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Cobalamin (Vitamin B_{12}) and Folate Deficiency

Effective Date: January 18, 2023

Scope

This guideline covers the primary care investigation and management of cobalamin (vitamin B_{12} or simply B_{12}) and folate deficiency in adults. This guideline outlines the indications for B_{12} testing and discusses an observed increase in B_{12} testing in BC. Specifically:

- Outpatient and inpatient laboratory test volumes for B_{12} investigations increased from 267,721 to 570,265 between 2013 and 2020. This resulted in an increase in annual B_{12} testing expenditure from $3.0 million to $5.6 million during the same time period.
- On average, 420,303 tests cost $4.4 million per year.
- Patients ≥ 65 years of age accounted for the majority (37%) of B_{12} test volumes in 2019.
- Female patients account for 62% of annual test volumes while males account for 38%.

Key Recommendations

- Routine B_{12} screening and testing in asymptomatic patients is not supported by evidence.
- Consider B_{12} supplementation without testing in asymptomatic patients with risk factors for B_{12} deficiency (see *Table 1: Patient Risk Factors Associated with B_{12} Deficiency*). Patients can call 8-1-1 to speak with a HealthLink BC registered dietitian.
- B_{12} deficiency can cause preventable permanent injury and should be considered with new onset neurological conditions and symptoms suggestive of B_{12} deficiency (See *low B_{12} symptoms* section below).
- Folate testing is rarely indicated but may be available via consultation with the laboratory medicine physician or scientist.
- Folate deficiency in pregnancy is associated with preventable and serious fetal harm, i.e., neural tube defects (NTD). Folic acid supplementation is recommended during pregnancy.
- A daily multivitamin containing B_{12} and folic acid is recommended for all people who could become pregnant, especially those with a vegan diet.

Background

The terms cobalamin (cyanocobalamin) and vitamin B_{12} can be used interchangeably. B_{12} will be used throughout this guideline.

A 2022 *CADTH review*[1] performed at the request of GPAC found:

- No studies evaluating the clinical utility of B_{12} testing in people with suspected B_{12} deficiency.
- No studies evaluating the cost-effectiveness of B_{12} testing in people with suspected B_{12} deficiency.
- No evidence-based guidelines regarding the use of B_{12} testing in people with suspected B_{12} deficiency.

No relevant literature was identified regarding the diagnostic test accuracy, clinical utility, and cost-effectiveness of serum folate testing in people with suspected folate deficiency.

Vitamin B_{12}

B_{12} is a water-soluble vitamin found in foods derived from animal products and from fortified foods.[2] (see HealthLink BC's page on *Quick Nutrition Check for Vitamin B_{12}* for dietary information).The prevalence of B_{12} deficiency in the general population differs between older and younger people. For example, 6% of those < 60 years in the United Kingdom were found to be B_{12} deficient, compared to 20% of those ≥ 60 years. B_{12} deficiency also correlates to geographic location and ethnic background (e.g., 6% of those in the United States were found to be B_{12} deficient, compared to 40% in Latin American countries and 70% in East Indian adults. Most cases of B_{12}[3] deficiency in high-income countries are attributable to malabsorptive disorders. A specific form of malabsorption, pernicious anemia, is caused by autoimmunity to intrinsic factor resulting in failure to absorb dietary B_{12}. Other causes for malabsorption include Crohn's disease, celiac disease, and medication interactions (e.g., proton pump inhibitor, metformin). A rare but serious form of B_{12} deficiency can arise from the protracted use of nitrous oxide (N_20) as a recreational inhalant. Vitamin B_{12} deficiency may also be caused by diet (e.g., vegan diet, breastfed neonates born to B_{12} deficient mothers).[1]

As vitamin B_{12} is stored in body tissue, mainly the liver, sub-clinical deficiency from dietary deficiency alone develops over the course of several years (e.g., 5-10 years).[4] Manifestations of vitamin B_{12} deficiency may be mild, such as fatigue and heart palpitations, but may progress to neurological manifestations, including peripheral neuropathy and dementia-like symptoms.[5]

There is currently no agreed upon reference standard for measuring B_{12}, and all are susceptible to confounding factors. A lack of agreement around cut-off levels (i.e., thresholds) to diagnose deficiency adds another layer of difficulty in diagnosing deficiency, as these thresholds may differ.[1]

Low B_{12} Symptoms: Patients may present with any of the following (specific or red flag symptoms in **Bold**):

- Neurologic abnormalities associated with impaired nerve function and demyelination, including new onset and otherwise unexplained central nervous system symptoms (e.g., **cognitive impairment**), **motor and/or sensory neuropathy**, and **subacute combined degeneration of the dorsal and lateral columns of the spinal cord**[4] (e.g., **symmetric paresthesias, numbness, gait disorder, positive Babinski and exaggerated patellar reflex**).
- Glossitis (including pain, swelling, tenderness, and loss of papillae of the tongue), and/or chronic (>3 months) unexplained gastrointestinal symptoms (e.g., pain or diarrhea), reflecting impaired regeneration of epithelial cells.
- **Worsening macrocytic anemia**: B_{12} deficiency may also cause a macrocytic (megaloblastic) anemia BUT, in the presence of folate supplementation, this anemia may be masked so that B_{12} deficiency may present with exclusively neurologic features. Therefore, in patients with neurologic symptoms do not rely on the complete blood cell count (CBC) to help rule in or out B_{12} deficiency.
- If a patient has specific or red flag features B_{12} deficiency testing should be initiated (see *Figure 1: B_{12} Test Result Review and Process Algorithm for Patients with Risk Factor for B_{12} Deficiency* and/or Non-specific** or Specific† Symptom of B_{12}Deficiency*).

Folate

Folate is found in dark green vegetables, legumes (i.e. peas, beans and lentils), and citrus fruit (see HealthLink BC's page on *Getting Enough Folic Acid (Folate)* for dietary information).[2,6] Mandatory folic acid fortification of foods (i.e. white flour, enriched pasta and cornmeal) was implemented in Canada in 1998.[6] This was associated with a significant increase in average population folate levels, and folate deficiency is now rare in Canada. Two outpatient laboratories in BC reported > 99% of folate tests were normal in 2010.

In rare cases, folate deficiency is associated with megaloblastic anemia and birth defects, especially neural tube defects, in children born to mothers with folate deficiency.[7]

Epidemiology

Between 2019 and 2021, 2.17 million B_{12} tests were performed for 1.39 million patients in BC. Approximately 33% of patients had two or more tests during this time period. Nine percent of all B_{12} tests had an abnormal result. The cost of a B_{12} test in BC is $14.38.

Patient Risk Factors Associated with B_{12} Deficiency

There is no evidence to support regular B_{12} screening for asymptomatic patients. In asymptomatic patients with risk factors (see *Table 1: Patient Risk Factors Associated with B_{12} Deficiency* below) consider supplementation in lieu of testing.

Table 1: Patient Risk Factors Associated with B_{12} Deficiency

Bold represents factors associated with more rapid onset of clinical symptoms i.e., within 5 years. Non-bold represents slower contributing factors (e.g., 5 to 10 years). Refer to *Table 3: Treatment of B_{12} deficiency* for supplementation routes, dosage and duration.

Factor	B_{12} Deficiency
Medications	• Histamine 2 (H_2) receptor antagonists[4,8,9] * • Proton pump inhibitors[8–10] * • Metformin[4,9–13] • Anticonvulsants[9] (especially phenobarbital, pregabalin, primidone, or topiramate)[14] • Protracted use of **N_20 gas** (when used as a recreational drug)[4,10]
Factors contributing to inadequate intake	• Low intake of B_{12} rich foods[4,10] • Chronic excess alcohol use[8,10] • Smoking[8] • Vegan or strict vegetarian diets[9,10] • **Vegetarian diet in pregnancy**[10] • Age >60 years[9] • South Asian ethnicity (cultural promotion of vegetarian diet)[15–17] • **Exclusively breast-fed infants of B_{12} deficient people**[18]
Decreased Ileal Absorption	• **Gastric/bariatric surgery**[4,8,10] • **Small intestine resection**[10] • **Inflammation of small intestine: Crohn's, celiac, tropical sprue**[3,9,10,19] • Tapeworm infection[3,4,10] • *H. pylori* infection[10] • Pancreatic insufficiency[10] • Infected with human immunodeficiency virus (HIV)[9] infection
Decreased Intrinsic Factor	• Atrophic gastritis[10] • **Antibodies to anti-intrinsic factor (i.e., pernicious anemia)[3,4,8,10] alone, or in association with other autoimmune conditions (e.g., Type 1 Diabetes Mellitus)** • **Post-gastrectomy syndrome**

* Vitamin B_{12} deficiency is associated with either long-term proton pump inhibitor (PPI) or Histamine-2 receptor blocker (H_2 blocker) use, but a causal relationship is not established.[20]

Patient Risk Factors Associated with Folate Deficiency

There is no evidence to support regular folate screening for asymptomatic patients. Consider supplementation in asymptomatic patients with risk factors (see *Table 2: Patient Risk Factors Associated with Folate Deficiency* below) consider supplementation. Refer to *Table 6: Treatment of folate deficiency* for supplementation routes, dosage and duration.

Table 2: Patient Risk Factors Associated with Folate Deficiency

Folate Deficiency Patient Risk Factors
• Neurologic abnormalities (more prominent in B_{12} deficiency) e.g., cognitive slowing and neuropathy • Medically unexplained symptoms (e.g., fatigue, irritability, cognitive decline), where other causes have been excluded • Oral ulcers[4] • Excessive consumption of alcohol[4,5] • Dietary deficiency or malabsorption[21] • Methotrexate, phenytoin, sulfasalzin, trimethoprim[21] • Worsening macrocytic anemia. In such a patient, B_{12} should also be ordered • Refer to the Society of Obstetricians and Gynaecologists of Canada (SOGC) *Guideline No. 427: Folic Acid and Multivitamin Supplementation for Prevention of Folic Acid-Sensitive Congenital Anomalies* for identified risk factors for fetal NTDs or low-folate status in pregnancy

Prevention

Prevention of B_{12} Deficiency

B_{12} is present in many animal products e.g., dairy products, and eggs; therefore, a typical non-vegetarian diet contains adequate B_{12}. Practitioners should consider specific B_{12} dietary counselling for patients currently on a vegetarian, or vegan diet, including patients who have recently initiated such a diet. To help prevent B_{12} deficiency, encourage all individuals to consume a diet with sufficient B_{12}. Consider a dietitian referral for patients to call 8-1-1 to speak with a HealthLink BC dietitian. With respect to B_{12} supplementation:

- Consider supplementation when patients adhere to a vegan or strict vegetarian diet.
- Consider supplementation when the patient has risk factors associated with B_{12} Deficiency as described in see *Table 1: Patient Risk Factors Associated with B_{12} Deficiency* above.
- Doses usually used in supplementation[16] are not associated with harm.[7] (See *Table 3: B_{12} Medication Table* below).
- Oral supplements are available over the counter in various doses and dosage forms. (Prices vary).
- Some PharmaCare plans provide coverage for select oral and parenteral formulations (1000 micrograms [mcg]/mL).

Prevention of Folate Deficiency

It is recommended that all people who could become pregnant take a daily supplement containing 400 mcg/0.4mg folic acid to reduce the risk of neural tube defects (NTDs).[22] This is most easily obtained through a prenatal vitamin:[23]

- Supplementation of 1 mg daily is recommended for patients with specific risk factors (e.g., bariatric/gastric surgery patients, those with severe malnutrition, chronic alcohol use, chronic hemolytic anemia and conditions with high cell turnover, and use of antimetabolite medications such as methotrexate).[21]
- The doses of folic acid used in supplementation (see *Table 5: Folic Acid Medication Table* below) are non-toxic and are not associated with harm.[21,23] Consider supplementation when the patient is prescribed medications causing folate deficiency, e.g., methotrexate.[8]
- Over the counter folate products include: 400 mcg/0.4 mg and 1 mg tablets.[†]
- Prescription folate products covered by PharmaCare[‡] include: 5 mg tablets and 5 mg/mL injection.

DIAGNOSIS

B_{12} Testing

Routine B_{12} screening is not supported by the current body of evidence. The test has the following limitations:

- Levels of B_{12} do not correlate well with clinical symptoms. Elderly patients may have normal B_{12} levels with clinically significant B_{12} deficiency.
- Women taking oral contraceptives may have decreased serum B_{12} levels in the absence of clinical deficiency (due to decreases in the B_{12} carrier protein, haptocorrin).
- There is a large 'indeterminate zone' between normal and abnormal levels (see *Figure 1: B_{12} Test Result Review and Process Algorithm for Patients with Risk Factor for B_{12} Deficiency* and/or Non-specific** or Specific† Symptom of B_{12}Deficiency* below).
- The reference intervals may vary between laboratories. The conventional cut-off for serum B_{12} deficiency varies from 150-220 pmol/L.[24]

In a clinically symptomatic patient with specific features of B_{12} deficiency, order a B_{12} test, see *Figure 1: B_{12} Test Result Review and Process Algorithm for Patients with Risk Factor for B_{12} Deficiency* and/or Non-specific** or Specific† Symptom of B_{12}Deficiency* for more detail. Refer to Perinatal Services BC's (PSBC) website for the *Early Prenatal Care Summary and Checklist for Primary Care Providers*.

Asymptomatic: In asymptomatic patients with risk factors (see *Table 1: Patient Risk Factors Associated with B_{12} Deficiency* above) consider supplementation in lieu of testing.

High total B_{12} pathway:

If the B_{12} level is above the upper limit of normal, follow up should be organized as follows:

i. Was the patient already taking B_{12}? If yes, decrease the dose. If no, go to step ii.
ii. Does the patient have end stage renal disease? If yes, no specific follow up for B_{12} is required. If no, go to step iii.
iii. Are there clinical features of liver disease, myeloproliferative disorder (e.g., blood film changes of unexplained cytopenia, thrombocytosis, or leukocytosis), or another cancer (e.g., cachexia, constitutional symptoms – fever, weight loss, night sweats)? If yes, refer to the appropriate specialist depending on symptoms. If no, go to step iv.
iv. Verify that the elevated B_{12} test result is not in error due to test interference (e.g., macroB_{12} or heterophile antibody interference) by ordering another test (e.g., total homocysteine). If total homocysteine is normal, this corroborates the B_{12} result. If the total homocysteine is elevated, contact the laboratory pathologist to facilitate further investigations.[25]

Repeat Testing:

Repeat testing of B_{12} may be warranted after a trial of therapy or as an assessment of adherence. Repeat testing should wait at least 2 months after therapy has been started.[26] If the B_{12} is normal (rare probability of B_{12} deficiency – see *Table 3: B_{12} Medication Table*), a repeat investigation is not required in the absence of new signs of disease. In absence of a reversible factor therapy, supplementation in most cases is lifelong.

Folate Testing

Serum folate and red blood cell (RBC) folate testing is no longer offered in BC.

In cases of unexplained macrocytic anemia associated with high homocysteine levels and normal B_{12} testing results, folate testing may be arranged if supported by laboratory specialist consultation. Refer to *Table 2: Patient Risk Factors Associated with Folate Deficiency* for more information.

If folate deficiency is suspected, it is reasonable to give oral folic acid (0.4 – 1 mg/day) without doing laboratory investigation for deficiency at least until the hemoglobin and mean corpuscular volume normalizes (or longer if the underlying cause cannot be eliminated).

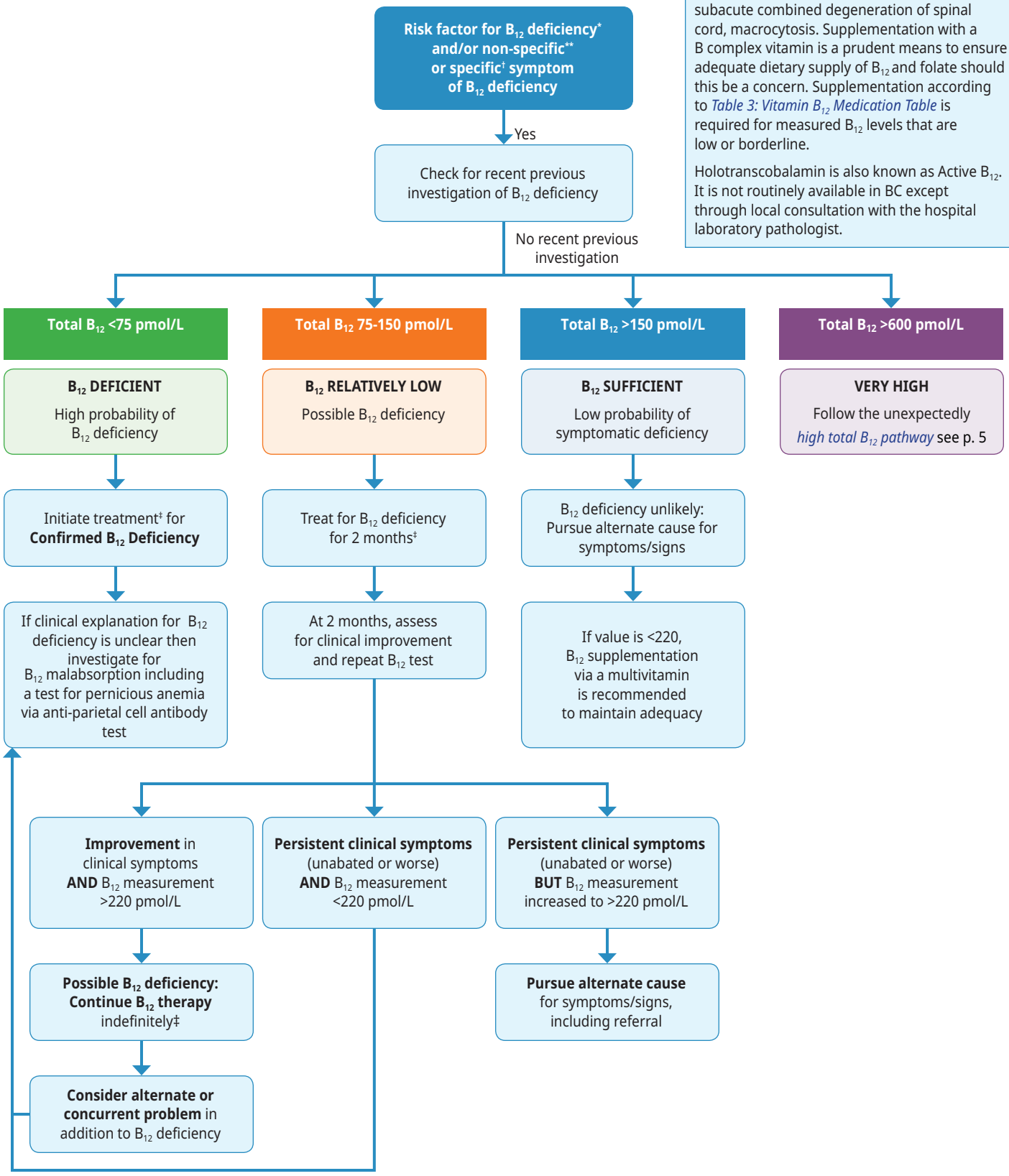
Figure 1: B_{12} Test Result Review and Process Algorithm for Patients with Risk Factor for B_{12} Deficiency* and/or Non-specific** or Specific† Symptom of B_{12} Deficiency

See *Table 1: Patient Risk Factors Associated with B_{12} Deficiency*

Non-specific symptoms: fatigue, irritability, depression, anxiety, diarrhea

Specific or Red Flag feature: cognitive impairment/dementia, peripheral neuropathy, subacute combined degeneration of spinal cord, macrocytosis. Supplementation with a B complex vitamin is a prudent means to ensure adequate dietary supply of B_{12} and folate should this be a concern. Supplementation according to *Table 3: Vitamin B_{12} Medication Table* is required for measured B_{12} levels that are low or borderline.

Holotranscobalamin is also known as Active B_{12}. It is not routinely available in BC except through local consultation with the hospital laboratory pathologist.



Treatment

In suspected B_{12} deficiency, supplement both B_{12} and folate.[23,27]

Vitamin B_{12}

Early treatment of B_{12} deficiency is particularly important because neurologic symptoms may be irreversible. Oral administration is extremely effective and less invasive compared to other routes. For selected symptomatic patients please review *Figure 1: B_{12} Test Result Review and Process Algorithm for Patients with Risk Factor for B_{12} Deficiency* and/or Non-specific** or Specific† Symptom of B_{12}Deficiency*.

Table 3: Vitamin B_{12} Medication Table

The table below is not an exhaustive list of all vitamin B_{12} products and therapeutic considerations.

Product Dosage Forms and Strengths	Recommended Adult Dose	Approx. Cost per month†	PharmaCare Coverage‡	Therapeutic Considerations
cyanocobalamin *Vitamin B_{12}* Oral/sublingual tablets: 250, 500, 1000, 2500 mcg liquid: 200 mcg/mL	500 – 2000 mcg PO daily[a] pernicious anemia: 1000 mcg po daily[b] food-cobalamin malabsorption: 250 mcg po daily[b]	$5 -10	Regular benefit (Plan W): 250, 1000 mcg tablets	• Oral is effective as parental therapy in improving hematologic and neurologic outcomes[c] • No clinical meaningful differences between sublingual and oral routes[d] • 1-5% of oral dose absorbed by passive diffusion[b] • Dose and duration of initial therapy dependent on severity of B_{12} deficiency[a]
Injection (IM or subcut): 1000 mcg/mL	Initial: 1000 mcg IM/subcut daily for 7 days[a] Maintenance: 1000 mcg IM/subcut monthly	$5	Regular benefit: 1000 mcg/mL	• Injectable product contraindicated in infants due to presence of benzyl alcohol • Anaphylactic reactions are rare • Usually nontoxic in large doses, however diarrhea, itch, urticaria have been reported[a]
methylcobalamin *Vitamin B_{12}* Tablets: 1000, 2500, 5000 mcg	500 – 2000 mcg PO daily[a]	$5 -10	Regular benefit (Plan W): 1000 mcg tablet	• More active cobalamin coenzyme form, however not superior to cyanocobalamin[e]

† Cost of generic without mark-up or professional fee rounded up to nearest $5; calculated from McKesson Canada *https://www.mckesson.ca/* (Accessed February 17, 2022)
‡ Coverage is subject to drug price limits set by PharmaCare and to the patient's PharmaCare plan rules and deductibles. See *https://www2.gov.bc.ca/gov/content/health/health-drug-coverage/pharmacare-for-bc-residents* and *https://pharmacareformularysearch.gov.bc.ca/*.
Note: For complete details, please review product monographs at *https://health-products.canada.ca/dpd-bdpp/index-eng.jsp* and regularly review current Health Canada advisories, warnings and recalls at: *http://www.hc-sc.gc.ca/ahc-asc/media/advisories-avis/index_e.html* for the most up to date information.)

Table 4: Treatment of B_{12} deficiency (adapted from Means 2021)[27]

Demographic	Route of administration	Dosage and frequency
Adults with normal absorption	Oral	1000 mcg orally once per day.
Adults with impaired absorption	Oral	Therapy with very high oral doses of oral vitamin B_{12} (e.g., 1000 to 2000 mcg daily) will be effective if the dose is high enough to provide absorption via a mechanism that does not require intrinsic factor or a functioning terminal ileum (i.e., passive diffusion/mass action).
Adults with dietary deficiency	Oral	Individuals with diets that lack vitamin B_{12} (e.g., vegans, vegetarians, infants exclusively breastfed by vitamin B_{12}-deficient mothers) are expected to have normal absorption via the oral route and can be treated with oral supplements that provide the recommended amount (500-2000 mcg).
Adults with pernicious anemia	Intramuscular** or deep subcutaneous injection High-dose oral vitamin B_{12}	Parenteral vitamin B_{12} at an initial dose of 1000 mcg (1 mg) once per week for four weeks, followed by 1000 mcg once per month. 1000 to 2000 mcg [1 to 2 mg] daily (provided there are no acute symptoms of anemia or neurologic complications and adherence is assured).
Adults with altered gastrointestinal anatomy	Parenteral	If the alteration is permanent, then indefinite treatment with parenteral vitamin B_{12} is usually appropriate. If the alteration is reversed, then therapy may be discontinued, although it is reasonable to check the vitamin B_{12} level several months after stopping therapy. Check B_{12} level three or four times during the first year off of therapy.
Adults with symptomatic anemia, neurologic or neuro-psychiatric findings, or pregnancy	Parenteral Oral	1000 mcg of vitamin B_{12} every other day initially for approximately two weeks, followed by administration once monthly (cyanocobalamin). Once the initial deficiency has been corrected, an oral trial is reasonable, based on patient preference and adequate B_{12} levels.

Note: Intranasal administration is generally not used. Transdermal forms of vitamin B_{12} are available over the counter, but this route of administration has not been validated clinically in the setting of vitamin B_{12} deficiency and should not be relied upon for treatment.
** "Individuals treated with parenteral vitamin B_{12} can be taught to self-administer the injections, often with good results, minimal to no pain, and lower costs than office-based injection."[27]

Folate

Treatment

Refer to *Table 6: Treatment of folate deficiency* below for folate deficiency treatment options and the SOGC *Guideline No. 427: Folic Acid and Multivitamin Supplementation for Prevention of Folic Acid-Sensitive Congenital Anomalies* for more information.

Table 5: Folic Acid Medication Table

The table below is not an exhaustive list of all folic acid products and therapeutic considerations.

Product Dosage Forms and Strengths	Recommended Adult Dose	Approx. Cost per month†	PharmaCare Coverage‡	Therapeutic Considerations
folic acid Tablets: 0.4, 1, 5 mg	1 – 5 mg PO dailyf	$5	Regular benefit: 1 mg (Plan W only), 5 mg tablets	• Folic acid supplementation alone may exacerbate neurological symptoms in patients with concurrent cobalamin deficiency • May decrease serum concentrations of phenytoin, fosphenytoin[g]
Injection (IM, subcut): 5 mg/mL	0.4 – 1 mg IM/subcut dailyf	$25	Non-benefit	• Allergic reactions (erythema, pruritus and/or urticaria) are rare[g]

† Cost of generic without mark-up or professional fee rounded up to nearest $5; calculated from McKesson Canada *https://www.mckesson.ca/* (Accessed February 17, 2022)

‡ Coverage is subject to drug price limits set by PharmaCare and to the patient's PharmaCare plan rules and deductibles. See *https://www2.gov.bc.ca/gov/content/health/health-drug-coverage/pharmacare-for-bc-residents* and *https://pharmacareformularysearch.gov.bc.ca/*.

Note: For complete details, please review product monographs at *https://health-products.canada.ca/dpd-bdpp/index-eng.jsp* and regularly review current Health Canada advisories, warnings and recalls at: *http://www.hc-sc.gc.ca/ahc-asc/media/advisories-avis/index_e.html* for the most up to date information.)

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Table 6: Treatment of folate deficiency (adapted from Means 2021)[27]

Demographic	Route of administration	Dosage and frequency
Individuals with reversible cause of deficiency	Oral	1 to 5 mg daily given for one to four months or until there is laboratory evidence of hematologic recovery.
Individuals with chronic cause of deficiency	Oral	1 to 5 mg daily, may be indefinitely (some advocate repeat testing for vitamin B_{12} deficiency in patients receiving long-term folic acid, especially if hematologic and/or neurologic worsening occur).
Individuals who are unable to take an oral medication (e.g., due to vomiting) or those who have severe or symptomatic anemia due to folate deficiency and hence have a more urgent need for rapid correction	Intravenous	1 to 5 mg daily.

ONGOING CARE

Ongoing Management

Vitamin B_{12}

Duration of therapy

Once a diagnosis of B_{12} deficiency *due to poor absorption* of B_{12} has been made, therapy should be maintained lifelong.[25]

Folate

Duration of therapy

Patients with pernicious anemia require lifelong therapy, while patients with malabsorption require treatment until underlying condition or diet is corrected.[27]

Monitoring

Increased clinical surveillance is suggested for patients with non-nutritional folate deficiency.[27]

Quality Check Point

To help practitioners review their own practice, some relevant measures have been included below. These measures may be obtained using your Electronic Medical Records (EMR) or with assistance from the *Health Data Coalition*:

- % patients on B_{12}
- % patients on folate
- % active patients with B_{12} test in last year
- % active patients with folate test in last year
- % pregnant patients on folate/B_{12}

This process would count towards *Mainpro+* credits or *College of Physicians and Surgeons of British Columbia* (CPSBC) accreditation processes.

Resources

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Abbreviations:

H_2	Histamine
HIV	Human immunodeficiency virus
IM	Intramuscular
NTDs	Neural tube defects
N_20	Nitrous oxide
PPI	Proton pump inhibitor
RBC	Red blood cell

Diagnostic Codes:

Vitamin B_{12}: 92450

Folate: 281.2

Practitioner resources

- **RACE: Rapid Access to Consultative Expertise Program** – *www.raceconnect.ca*

  RACE means timely telephone advice from specialist for Physicians, Medical Residents, Nurse Practitioners, Midwives, all in one phone call.

  Monday to Friday 0800 – 1700

  Online at *www.raceapp.ca* **or though** *Apple* **or** *Android* **mobile device. For more information on how to download RACE mobile applications, please visit** *www.raceconnect.ca/race-app/*

  Local Calls: 604–696–2131 | **Toll Free:** 1–877–696–2131

  For a complete list of current specialty services visit the *Specialty Areas page*.

- **Pathways**
  - An online resource that allows GPs and nurse practitioners and their office staff to quickly access current and accurate referral information, including wait times and areas of expertise, for specialists and specialty clinics. See: *https://pathwaysbc.ca/login*

- **Perinatal Services BC (PSBC)** – *www.perinatalservicesbc.ca*
  - Perinatal Services BC (PSBC) provides leadership, support, and coordination for the strategic planning of perinatal services in British Columbia and is the central source in the province for evidence-based perinatal information.

Patient, Family and Caregiver resources

- **HealthLinkBC:** HealthLinkBC provides reliable non-emergency health information and advice to patients in BC Information and advice in several languages is available by telephone, website, a mobile app and a collection of print resources. People can speak to a health services navigator, registered dietitian, registered nurse, qualified exercise professional, or a pharmacist by calling 8-1-1 toll-free in BC or 7-1-1 for the deaf and hard of hearing.
  - *HealthLinkBC: Quick Nutrition Check for Vitamin B_{12}*
  - *HealthLinkBC: Vitamin B_{12} Deficiency Anemia*
  - *HealthLinkBC: Getting Enough Folic Acid*
  - *HealthLinkBC: Folate and Your Health*
  - *HealthLinkBC: Folic Acid – Oral*
  - *HealthLinkBC: Pregnancy and Nutrition: Folate and Preventing Neural Tube Defects*
  - *HealthLinkBC: Folic Acid Test*

- *Health Canada: Canadian Nutrient File*
- *National Institutes of Health: Vitamin B_{12} Fact Sheet for Consumers*
- *National Health Service (NHS): Patient Factsheet: Vitamin B_{12} Deficiency*

This guideline is based on scientific evidence current as of the effective date.

This guideline was developed by the Guidelines and Protocols Advisory Committee in collaboration with the Provincial Laboratory Medicine Services, and adopted under the *Medical Services Act* and the *Laboratory Services Act*.

For more information about how BC Guidelines are developed, refer to the GPAC Handbook available at *BCGuidelines.ca: GPAC Handbook*.

THE GUIDELINES AND PROTOCOLS ADVISORY COMMITTEE

The principles of the Guidelines and Protocols Advisory Committee are to:

- encourage appropriate responses to common medical situations
- recommend actions that are sufficient and efficient, neither excessive nor deficient
- permit exceptions when justified by clinical circumstances

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