some women should continue to be screened annually. Women with immunosuppression should be screened with a Pap test

every six months until there are two normal tests, and then continue at twelve month intervals. This includes women who are HIV positive, have had an organ transplant, or have been on long-term steroids. Immunosuppressed women are at higher risk for HPV infection, precancerous lesions, and invasive cervical cancer,<sup>10</sup> as previously outlined in the Risk Factors section.

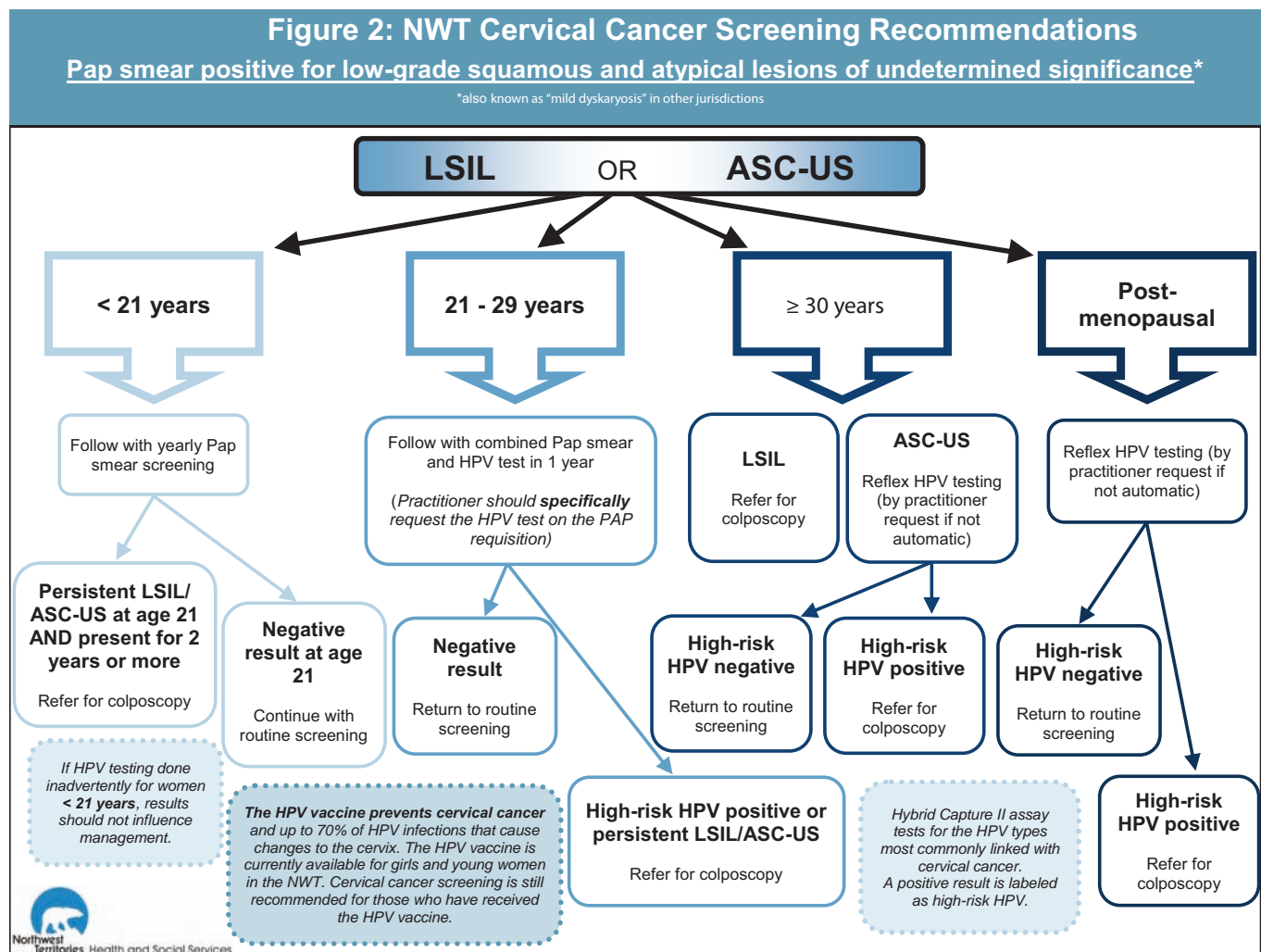
Women with a history of cervical cancer, high-grade squamous intraepithelial lesions (HSIL), adenocarcinoma in situ (AIS), or invasive cervical cancer should also be screened annually for life. Women who have had a hysterectomy with the cervix removed may discontinue screening as long as there is no history of high-grade lesions. If there is prior history, vaginal vault Pap tests should be performed annually. For women who have had a hysterectomy and retained their cervix, they should continue with routine Pap screening.

Pregnant women should be screened with a Pap test if it has been more than one year since the last Pap test. If the result is a mild abnormality, the Pap test should be repeated six months postpartum.

Figure 2 outlines recommended procedures for low-grade squamous and atypical lesions of undetermined significance. Complete clinical practice guidelines for cervical cancer screening in the Northwest Territories are available online from the NWT Health and Social Services website: <http://www.hlthss.gov.nt.ca/>.

### Conclusions

The updated 2010 cervical cancer screening guidelines for the NWT have identified HPV testing as being an important part of future direction with cervical cancer screening. With HPV vaccination now available, women of the Northwest Territories are presented with an



unprecedented option for the prevention of cervical cancer. As annual screening is no longer recommended for all women, the updated guidelines will also help prevent anxiety and potential harms of overscreening, while maintaining efficiency at detecting precancerous changes to the cervix.

Screening programs are highly successful in decreasing cervical cancer rates when implemented. Programs aim for high coverage rates to ensure the successful reduction in number of cases, with over half of the women diagnosed not receiving adequate screening. Women in the NWT are encouraged to visit their health care provider for more information and to talk about getting tested.

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# Introduction of NWT Colorectal Cancer Screening Guidelines

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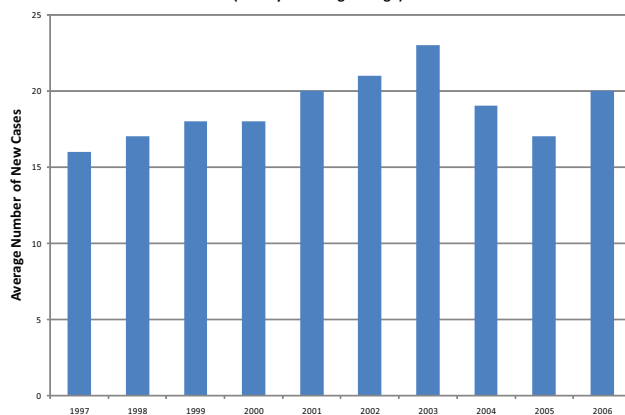
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Colorectal cancer (CRC) is the second leading cause of cancer-related death for men and women in Canada. In 2009, an estimated 22,000 Canadians were diagnosed with colorectal cancer and 9,100 died from it.<sup>1</sup>

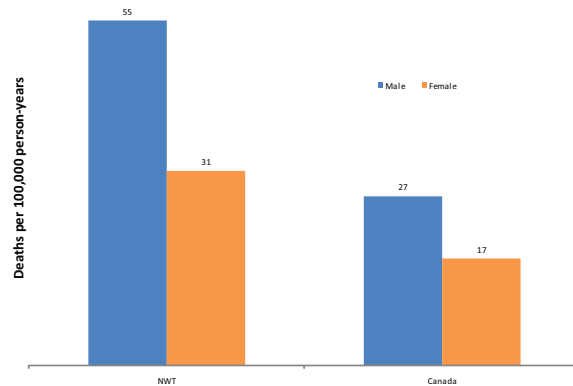
The incidence of colorectal cancer in the Northwest Territories is among the highest in the country. Men are 1.5 times more likely, and women 1.3 times more likely to be diagnosed with colorectal cancer than their Canadian counterparts.<sup>2</sup> Almost 20 NWT residents were diagnosed with colorectal cancer each year, from 1997 to 2006. As seen in *Figure 1*, the average number of new cases of colorectal cancer diagnosed each year from 1997 to 2006 in the NWT has remained fairly constant.<sup>2</sup>

**Figure 1: Average Number of New Cases of CRC in the NWT 1997-2006 (three-year rolling average)**



The mortality rate due to colorectal cancer in the NWT is also among the highest in the country. The risk of dying from CRC in the NWT for men is 2 times higher, and for women 1.8 times higher than the rest of Canada. This trend is shown in *Figure 2*.<sup>2</sup>

**Figure 2: Age-Standardized Mortality Rates for Colorectal Cancer by Sex, NWT and Canada<sup>ii</sup>**



<sup>i</sup>2000-2004 Average for NWT  
<sup>ii</sup>2004 for Canada  
 Note: Age-standardized to 1991 Canadian Standard population

Colorectal cancer affects men and women of all backgrounds and is “Preventable, Treatable and Beatable!” It can be successfully treated 90% of the time if detected early. Screening programs are associated with decreased morbidity and mortality rates of CRC. It is for these reasons that the Department of Health and Social Services (DHSS) has provided a risk stratified, evidence based Colorectal Cancer Screening Program for the NWT.

## What is Colorectal Cancer?

Colorectal cancer is cancer of the colon or rectum. Other terms include cancer of the large intestine and bowel cancer. CRC usually begins as small, slow-growing, non-cancerous polyps on the inner surface of the colon. Polyps can grow and become cancerous, potentially spreading to other parts

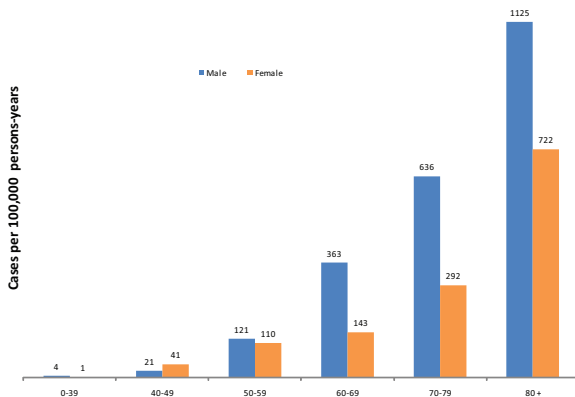
- Preventable
- Treatable
- Beatable

of the body. The two most common types of polyps are hyperplastic and adenomatous. Hyperplastic polyps are small in size and rarely become cancerous, whereas adenomatous polyps can grow over time and become cancerous if left untreated.

## Risk Factors

The cause of CRC is unknown, but there are specific risk factors that may increase an individual's risk of development. Age is the most significant risk factor for CRC, with over 85% of cases in the NWT occurring in those over 50 years old. *Figure 3* shows the incidence of CRC by age group and sex in the NWT.<sup>2</sup> It is recommended that all NWT residents aged 50 to 74 years undergo screening at least once every two years.

**Figure 3: Age and Sex-Specific Incidence Rates for Colorectal Cancer, NWT 2003-2007**



Among those 70 years of age and older, the incidence rate of CRC among aboriginals is 3 times higher than among non-aboriginals. From the years 1994 - 2005 in the NWT, 63% of all CRC cases occurred among aboriginal groups (Dene and Inuit), while 37% occurred among non-aboriginal groups (Metis and Non-aboriginals).<sup>3</sup> *Table 1* outlines other major risk factors for the development of CRC.

**Table 1: Risk Factors for the development of CRC<sup>3</sup>**

Risk Factor	Increased risk with:
<b>Age</b>	Increasing age. About 80-90% of people diagnosed with CRC are age 50 and older.
<b>Family History and Heredity</b>	First-degree relatives with CRC.
	Familial adenomatous polyposis (hereditary condition associated with hundreds or thousands of colonic polyps)
	Hereditary nonpolyposis colon cancer.
<b>Bowel Disease</b>	Lower intestinal disease such as ulcerative colitis, Crohn's Disease or Inflammatory Bowel Disease.
<b>Diet</b>	Diet high in red meat and low in fruits and vegetables.
<b>Weight</b>	Obesity and lack of physical exercise.
<b>Alcohol Consumption</b>	Alcohol consumption, especially beer.
<b>Smoking</b>	Smoking not only increases risk of CRC, but also the development of precancerous polyps.

## Screening

### Fecal Immunochemical Test (FIT)

Blood vessels at the surface of CRCs and polyps can be very fragile and easily damaged with the passage of feces, causing a small amount of blood to be released.<sup>3</sup> This occult (hidden) blood cannot be seen with the naked eye, but is detectable with FIT. This test can be done at home. The patient collects three samples from separate bowel movements and smears them onto three cards, which are then returned to one of the labs for testing. The test does not require any diet restrictions, and detects blood specifically coming from the colon or rectum. To determine the cause of bleeding, a positive FIT is followed up with an internal screening test such as colonoscopy.

### Colonoscopy

Colonoscopy is used to visually examine the entire colon and rectum for abnormalities. Polyps can be detected and removed through colonoscopy, and biopsies can be performed on questionable lesions. Patients must follow dietary guidelines for 1-2 days before examination, and ingest an oral solution to clear out the bowels before the test. Patients are sedated for approximately 30 minutes during the procedure, and

subsequent recovery time is 30–45 minutes. Risk of serious complications, such as bowel perforation or bleeding, is 1 in 1000 cases.<sup>4</sup>

### Other Screening Tests

Other diagnostic procedures may be performed if a colonoscopy is deemed not to be an appropriate follow-up test. This decision should be made by the patient in consultation with their primary health care provider or an endoscopist. Alternative procedures include flexible sigmoidoscopy, double contrast barium enema (DCBE), or computed tomography (CT) colonography.

CT colonography is considered the preferred alternative method to colonoscopy, with the highest sensitivity and specificity of the alternative screening tests.<sup>3</sup> It may expose the patient to less radiation than DCBE and allows visualization of the entire colon. However, for lesions less than 10 mm, colonoscopy has a sensitivity and specificity advantage over CT colonography.<sup>5</sup>

CRC screening tests, ranked in order from most to least cost effective are (1) FIT, (2) colonoscopy, (3) DCBE and flexible sigmoidoscopy, (4) CT colonography, and (5) no screening program. Additional pros and cons of each screening test are outlined in *Table 2*.

**Table 2: Summary of Colorectal Cancer Screening Tests<sup>3</sup>**

Test	Pros	Cons
<b>FIT</b>	<ul style="list-style-type: none"> <li>Simple</li> <li>Cost effective</li> <li>No prep required</li> </ul>	<ul style="list-style-type: none"> <li>Viewed as unsanitary by some</li> <li>Patient must retrieve samples from their own stool</li> <li>Detects the presence of blood in stool, not cancer</li> </ul>
<b>Colonoscopy</b>	<ul style="list-style-type: none"> <li>The most thorough method for evaluating colorectal area</li> <li>High detection rate for polyps, removal possible during procedure</li> <li>Biopsies of any abnormal areas can be taken right away</li> </ul>	<ul style="list-style-type: none"> <li>Expensive</li> <li>1 to 2-day bowel preparation needed - difficulty in getting patient compliance</li> <li>Slight risk of colon wall perforation (1 in 1000)</li> </ul>
<b>Flexible Sigmoidoscopy</b>	<ul style="list-style-type: none"> <li>More cost effective than the more thorough tests</li> </ul>	<ul style="list-style-type: none"> <li>Can only effectively examine the lower third of the colon</li> <li>1 to 2-day bowel preparation needed - difficulty in getting patient compliance</li> </ul>
<b>Double Contrast Barium Enema (DCBE)</b>	<ul style="list-style-type: none"> <li>Lower cost than colonoscopy</li> </ul>	<ul style="list-style-type: none"> <li>Radiation exposure (moderate)</li> <li>1 to 2-day bowel preparation needed - difficulty in getting patient compliance</li> <li>Often not used effectively in practice</li> <li>Misses too many polyps</li> </ul>
<b>CT Colonography</b>	<ul style="list-style-type: none"> <li>Less invasive than colonoscopy</li> <li>Second highest detection rate</li> <li>Very low risk of perforation</li> </ul>	<ul style="list-style-type: none"> <li>Radiation exposure (moderate)</li> <li>1 to 2-day bowel preparation needed - difficulty in getting patient compliance</li> <li>Lower sensitivity and specificity than colonoscopy for lesions less than 10 mm</li> </ul>

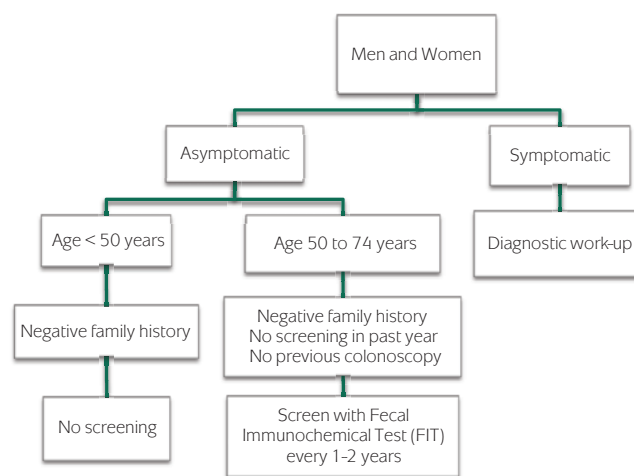
## Eligibility for CRC Screening

### Average risk

All average risk men and women between the ages of 50 and 74 should have FIT screening for CRC at least once every two years. Men and women eligible for FIT must be asymptomatic, have no personal history of CRC, and

have not been screened in the past year. *Figure 4* outlines the approach to average risk screening for CRC in the NWT.

**Figure 4: Approach to Average Risk Screening<sup>7</sup>**



### High risk

All high risk men and women, regardless of age, should have colonoscopy screening by recommendation of their health care provider. Individuals are considered high risk for CRC based on the following criteria:

- A first-degree relative or 2 or more second degree relatives with CRC<sup>4</sup>
- A personal history of benign polyps
- Inflammatory bowel disease such as ulcerative colitis or Crohn's Disease
- A family history or personal diagnosis of hereditary syndromes linked to CRC, such as familial adenomatous polyposis (FAP) or hereditary nonpolyposis colorectal cancer (HNPCC)
- Previous positive FIT

## Follow-up and Re-screening Recommendations

If the FIT result is negative, the patient should be tested 1–2 years later. If the FIT result is positive, the primary health care provider or endoscopist should consult with the patient about further screening.

After a colonoscopy, if no cancer is detected and no polyps are removed, the patient receives the results and

may return for CRC screening after 7 to 10 years. The high sensitivity and specificity of the colonoscopy enables the patient to forego testing for such a long time interval. If cancer is not diagnosed, but any adenomatous polyps are found, the patient will return for CRC screening at the appropriate interval for repeat colonoscopy and treatment.

## Conclusion

Colorectal cancer screening programs reduce morbidity and mortality rates of the disease and are an important part of comprehensive health care approaches. Colorectal cancer is “Preventable, Treatable and Beatable”, and the Department of Health and Social Services encourages screening and education about the disease. If you are age 50 or older, talk to your health care provider about getting tested.

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# Evaluation of the NWT Varicella Vaccination Catch-Up Program

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## Overview

Varicella (chickenpox) is a reportable disease in the NWT. It is caused by the Varicella-zoster virus (VZV), a DNA virus of the herpesvirus family. VZV primarily causes chickenpox and establishes latency in the sensory nerve ganglia, which may be reactivated later as herpes zoster (commonly known as shingles). The likelihood of reactivation over a person's lifetime is between 15-20%.<sup>1</sup>

VZV is an airborne disease, which is also spread by direct contact from the virus shed from skin lesions. The incubation period is from 10 to 21 days, usually in the range of 14 to 16 days.

Varicella is a common childhood infection, and by the age of 12 it is estimated that upwards of 90% of the population will come into contact with the virus.<sup>1</sup>

VARIVAX, a single-antigen varicella vaccine, was licensed in Canada in December 1998, for use among healthy children aged 12 months and over.<sup>2</sup> The recommendations of the National Advisory Committee on Immunization included the vaccination of children at the age of 12 months, the catch-up vaccination of children aged 19 months to 12 years, and the vaccination of susceptible individuals of all ages in high-risk situations such as health-care professionals and household contacts.<sup>2</sup>

Like any vaccine, varicella vaccine is not 100% efficacious, and vaccine-modified disease (also known as breakthrough varicella) can be expected to develop in approximately 7.2% of the vaccinated population.<sup>1</sup>

## Pros and Cons of Varicella vaccination

Since its release, the varicella vaccine has been widely implemented in North America, and substantial declines in morbidity and mortality rates attributable to varicella infection have been seen in the United States and in Canada.<sup>2</sup> Economic gains have also been realized, as the total medical and societal costs of varicella in Canada were estimated in a multicentre study to be \$122.4 million yearly, or \$353.00 per individual case.<sup>1</sup>

Despite these positive results, varicella vaccination somehow continues to be a controversial subject among

health care providers and parents.<sup>3</sup> Some believe that chickenpox is a mild disease that does not warrant a vaccination, while other concerns center around potential vaccine-associated adverse events.

In healthy children the adverse effects of the vaccination are limited to some local swelling and redness at the site of injection during the first hours following vaccination (27%), and fewer than 5% of vaccinees experience a mild varicella-like disease with rash within four weeks (World Health Organization).

While the morbidity of varicella infection is often mild in childhood cases, severity and mortality of the infection increase with age.<sup>17</sup> The more serious complications include secondary bacterial infections, pneumonia, septic arthritis, stroke and encephalitis.<sup>1</sup> Varicella can also have very serious complications for immunosuppressed individuals such as those with leukemia or AIDS. Additional concerns involve the possibility of the immune response to the vaccine waning over time, leading to a shift in incidence from a mild childhood illness to a severe adult illness.<sup>4</sup> This would result in increased morbidity and mortality among varicella cases despite an overall decrease in incidence.<sup>3</sup>

Despite potential drawbacks, the gains from vaccination are substantial. While some may consider the disease to be mild, it is nevertheless an uncomfortable experience for the child, and an economic burden on society in terms of time the child must be isolated and parental time missed at work.<sup>1</sup>

## Toward a two-dose schedule

In June 2007 the U.S. Advisory Committee on Immunization Practices (ACIP) noted that despite high vaccination coverage rates (96%-100%) there have been numerous reports of varicella outbreaks between 2001-2005 in American elementary schools. This strongly suggests that the 1-dose vaccination program is not completely effective in preventing outbreaks<sup>2</sup>. These vaccine failures could be attributable to either primary vaccine failure (variables include improper vaccine storage, asthma, age at the time of vaccination, period of time between varicella and MMR vaccine<sup>8</sup>), or secondary vaccine failure due to waning immunity over time.<sup>5</sup> Two

solutions exist to strengthen immunity:

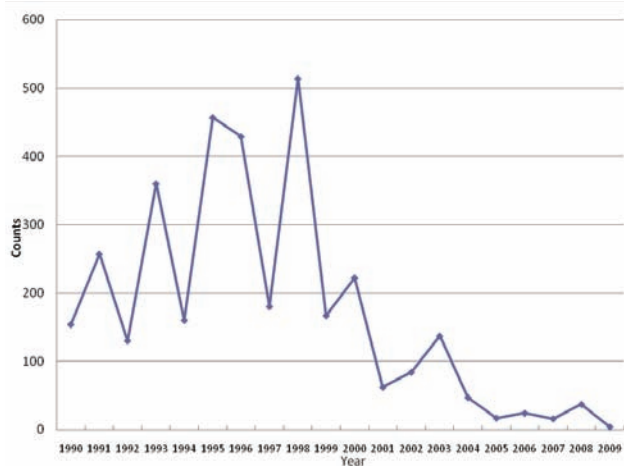
- A higher single dose of vaccine, and
- More than one dose of vaccine.<sup>5</sup>

In a study published in 2004 it was seen that individuals who were given two doses of varicella vaccine 3 months apart showed increased vaccine efficacy.<sup>6</sup> In response to this information, ACIP has recently adjusted its recommendations and now advises a routine 2-dose varicella vaccination program and a booster vaccination for all individuals who have already received the first dose. Introducing a second dose should reduce the chance of a primary vaccine failure, and will help prevent a decrease in immunity over time.<sup>5</sup> In Canada, the National Advisory Committee on Immunization (NACI) has yet to update its statement on varicella immunization, but it is anticipated that the NWT will also move in this direction.

## Varicella in the North

In the NWT, varicella vaccine was introduced in two phases. The first phase was the inclusion of the vaccine as part of the universal immunization schedule in September 2001. The second phase was a catch-up program implemented on May 1<sup>st</sup>, 2002, aimed at children 18 months to 5 years of age. The number of reported cases of chickenpox in the NWT has decreased by more than 90% from 1998 to 2009. (*Figure 1*)

Figure 1: Cases of Varicella in the NWT (1990-2009)



Between 2002 and 2008 there were 10 reported cases of varicella vaccine-associated adverse events across the territory for well over 4000 doses given.

To determine whether or not the two-dose schedule

should be implemented in the NWT, it is necessary to evaluate the success of the varicella vaccination catch-up program in preventing outbreaks of varicella, and document any occurrences of vaccine-modified disease. If the results indicate that the single-dose program has been ineffective, it will then be necessary to look at the cost-benefit ratio of introducing a second dose based on population levels, the current rates of varicella and hospitalization costs.<sup>5</sup>

## Methods

A cohort was established based on children born between May 1<sup>st</sup>, 1997 and September 1<sup>st</sup>, 2000 who resided in the NWT at least for the full year between his/her 5th and 6th birthday. Immunization records for this cohort were requested from each community health centre in the NWT. All immunization information was entered into iPHIS (integrated Public Health Information System) and included data such as demographic and branch information, date of vaccination, site, route, dosage (when available), any history of chickenpox and any IgG tests.

After data collection and entry of information from the immunization cards, attempts were made to track any information missing from the cohort. Cards that could no longer be located by the health centre due to child relocation were removed from the cohort so as not to underestimate coverage rates. Communities that did not respond to the department's requests for immunization information and failed to supply either an immunization card or confirmation that the card could not be located remained in the cohort.

Unvaccinated individuals with a history of chickenpox or a positive IgG test are considered immune. Individuals whose parent/guardian refused the vaccine were noted as such, but are still considered at-risk and eligible for vaccination.

Data analysis involved tallying the number of children who received the varicella vaccination or had a previous history of being infected with the varicella virus. Coverage rates for each regional health authority were then calculated using both the number above as the numerator and the total number of children in the cohort residing in the regional health authority as the denominator.

## Results

In *Table 1*, 379 children among the 1708 children in the cohort were not vaccinated or had no previous history

of immunity (either documented as a history of chickenpox or an IgG test). These 379 children include the parent/guardian refusal group among the under-immunized. Of the 1329 that were vaccinated, 9 individuals experienced vaccine-modified disease, although it is impossible to tell whether these cases can be attributed to primary or secondary vaccine failure. Among those born in the cohort who had chicken pox, 98% were not immunized.

**Table 1: Varicella coverage rates**  
( May 1, 1997 - September 1, 2000 birth cohort)

Regional Health Authority	Proportion immune	Number Vaccinated or previous history of chicken pox	Total Cards Reviewed
Beaufort-Delta	85.1%	262	308
Tlicho	71.7%	134	187
Sahtu	50.5%	56	111
Hay River	80.0%	132	165
Deh Cho	64.6%	84	130
Yellowknife	82.7%	594	718
Fort Smith	75.3%	67	89
NWT	76.6%	1329	1708

	good coverage
	adequate coverage
	needs improvement

## Implication of Results and their affect on the NWT Varicella Program

The overall coverage rate for varicella in the NWT is satisfactory at 76.6%, although there is need for improvement in some regions. There were 9 cases of vaccine-modified disease reported based on the information provided. This results in a vaccine failure of only 0.7% of the 1329 immunized individuals. The NWT Advisory Committee on Immunization will continue reviewing the NACI national recommendation for a 2 dose schedule and is monitoring varicella disease.

## Limitations

Underreporting is a major concern in varicella surveillance because of the general belief that chickenpox is not serious enough to merit a visit to the doctor. In addition, data sources from health centers outside of Yellowknife were based solely on copies of immunization cards. Further information concerning parent/guardian refusal and history of chickenpox is often recorded within the patient's medical chart and not necessarily on the immunization card. Both of these

issues could lead to an overestimate of unvaccinated children eligible for immunization. It should be noted, however, that since the implementation of the vaccination program in NWT, parents and physicians are more apt to report a case of chickenpox, as any occurrence of varicella is unexpected.

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## NOTIFIABLE Diseases

CUMULATIVE TOTALS for the Northwest Territories (NWT) January - March 2010<sup>a</sup>

		January - December	January - March	
		2009	2010	
		NWT	NWT	
Preventable Diseases	Vaccine	Hepatitis B	0	0
	Diseases	Haemophilus Influenza	1	1
		Influenza A	405	0
		Influenza B	8	0
		Pertussis	1	0
		Chicken Pox	4	3
Sexually Transmitted/ Bloodborne Diseases	Chlamydia	1,015	245	
	Gonorrhea	239	72	
	Hepatitis C	12	4	
	Hepatitis, Other	0	0	
	Syphilis	41	6	
	Diseases by Direct Contact/ Respiratory Route	Invasive Group A Strep	2	0
Invasive Group B Strep in neonates		1	0	
Invasive Group B Streptococcus		1	0	
Invasive Pneumococcal Disease		13	1	
Legionellosis		0	0	
Listeriosis		0	0	
Meningitis/Other Bacterial		0	0	
Meningitis/Unspecified		0	0	
Meningitis/Viral		0	1	
Meningococcal Infections		1	0	
Respiratory Syncytial Virus		60	13	
Tuberculosis		13	2	
Enteric, Food and Waterborne Diseases		Botulism	0	0
	Campylobacteriosis	6	1	
	Cryptosporidiosis	0	1	
	E.Coli O157:H7	1	0	
	Giardiasis	10	2	
	Hepatitis A	0	0	
	Salmonellosis	11	3	
	Shigellosis	0	0	
	Tapeworm	0	0	
	Trichinosis	0	0	
Vectorborne/ Other Zoonotic Diseases	Yersinia	0	0	
	Brucellosis	0	2	
	Malaria	0	0	
Antibiotic resistant microorganisms	Rabies Exposure	77	15	
	Methicillin-resistant Staph. Aureus	108	36	
	Vancomycin-resistant Enterococci	0	0	

## NWT HIV Infections Reported from 1987 to 2009

Total	Age at Diagnosis								Gender		Risk Category						
	0-9	10-14	15-19	20-29	30-39	40-49	50-59	60+	Female	Male	MSM <sup>b</sup>	MSM/ IDU <sup>c</sup>	IDU	Hetero- sexual	Perinatal	Blood Products	Other
37	2	0	0	5	21	7	1	1	8	29	14	1	7	11	2	1	1

- a Statistics are based on currently available data and previous data may be subject to change  
 b Men who have sex with men (MSM)  
 c Injection Drug User (IDU)

Updated April 21, 2010  
 Office of the Chief Public Health Officer